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Basic Principles for effective International Science, Technology and Innovation Agreements

Main Report

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Basic Principles for effective International Science, Technology and Innovation Agreements

Main report

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Directorate-General for Research and Innovation
International Cooperation

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I. INTRODUCTION

International collaboration in Science, Technology and Innovation (STI) has become an important aspect of the STI policy agenda. Particularly in the European Union, the policy focus on research excellence and the European Research Area, drew attention to international STI collaboration. As a result, internationalisation strategies vis-à-vis non-EU countries have become increasingly part of the general STI policies at national, European and global levels (Technopolis, 2012a; 2012b).

A. Objectives of the study

The internationalisation of STI policy may be approached more rationally, by both EU Member States and the European Union. This particularly goes for the most formal basis underlying STI cooperation: bilateral Science, Technology and Innovation agreements.

For that purpose the European Commission, Directorate General for Research and Innovation (RTD), asked a consortium led by Technopolis Group in 2013 to develop a more detailed understanding of the range of existing international STI agreements used by the EU, EU Member States and the USA. Moreover, the consortium was asked to explore the impact of STI agreements, and to explore the potential scope for umbrella agreements between the EU and Member States with non-EU countries (so-called third countries).

The study was prepared by Derek Jan Fikkers (project leader), Alfred Radauer, Léonor Rivoire, Jon van Til and Jerome Treperman at *Technopolis Group*; Manfred Horvat at *Technische Universität Wien*; and Heinz Goddar, Christian Czychowski and Julian Waiblinger at *Boehmert & Boehmert Anwaltssozietät*. Support was given by Erik Arnold, Patries Boekholt and Wieneke Vullings.

B. Policy Background

In January 2008, the CREST Expert Group presented its report on international cooperation (CREST, 2008). It provides an inventory of policy approaches to the internationalisation of R&D and innovation by Member States and Associated Countries and identifies good practice for international cooperation. The Expert Group concluded that both Member States and the European Commission are involved in a myriad of research cooperation activities with third countries. The report found a clear tendency at the level of Member States for a closer STI cooperation at the policy level towards non-EU countries (so-called third countries). However, the absence of a common framework at a European level had led to duplication, a waste of resources, lack of alignment or coordination, and a reduced impact in this cooperation. Furthermore, the Expert Group showed that official international STI cooperation is often the result of individual contacts between researchers and research organisations; again, often without any government strategy behind it. However, the CREST Expert Group also stated that "cooperation and coordination needs to be built on national interests and to prove clear benefits for all parties involved". Following the 2008 CREST Report, the European Commission adopted the Communication on a strategic framework for international STI in September 2008 (EC, 2008a). The Communication laid the foundation for a strategic framework for international cooperation in science and technology.

In addition to this, in 2008 the Strategic Forum for International S&T Cooperation (SFIC) was established as an advisory body to the Council and the Commission with a view to implementing a European Partnership in the field of international scientific and technological cooperation.[1] SFIC is chaired by a representative from one of the EU Member States.

In 2010, the Europe 2020 Innovation Union flagship initiative stressed that the EU must further deepen its international scientific and technological cooperation (EC, 2010). Europe should act as one to achieve a global level playing field for research and innovation. The Innovation Union

[1] See: http://www.consilium.europa.eu/policies/era/sfic?lang=en and http://ec.europa.eu/research/iscp/index.cfm?pg=sfic

Commitment 31, states that the European Union and its Member States should treat scientific cooperation with third countries as an issue of common concern and develop common approaches.

This should contribute to global approaches and solutions to societal challenges and to the establishment of a level playing field. This implies that:

- The EU and Member States should 'act in a concerted manner when engaging in STI agreements and activities with third countries';
- The potential scope for 'umbrella' agreements between the EU and Member States with third countries is to be explored.

The Innovation Union thus stressed the importance of improved coordination in cooperation in STI, while acknowledging the important role of the diverse set of agreements in place. Moreover, the Innovation Union noted that in 2012, together with the ERA framework, the Commission would propose EU/MS priorities as a basis for coordinated action vis-à-vis third countries.

In September 2012 the European Commission adopted the Communication 'Enhancing and focusing EU international cooperation in research and innovation: A strategic approach'. The Communication identifies a number of targeted actions. First, areas for international cooperation with third countries will be identified. Clear criteria are presented for that purpose.[2] Second, multi-annual roadmaps for cooperation with key partner countries will be developed. For each group of third countries focuses and objectives are defined. Supporting instruments, e.g. policy dialogues, information gathering and funding instruments, are to be defined.

C. Research methods

This study took place between January 2013 and January 2014. The team consisted of consultants, academics, and patent lawyers from Technopolis Group, the Technische Universität Wien, and Boehmert & Boehmert. We have used several research methods. These include:

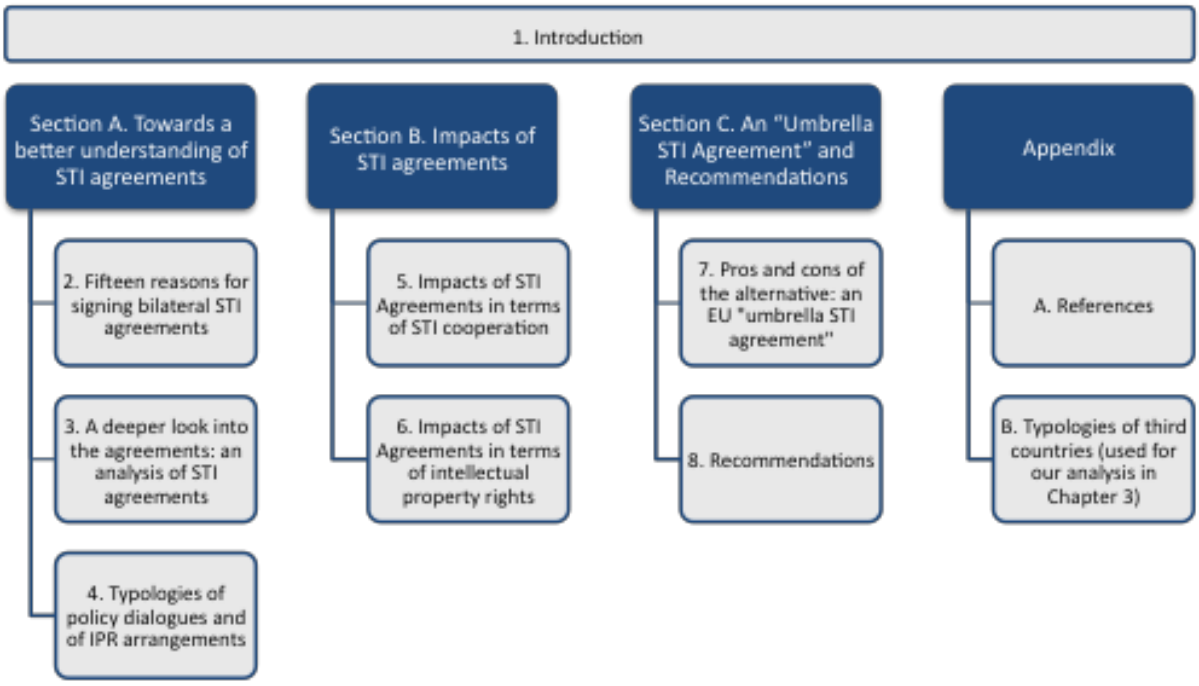
- **Academic literature review.** We made an analysis of the academic state of the art in the field of STI agreements. The 59 sources used are presented in Appendix A.1;
- **Analysis of bilateral STI agreements.** For this report, a total of 103 EU, USA, and Member States bilateral STI agreements were analysed over 48 different variables. During the selection of the agreements, we made sure that the group of third countries was kept constant. This made it possible to compare between USA, EU, and Member States agreements. The STI agreements that we analysed are presented in Appendix A.2;
- **Meta-evaluation of impacts**. We analysed 18 policy evaluations and reviews of STI agreements to be able to assess the impacts of STI agreements. These are presented in Section C, page 30;
- **Consultation of experts**. To validate our findings we have consulted nineteen external experts through interviews, and an expert workshop. The experts are listed in Appendix A.3.

[2] E.g. Research and Innovation capacity, risks and opportunities for markets, contribution to the Union's international commitments, and legal and administrative frameworks in place.

D. The content of this report

This report presents an insight into existing STI agreements used by the EU, EU Member States and the USA. Moreover, it examines the impacts of STI agreements, and explores the potential scope for umbrella agreements between the EU and Member States with third countries.

The report consists of three sections that present respectively (A) insights into STI agreements used by the EC; Member States, and the USA; (B) information on the impact of STI agreements; (C) the alternatives for the current situation, our findings on the feasibility of an umbrella STI agreement, and recommendations. The figure below presents the sections and relevant chapters.



II. FIFTEEN REASONS FOR SIGNING BILATERAL STI AGREEMENTS

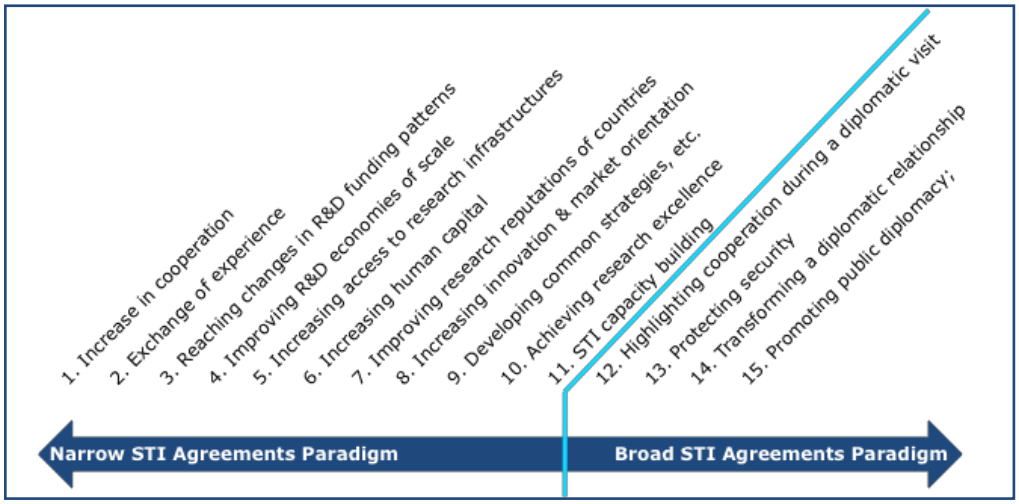
This chapter explores the reasons why individual countries sign STI agreements with other countries. We have identified a total of fifteen reasons that can be grouped in two paradigms. This chapter is based on a broad literature study and on our interviews.

Key findings: Basically, fifteen reasons for signing STI agreements can be distinguished. Some of them show some overlaps. These reasons (or rationales) can be grouped into two paradigms. Most of the rationales fall under the 'narrow STI agreements paradigm'. They focus on cooperation. A small number of reasons fall under the 'broad STI agreements paradigm'. They focus on what we might refer to as science diplomacy or even high level politics.

Despite the fact that most countries are signatory parties in bilateral STI agreements, the rationales behind these agreements in terms of the expected benefits for the signatory countries are often ambiguous (Georghiou, 1998). The official reasons for signing a bilateral STI agreement are clear: most agreements themselves make reference to the rationale of 'increasing the cooperation in science and technology'. This is what is stated in the objectives and the principles of the agreements, and it is what is being said in press releases. But there are more reasons for signing bilateral STI agreements than just 'increasing cooperation in science and technology'. In this chapter we explore the reasons for engaging in bilateral STI agreements.

We group the respective rationales from what we refer to as a **narrow STI agreements paradigm** and a **broad STI agreements paradigm**. The first paradigm is only related to quality, scope and critical mass in STI by linking resources and knowledge with resources and knowledge in other countries. The second paradigm also includes non-science policy objectives. In the broad paradigm, signing a bilateral STI agreement becomes a means to reach policy ends outside the realm of science, technology, and innovation. The figure below presents both paradigms and the respective reasons for signing a bilateral STI agreement.

Figure 1. Reasons for signing STI agreements grouped in two paradigms



A. Under the narrow STI agreements paradigm, there are 11 reasons to sign an STI agreement. All focus on science, technology and innovation

The narrow STI agreement paradigm consists of rationales that refer to quality, scope and critical mass in science and research by linking resources and knowledge with resources and knowledge in other countries. The ERA Expert Group on International Cooperation in Science and Technology – that also stressed the need of developing an 'ERA framework' of common rules and procedures - introduced two conventional reasons for signing bilateral STI agreements (ERA Expert Group, 2008). These were restricted to the most narrow definition of STI activities and cooperation:

- Increase in cooperation;
- Exchange of experience.

These rationales are not unconventional. They are referred to in many agreements as 'basic principles' or as 'objectives'. Basically these rationales are related to achieving cross-fertilisation, competition, the combination of complementary knowledge, and access to world-class researchers, facilities and groups (Boekholt et al., 2009).

Korez et al. (2010) discuss – on behalf of UNESCO - the bilateral and regional STI cooperation of several South Eastern European countries. In that context they identify six – somewhat broader - rationales for signing bilateral STI agreements:

- Reaching changes in R&D funding patterns;
- Improving R&D economies of scale;
- Increasing access to research infrastructure;
- Increasing human capital;
- Improving research reputations of countries;
- Increasing innovation & market orientation.

Korez et al. (2010) seek rationales at the more abstract STI policy level. They consider bilateral STI agreements as potential game changers, in the sense that they have the ability to fundamentally change R&D funding patterns (#3). This is especially the case for third countries participating in the European Framework Programmes or similar large programmes. The authors also state that bilateral STI agreements can result in 'larger projects and consequently more joint publications' (#4). This will indeed be the case, especially if national resources are too limited to realise the ambitions. Related to this is another rationale: access to research infrastructure (#5). This includes for instance the use of research potential abroad; better access to scientific networks; technology; databases and information and access to complementary sources of expertise or know-how to further develop national research potential.

Increasing human potential (#6) is about both educating internally and researcher mobility, exposing them to other research environments and approaches. Signing bilateral agreements is considered a useful way to promote researcher mobility, and indirectly increases the quality and quantity of human capital. This is particularly relevant for countries with a less developed STI system and a smaller human capital stock. But it is also very relevant for Europe, where demographic developments and the decreasing share of graduates in science and engineering lead to urgent shortages of research talent (Boekholt et al. 2009). Korez et al. also believe that bilateral STI agreements help building research reputation (#7) of the parties that sign the agreement, and hence can result in future partnerships with other countries (see also BMBF, 2006). For many governments it might indeed be strategically important to affiliate with strong STI partners, such as the European Union, Germany or the United States. The same might be the case for some upcoming third countries, in particular China. Lastly, Korez et al. stress that bilateral STI agreements might be signed to increase innovation and market orientation in research activities (#8). These include for example general access to new markets for private enterprise. But it also includes the opportunity to implement scientific results/ applied innovations and to use them for social and economic development of the signatory countries. This is very often the rationale behind establishing science and technology attachés, and foreign investment offices located in specific third countries (Boekholt et al., 2009).

Earlier, we introduced two rationales for signing STI agreements identified by the ERA Expert Group (2008). Besides the two conventional reasons for signing bilateral STI agreements the Expert Group presented a rationale for bilateral STI agreements that is slightly more broad:

- Developing common strategies, new programmes and schemes, joint calls.

This might be achieved in the agreement itself (by choosing certain sectors for cooperative focus), or through a policy dialogue that can be established as part of the agreement. For such a policy dialogue, a (framework for a) governance structure might be introduced in the STI agreement. This can be done by identifying executive agencies, setting up a Steering Group, and indicating the meeting frequency for this Steering Group.

Technopolis (2012) conducted an overview of international STI activities between EU Member States and third countries. In that context several policy related rationales were identified for signing STI agreements. We can make a distinction between science policy and broader policy rationales (which are discussed later). In terms of science policy, the following reasons for signing STI agreements are relevant:

- Achieving research excellence;
- STI capacity building.

Research excellence (#10), can be reached by promoting collaborations resulting in co-authored papers; and by promoting co-publications in the international scientific literature leading to increased citation rates. STI capacity building (#11) on the other hand, can be reached by promoting internationalisation of university research and teaching, and by promoting capacity building.

B. The broad STI agreements paradigm contains four more reasons, mainly related to high level politics and science diplomacy

The broad STI agreement paradigm involves non-science policy objectives that interact with the intrinsic science-oriented objectives. In this paradigm, signing a bilateral STI agreement becomes a means to reach other policy ends.

Wagner (2002) and Dolan (2012) elaborate on the broad STI agreements paradigm. Together, they distinguished four rationales for STI agreements, all related to science diplomacy:

- Highlighting cooperation during a diplomatic visit;
- Protecting security;
- Transforming a diplomatic relationship;
- Promoting public diplomacy.

Highlighting cooperation during a diplomatic visit (#12) might be an important rationale for signing STI agreements. Even though it could appear as trivial, signing an STI agreement is often seen as a useful agenda item during a diplomatic visit. Protecting security (#13) might be another rationale for signing bilateral STI agreements. The USA in particular has used this rationale actively (National Research Council, 1999; Hormats, 2012; and Neureiter & Cheetham, 2013).[3] In the early 1990s, USA diplomacy focused on demilitarisation of science in the former Soviet Union. In the years following 9/11 the USA has invested heavily in better relationships with Muslim countries. Improving these relations became a rationale for several STI agreements (Dolan, 2012).

[3] The establishment of the AAAS Center for Science Diplomacy also serves as a clear indication.

Transforming a diplomatic relationship (#14) is also a well-accepted rationale for signing STI agreements. Boekholt et al. (2009) show how in such cases the choice of bilateral partners might have little to do with STI strategies. Countries might be targeted for reasons concerned with trade, history and cultural ties (shared language, colonial history, shared political system). A clear example of such a rationale in action is the 1961 STI Agreement between Japan and the USA. Both countries explicitly wanted to go back to equilibrium in bilateral relations after the protests following the signing of the Treaty of Mutual Cooperation and Security between the two countries. Signing an STI agreement was seen as the best way to transform the diplomatic relationship between the two countries (e.g. Heaton, 2006; Jones, 2010; Wessner, 2011). The current STI collaboration between the United States and Iran is also a clear example of STI collaboration for the sake of transforming a diplomatic relationship (Schweitzer & Neureiter, 2008; Jillison, 2013).

Promoting public diplomacy (#15) is another rationale for signing STI agreements under the broad paradigm. The signing of an agreement (and the media attention that this might bring) can be an opportunity to send out a message. It clearly indicates which third countries are considered to be of significant importance.

A clear example is the bilateral STI agreement between the USA and China (Suttmeier, 1998). One of the purposes of this agreement was to build stronger diplomatic ties between the two nations. An STI agreement might also be used to keep communication channels where there are no other ways to communicate. A clear example is the STI agreement between the USA and the USSR during the Cold War. The STI Agreement offered communication channels to the diplomatic community.

III. A DEEPER LOOK INTO THE AGREEMENTS: AN ANALYSIS OF STI AGREEMENTS FROM EU, EU MEMBER STATES AND THE USA

This chapter presents the first analysis and comparisons of bilateral STI agreements of the EU, individual EU Member States, and the USA.[4] It discusses respectively the formal objectives (section A, page13); thematic priorities (section B, page14); executive agents (section C, page16); steering groups dedicated to the agreement (section D, page17); cooperative activities (section E, page17); reciprocity mechanisms (section G, page20); IPR (section G, page20); and evaluation requirements (section E, page22).

Below we present the detail of our analysis. Respectively we discuss: the formal objectives of the bilateral STI agreements; the thematic priorities in the STI agreements; our findings on bilateral coordination and setting up bilateral policy dialogues; the actual cooperative activities in the agreements, and reciprocity; information on the role of Intellectual Property Rights (IPR) in the agreements; and our findings regarding renewal procedures.

A. There are three types of formal objectives of bilateral STI agreements

The general objectives of the EU's international cooperation policy are to strengthen the EU's attractiveness in research and innovation as well as its industrial and economic competitiveness, to tackle global societal challenges, and to support the EU's external policies. Within this framework, bilateral STI agreements are being signed.

However, most agreements themselves set certain formal objectives at the less aggregated level. In most agreements, these formal objectives are mentioned in Article 1. They are referred to in the agreements as 'objectives of the agreement', as purposes' or as 'principles'. They identify the formal basis or the fundamental reason for signing the agreement. In this section we examine these formal objectives.

Key findings: Most USA and EU agreements only focus on STI objectives. Member States, on the other hand, usually define broader objectives in their STI agreements including diplomatic relations and general welfare.

In most agreements, the signatory parties specify the objectives of signing the agreement. Not all agreements are exclusively about increasing bilateral STI cooperation. Basically, there are three types of objectives included in the agreements. These are:

- The facilitation of cooperative activities in fields of common interest in STI;
- The increase of general welfare of the signatory countries;
- Explicit diplomacy objectives.

Officially, a majority of STI agreements exclusively focus on the facilitation of cooperative activities in fields of common interest in STI. This holds true for the EU agreements (93%), for the US agreements (88%), and for the STI agreements signed by individual EU Member States (57%). This implies that Member States, more than the EU and the USA, have a tendency to include non-STI objectives in their STI agreements.

More precisely, in 29% of the Member States agreements, the increase of welfare is mentioned as an official objective of the agreement, and in 25% of the Member States agreements, strengthening diplomatic ties is mentioned as a formal objective. Especially the larger EU Member States (in particular Spain, Germany, and France) formulate their objectives in a relatively broad way.

[4] It corresponds with Task 1 and Task 2 of the Terms of Reference

The scope of the objectives also depends on the third countries. Agreements with European Neighbourhood Policy (ENP) countries usually have broader objectives than agreements with non-ENP countries. This is also the case for agreements with developing countries. Agreements with industrialised third countries and emerging economies focus primarily on the facilitation of cooperative activities in fields of common interest in STI. There seems to be some correlation between the third country's GDP per capita and the scope of the objectives: the higher the GDP/capita, the smaller the scope. In other words, the more prosperous a third country, the more the agreement only focuses on STI cooperation.

B. The EU in particular mentions thematic priorities explicitly in its STI agreements

In this section we discuss the role of thematic priorities of bilateral STI agreements. A thematic priority is a scientific field in which cooperation under the agreement is to take place. Under FP6 such a thematic priority would be referred to as 'priority thematic area', under FP7 it would be referred to as a 'key thematic areas', while under Horizon 2020 a thematic priority would be called a 'research area'.

In general, STI agreements identify several of these thematic priority area fields in which STI cooperation under the agreement is to take place. They are often identified relatively early in the agreement.

Key findings: More than the USA and EU Member States, the EU demarcates its agreements in terms of thematic priorities. Both USA agreements and Member States agreements are more flexible in terms of thematic demarcation of the cooperative activities.

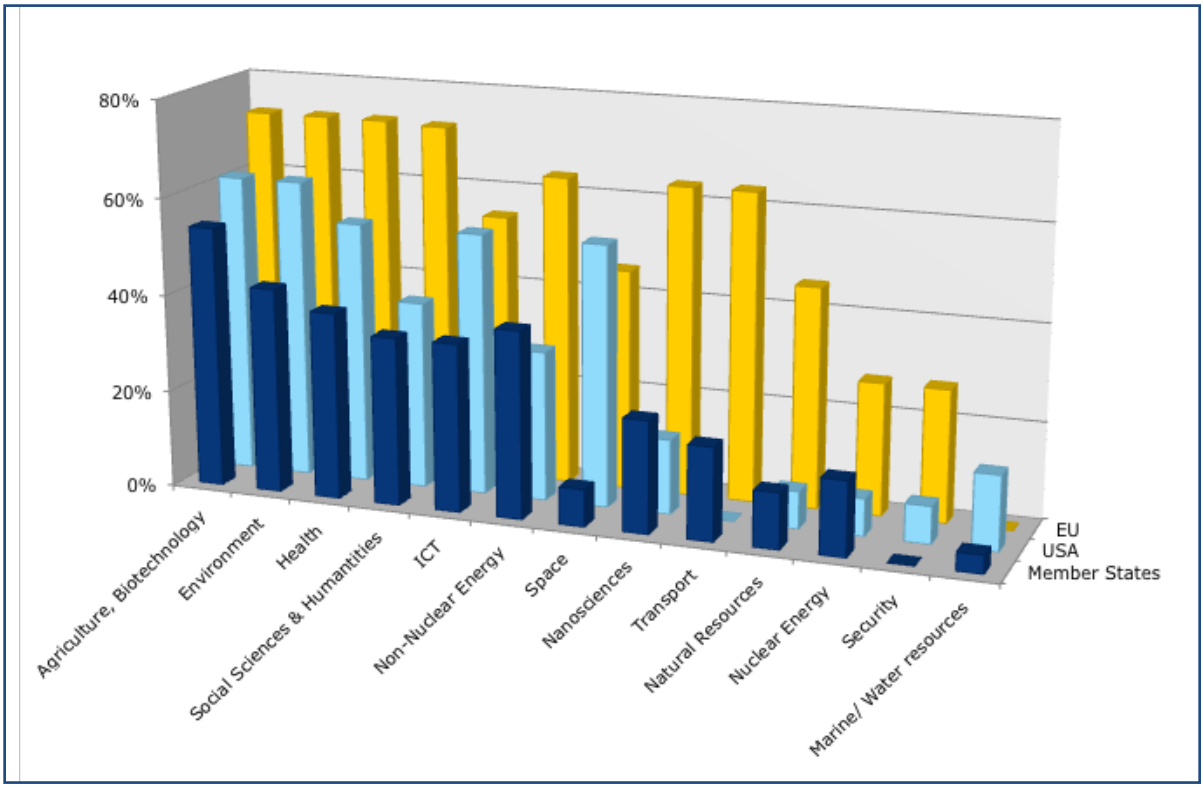
Basically, there are three ways in which the bilateral STI agreements can deal with the identification of thematic priorities:

- Not mentioning thematic priorities;
- Implicitly mentioning thematic priorities;
- Explicitly mentioning thematic priorities.

In about half of the agreements, no thematic priorities are mentioned. Especially the USA (46%), and individual EU Member States (55%) use this strategy of rather broad and generic agreements. The EU (13%) uses this strategy only in a small number of its agreements. Implicit mentioning is defined as 'the identification of these priorities left to the Steering Group or other policy dialogue structures under the agreement'. In other words, the signatory parties promise that thematic choices will be made when implementing the agreement. This strategy is only used in a small number of agreements signed by the USA and individual EU Member States.

The figure on the next page presents for the EU, the USA and EU Member States the presence of the respective thematic priorities in their agreements in terms of percentages.

Figure 2. Comparison of thematic focus of USA, EU and Member State agreements



As half of the agreements do not have an explicit mentioning of thematic priority areas, the other half of our sample does have thematic priority areas. The EU in particular uses this strategy (73%) as their predominant approach more so than EU Member States (40%) and the USA (54%). The agreements where thematic priorities are mentioned usually focus on fewer than five thematic priorities. If thematic priorities are being mentioned explicitly, the EU agreements usually identify a larger number of priorities than the US agreements, or the Member States agreements. On average, the EU agreements mention 7.5 thematic priorities, while the USA agreements on average focus on only 4.6 priorities. The Member States agreements on average focus on 3.7 thematic priorities.

In general, food & agricultural research, health research, and environmental research are the thematic priorities that the agreements focus on most often. In comparison with the USA, the EU puts a particular emphasis on social sciences & humanities; non-nuclear energy; nanosciences; and transport research. The USA, in comparison with the EU pays significantly more attention to marine sciences & water resources. In comparison with EU Member States, the EU seems to focus on transport research, space research, nanosciences, and health research.

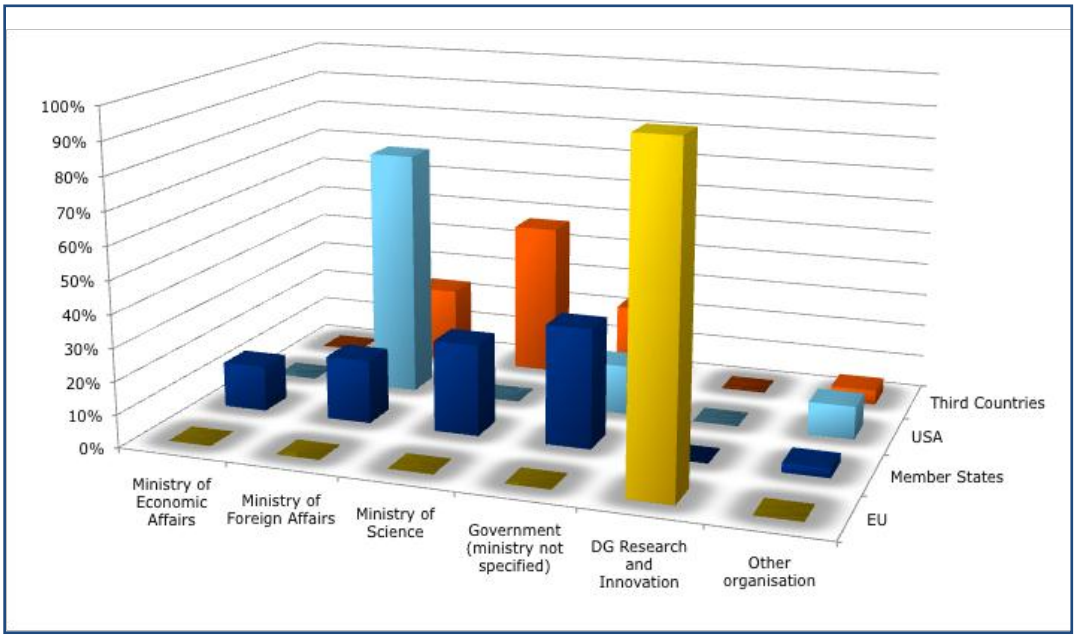
C. The EU identifies an STI-oriented organisation as executive agency of its STI agreements. Other entities prefer their Foreign Affairs Ministry

This section examines the executive agents in the agreements. These executive agents arrange the coordination and the implementation of cooperative activities under the agreement for their particular side of the agreement. In most agreements they are identified in a relatively early stage. Both signatory countries can identify executive agents – on both sides - for arranging the coordination and expediting of cooperative activities under the agreement. Together with the steering group (see section D, page17) they can play an important role in the bilateral policy dialogue that we elaborate in section A, page23.

Key findings: Most agreements identify executive agents. The EU agreements do so more often than the Member States' agreements. Whereas the EU always identifies the Commission's DG Research and Innovation as the executive agent, Member States, third countries, and the USA have a preference for Ministries of Foreign Affairs and Ministries of Economic Affairs. Such agreements are often intergovernmental agreements falling under the responsibility of the Ministry of Foreign Affairs

The majority of the agreements in our sample (65%) identify executive agents on both sides of the agreement. More specifically, 80 per cent of the EU agreements, and 83 per cent of the USA agreements identify executive agents. About 55 per cent of the STI agreements signed by EU Member States identify executive agents. The figure below shows the different types of executive agents assigned by the EU, EU Member States and the USA. The executive agents assigned by the third countries are also included.

Figure 3. Executive agents identified in USA, EU and Member State agreements



The executive agent on behalf of the EU is clear: in all cases it is DG Research and Innovation. The USA has a completely different approach. In most USA agreements, the Department of State is assigned as the executive agent. EU Member States on the other hand show a very heterogeneous pattern. Ministries of Economic Affairs, Ministries of Foreign Affairs, Science Ministries, and 'governments in general' are identified as executive agents. Third countries also show a heterogeneous pattern, but the Ministry of Science is most frequently appointed as executive agent.

D. Only the EU structurally establishes bilateral steering groups in its agreements

Setting up a bilateral steering group is another potential coordination mechanism for an STI agreement. A steering group for a particular bilateral agreement is established by the signatory parties, or by the executive agents that we introduced in section C, page16. Whereas the executive agents are unilateral bodies working together and arranging practicalities and other operational matters within the respective countries, the steering group is a body in which representatives from both signing countries cooperate. These representatives might have a background in public policy or in academia. These steering groups go by different names, e.g. steering committee, joint consultative group or joint operational body. Like the executive agents introduced in Section D, steering groups can contribute to the policy dialogue to be discussed in section A page23.

Key findings: The EU agreements structurally establish bilateral steering groups. Member States' agreements and USA agreements do so less often. The statutory powers of EU steering groups do not differ much from the steering groups in other agreements.

The EU includes bilateral steering groups in all of its agreements. The USA uses it less frequently (74%) as do the EU Member States (69%). In those agreements where a steering group is set up, the EU agreements almost always prescribe the meeting frequency of the steering group. Member States' agreements (43%) and USA agreements (37%) do so far less.

One can distinguish between certain statutory powers of the bilateral steering groups. These do not differ tremendously throughout the agreements. In 38 per cent of the agreements, the steering group can assess and decide on priority areas. In 37 per cent of the agreements, the steering group provides the signatory countries with the opportunity for regular updates on STI policy. In 14 per cent of the agreements, the steering group can establish task forces and decentralised working groups that may have formal authorities as well. In 11 per cent of the agreements the steering group can decide on common STI roadmaps. The differences between the agreements signed by EU Member States, the USA, and the EU are not substantial. The USA usually does not authorise the steering groups in its agreements to identify priority areas, whereas the EU and EU Member States do so.

E. Cooperative activities do not differ significantly, but unlike individual countries the EU almost always uses its STI agreements to give access to research programmes.

Most STI agreements identify cooperative activities to be undertaken under the agreement. These cooperative activities are basically the expected outputs of the agreements. In this section we discuss the cooperative activities that are identified in the bilateral STI agreements.

Key findings: All but a few agreements explicitly mention the cooperative activities to be undertaken between the countries. Only the EU uses the agreements to give access to research programmes (the Framework Programmes) on a large scale. The USA and Member States do not do so.

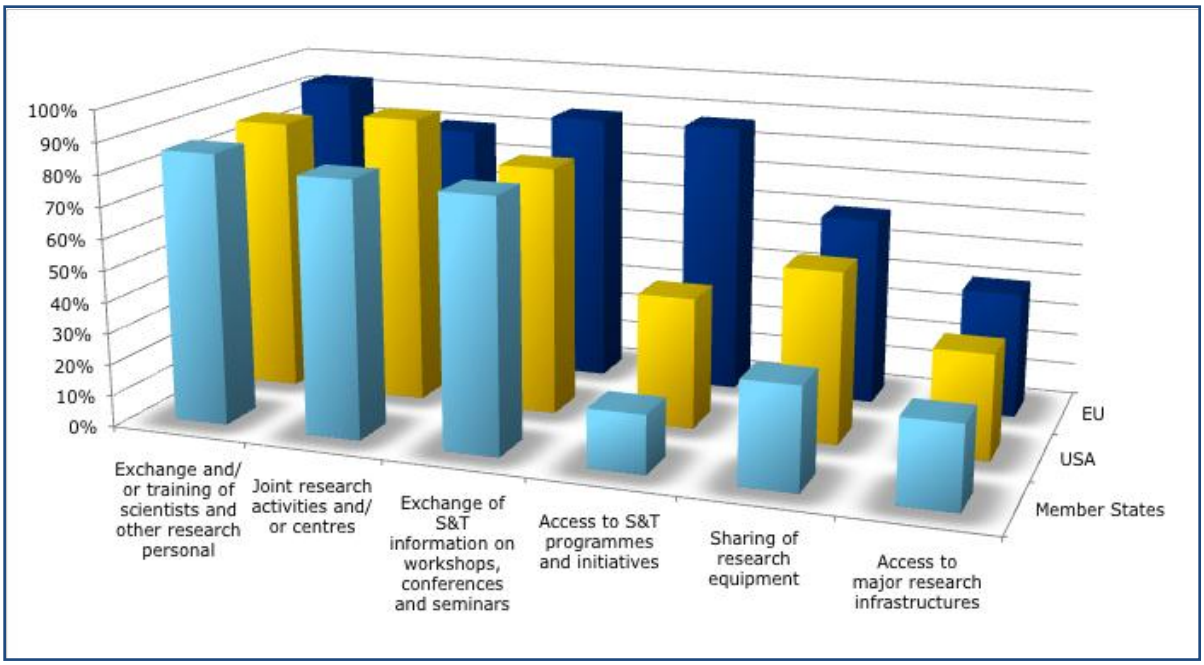
The agreements can identify several potential modalities of cooperative activities for bilateral STI cooperation. Often they are referred to as cooperative activities. Basically, these are the STI activities for which the particular agreement was signed.

Basically six different cooperative activities can be identified in the respective agreements:

- (Reciprocal) exchange and/ or training of scientists and other research personnel;
- Setting up joint research activities and/or centres;
- Exchange of STI information at workshops, conferences and seminars;
- (Reciprocal) participation in/access to STI programmes and initiatives;
- Support in the provision or sharing of research equipment;
- Granting (reciprocal) access to major research infrastructures.

The figure below presents the activities identified in the agreements of, respectively, the EU, the USA, and EU Member States.

Figure 4. Actual cooperative activities identified in USA, EU and Member State agreements



Most agreements (about 96%) mention at least one of these cooperative activities. The figure above shows that especially (1) the exchange and/ or training of scientists and other research personnel; (2) setting up joint research activities and/or centres; and (3) exchange of STI information in workshops, conferences and seminars, are mentioned in many agreements. The EU, the USA, and EU Member States use these cooperative activities intensively in their agreements.

The fourth of the cooperative activities, access to STI programmes and initiatives, shows significant differences. The EU agreements are the only ones that usually (87%) give access to research programmes. The USA agreements do so less often (42%), which is also the case for Member States agreements (19%). In other words, the EU is the only entity that structurally uses its bilateral STI agreements to give access to third countries to research programmes.

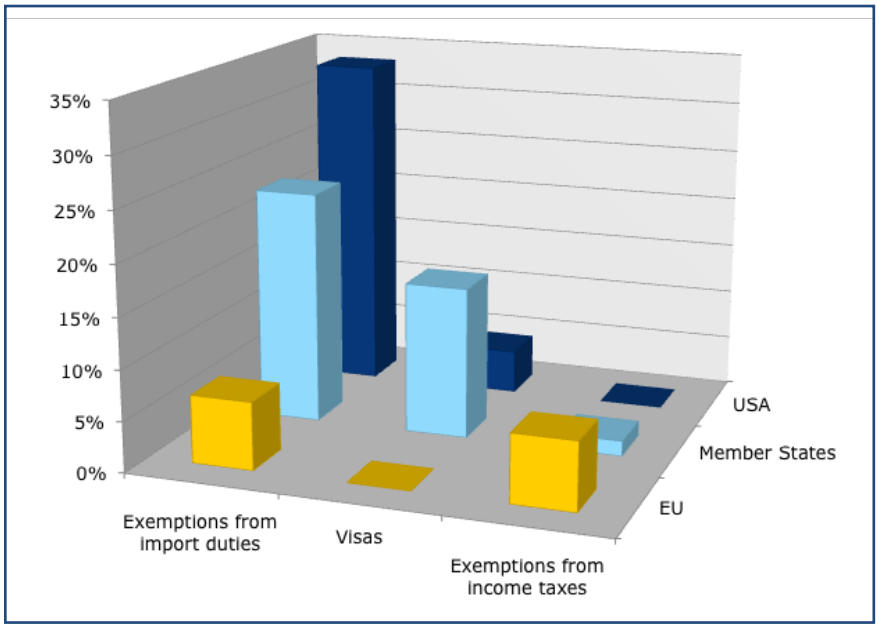
F. Concrete measures to improve framework conditions for cross-border mobility

Cross-border mobility includes the entry of personnel and the entry of equipment. Apart from programmes that might stimulate cross-border mobility, STI agreements can improve the legal framework conditions for cross-border mobility. This can be done via the facilitation of entry of personnel (e.g. through scientific visas); exemptions from import duties; and exemptions from income taxes. This section explores the use of these three measures in bilateral STI agreements.

Key findings: The STI agreements include only few measures to improve framework conditions for cross-border mobility. Both the USA and Member States sometimes include measures to reduce import duties.

In general, STI agreements include only few references to measures that improve the framework conditions for mobility. Moreover, when measures are mentioned, it is often made explicit that they might not add to already existing legal frameworks. In those cases, phrases like 'each party shall take all reasonable steps and use its best efforts, in accordance with its laws and regulations' are being used. The figure below shows that a number of agreements nevertheless include concrete measures to reduce mobility bottlenecks.

Figure 5. Addressing mobility issues in USA, EU and Member State agreements



About one third of the USA agreements include tax and custom preferences. This can include exemption from import duties and taxes on personal effects and initial arrival of household effects. In its more recent agreements, the USA stresses that all commodities provided and services rendered in the form of a gift by the USA under the agreement to the third country, shall be exempt from VAT and import duties. Individual EU Member States also include exemption from import duties in their agreements. About 15 per cent of the Member States agreements include measures related to visas. Their contents differ. Examples include the agreement to provide visas to experts within 14 days after request, or granting visas free of charge.

G. The EU demands reciprocity in the agreements twice as often as do EU Member States and the USA

Reciprocity implies both mutual benefits based on an overall balance of advantages and access of researchers of each of the signatory countries to the STI activities undertaken by the other signatory country.[5] Signatory countries can include reciprocity as a principle of cooperation in the agreement.

Key findings: Only 38% of the agreements include the principle of reciprocity. The EU uses the principle much more frequently than the USA and Member States.

In general, it is not common to include the reciprocity principle in a bilateral STI agreement. In general a minority of agreements (38%) includes reciprocity as a guiding principle. However, the EU agreements follow another line. Two thirds (67%) of the EU agreements identify reciprocity as a guiding principle for cooperation. Both the USA (29%) and individual EU Member States (35%) use it less frequently in their agreements. They seem to take a more pragmatic approach in their agreements. Within the Member States sample, a clear pattern cannot be found. The USA sample shows that the USA demands reciprocity primarily from BRICS countries. Agreements with non-BRICS countries are not built on a reciprocal basis.

H. The USA and the EU deal with Intellectual Property Rights in the Agreements in different ways

This section considers Intellectual Property (IP) regulations in bilateral STI agreements. Intellectual property can broadly be described as the legal rights which result from intellectual activity in the industrial, scientific, literary and artistic fields (WIPO, 2004). IP regulations can be included in the main text of the agreement, but also in a separate 'Intellectual Property Annex' of the agreement.

Key findings: Less than half of the Member States' agreements discuss Intellectual Property Rights. The ones that do so usually do not go into detail. Both USA and EU agreements contain more IP regulations. The ways they deal with IPR (and the issues the agreements regulate) differ between the two.

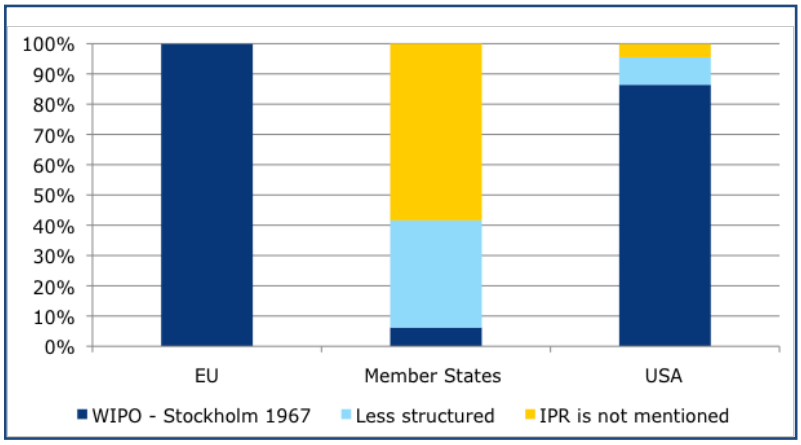
Basically, there are three ways in which a bilateral STI agreement can define intellectual property rights:

- Intellectual property is defined in detail as in Article 2 of the Convention establishing the WIPO (Stockholm, 1967);
- Intellectual property is defined in another, less structured way;
- Intellectual property is not mentioned in the agreement.

The figure on the next page shows the approaches of the EU, the USA, and EU Member States in their respective agreements.

[5] In a strict sense the implementation of the reciprocity principle in a bilateral STI agreement implies that all unilateral investments in cooperative activities are contingent on rewarding reactions from the third countries and that cooperative activities will cease when these reactions are not forthcoming (Gouldner, 1960). In other words, it implies both the equivalence of benefits (Keohane, 1986), and the equivalence of concessions (Axelrod, 1984).

Figure 6. Definitions of IPR in USA, EU and Member State agreements



It is clear from the figure that while the EU focuses entirely on the WIPO definition and the USA does so almost entirely, EU Member States take another approach. About 59 per cent of the Member States do not mention IPR in their bilateral STI agreements. The Member States' agreements that do mention IPR mostly do so in a less structured way. In those cases reference is limited to mentioning IPR as an important concept of which the signatory countries are aware.

But most agreements go beyond defining IPR in their STI agreements. Below we consider a number of specific aspects of IP arrangements in STI agreements. These are:

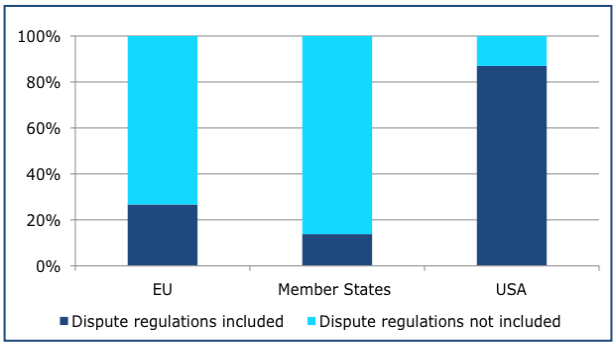
- Provisions with regard to sharing and obtaining IP rights;
- Procedures to solve disputes;
- Researchers' mobility;
- Confidential business information.

In the next Chapter, specifically in section B, page25, we will use these aspects, and a number of additional ones to identify typologies for arranging IPR in STI agreements.

1. Sharing of IP rights. About 44 per cent of the agreements have provisions with regard to sharing and obtaining IP rights between the signatory countries. Distributions differ significantly between the countries. Of the EU agreements, about 87 per cent contain such provisions; of the USA agreements the percentage is 91 per cent. However, of the Member States' bilateral agreements, only 18 per cent have provisions with regard to obtaining and sharing IP rights.

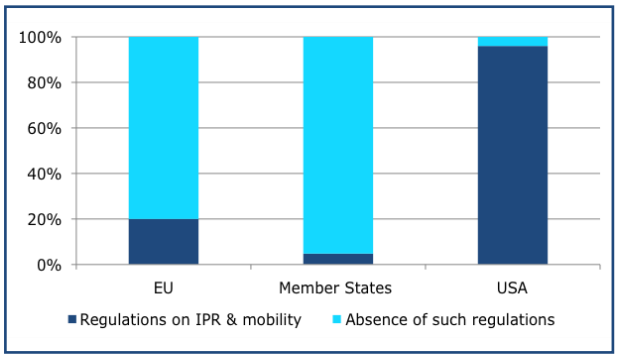
2. IPR disputes. The agreements can include procedures to solve disputes concerning intellectual property. About 32 per cent of the agreements include dispute regulations. If these procedures are installed in the agreement, they usually state that all disputes rising from the agreement shall be submitted to an arbitral tribunal. This tribunal shall then follow the arbitration rules of the United Nations' Commission on International Trade Law (UNCITRAL). This is the case for 87 per cent of the USA agreements, for 27 per cent of the EU agreements, and for only 14 per cent of the EU Member States' agreements.

Figure 7. IPR dispute regulations



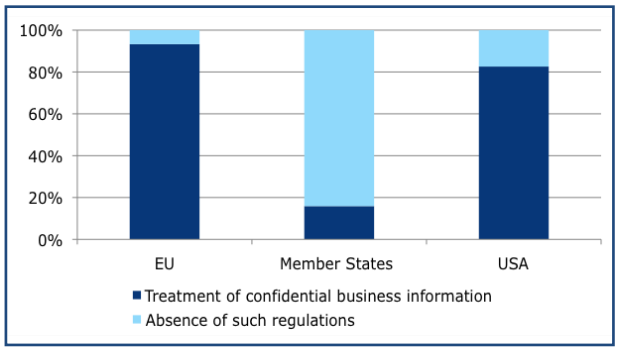
3. IP rights in relation to researcher mobility. The IP annex of a bilateral STI agreement can make reference to IPR related to researcher mobility. This implies that visiting researchers receive intellectual property rights under the policies of the host institution. This might entitle him or her to a share in a portion of royalties that are earned by the host institution from licensing activities. EU Member States usually do not have such regulations in their bilateral STI agreements; only 5 per cent do. About 20 per cent of the EU agreements and 96 per cent of the USA agreements regulate IPR in the case of mobility.

Figure 8. IPR and researchers' mobility



4. Treatment of confidential business information. The bilateral agreements can also contain regulations on the protection of confidential business information. These regulations imply that in the event that information is identified by either of the signatory country as confidential, the other country shall protect this information. Often these regulations also include definitions of confidentiality. In general 43% of the agreements contain such regulations. EU Member States agreements include them less frequently than the USA and the EU.

Figure 9. Confidential Business Information



I. Only EU agreements require evaluations before renewal

The average initial validity of the agreements is about 5.3 years. EU agreements in our sample all have a validity of 5 years. USA agreements have a longer validity. The average is 7.3 years. Most agreements (81%) have some sort of provision on agreement renewal. Most often this is an automatic renewal after *x* years. Both the EU (80%) and the USA (87%) have provisions for continuation of individual projects after expiry of the agreement. Individual Member States include such provisions less often (34%).

The EU is the only entity that always requires an evaluation of the agreement before the renewal of the agreement. The USA uses this requirement in 21 per cent of its agreements. The Member States hardly use it.

IV. TYPOLOGIES OF POLICY DIALOGUES AND OF IPR ARRANGEMENTS

Our analysis of STI agreements uses over 135 variables to describe the characteristics of the agreements. This implies that our data – and therefore the agreements themselves - are too complex to describe in one particular typology. In the previous chapter we explored nine different aspects of bilateral STI agreements. In this chapter we present two typologies that cover two of potentially important characteristics of bilateral STI agreements:

- Policy dialogues (section A, page23);
- Intellectual property rights (section B, page25).

The typology of policy dialogues is based on a further deepening of data analysis that was briefly presented in section C, page16 and section D, page17. The typology of IPR arrangements is a further deepening of data analysis that was briefly presented in section H, page20. The methods through which the typologies are identified differ between the two. The first typology (Policy dialogues) is constructed in a top-down way and should formally be referred to as a conceptual typology. The second (Intellectual property rights) was based on too complex data to follow that strategy. This typology was constructed in a bottom-up way and might therefore also be referred to as an empirical typology.

However, these methodological differences are negligible. The result is the same: the typologies give an insight in the ways the EU, EU Member States, and the USA arrange respectively the policy dialogues, and IPR in their bilateral STI agreements.

A. Typology of policy dialogues: six different ways of arranging a bilateral dialogue can be distinguished

We define a policy dialogue as a regular interaction of representatives from both signatory entities to increase STI cooperation between the two countries. These representatives might come from public policy or academia. A bilateral STI agreement can potentially contribute to a policy dialogue between two countries since it might identify certain 'rules of engagement'. Several structures can be set up to ensure a continuous and intensive policy dialogue. This section explores the different ways of arranging policy dialogues in an STI agreement.

Key findings: Our analyses show that there are six different ways of arranging bilateral policy dialogues. The most substantial policy dialogue arrangements can be found in agreements signed by the EU. They include both the identification of Executive Agents and bilateral Steering Groups. Moreover, unlike the USA and most Member States, the EU agreements often grant substantial authority to the bilateral Steering Groups.

At the aggregated level, the characteristics of the policy dialogues can be predicted best by looking at the question: is the agreement signed by the USA or the EU? In general the characteristics of the policy dialogues are mostly determined by the question whether they are signed by the USA or by the EU. The influence of third countries on the characteristics of policy dialogues is very limited.

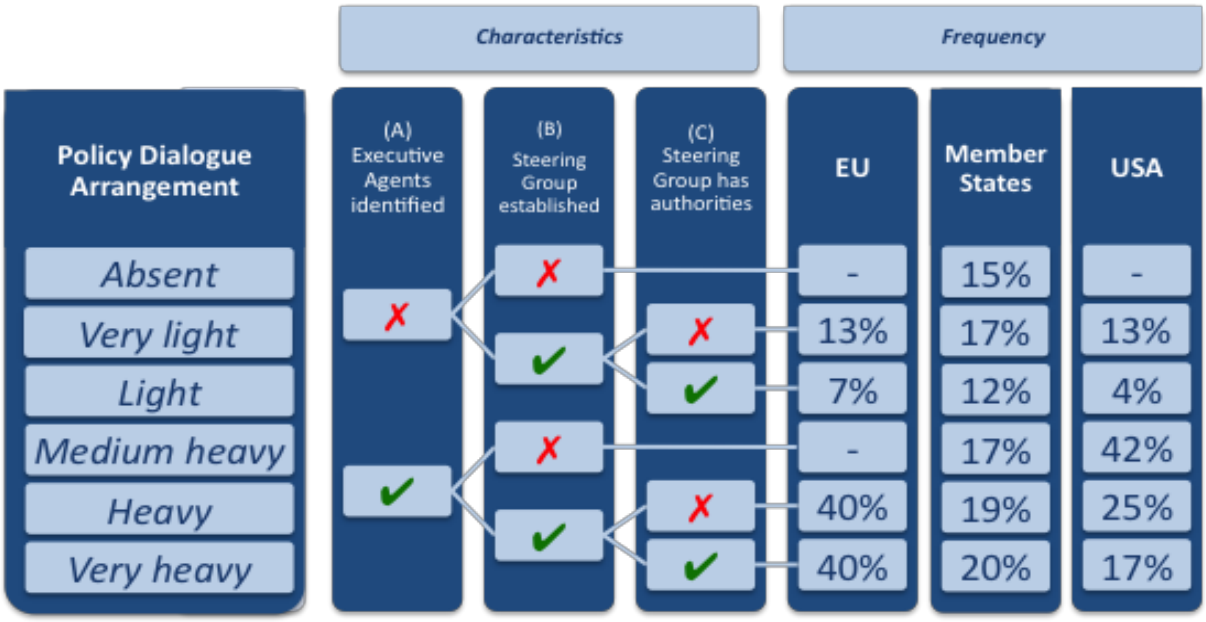
STI agreements usually have three 'tools' for establishing STI policy dialogues between the two signatory countries. These are:

- Identification of **Executive Agents** for each signatory country (see section C, page16);
- Establishment of **Steering Groups** with representatives from both countries as an infrastructure for the policy dialogue (see section D, page17);
- Granting of **substantial authorities** to the Steering Group as a further enhancement of the infrastructure. This can be the authority to identify priority areas for cooperation or the establishing of common STI roadmaps.

Together, these three tools can be used to arrange a policy dialogue in the framework of STI agreements. These arrangements come in six different types.

The figure below shows the six ways policy dialogues are arranged in STI agreements. The first three types (*Absent*; *Very light*; and *Light*) do not identify Executive Agents. They might identify Steering Groups. But in most cases these Steering Groups are not granted substantial authorities. In terms of policy dialogues, these agreements are not very significant. These types of arrangements are most often seen in agreements signed by EU Member States. *Medium heavy arrangements* do identify Executive Agents. But they do not identify Steering Groups as an infrastructure for the policy dialogue. The USA often signs such agreements. The latter two types are referred to as *Heavy arrangements* and *Very heavy arrangements*. These arrangements are most commonly seen in EU agreements. These agreements identify Executive Agents, they establish Steering Groups, and they award substantial authority to the Steering Groups. These agreements seem to offer the most elaborate infrastructure for bilateral STI policy dialogues.

Figure 10. Typology of policy dialogues arrangements in the STI agreements of the USA, EU and Member States



But the way policy dialogues are arranged in STI agreements also depends on third country characteristics. The size of the third countries is not a relevant factor in the way policy dialogues are arranged (see Appendix B.1): there is no significant statistical relationship between the size of a country and the type of policy dialogue that is set up in the agreement. The same goes for the science base of the third country (see Appendix B.2). However, there is a relationship between the extent to which third countries have well developed business R&D and innovation systems and the way the policy dialogue is organised in the STI agreement. Business R&D and innovation systems are described in Appendix B.3. Third countries with less developed business R&D and innovation systems, often have elaborate infrastructures for a bilateral STI policy dialogues set up in their agreements with the EU or with the USA.[6]

One should be aware that using Heavy arrangements or even Very heavy arrangements in an STI agreement is not a guarantee for successful policy dialogue. In section E page36 we will show how many STI policy dialogues are far from as intense as they could be.

[6] ρ=-.217 ; $p<.05$

B. Typology of IPR in bilateral STI agreements: four different IPR arrangements can be distinguished

This section introduces a bottom-up typology for IPR arrangements in bilateral STI agreements. Unlike the policy dialogues typology that we identified in section A, page23, this is a bottom-up typology, constructed through statistical clustering.

Key findings: Throughout the world, there are basically four different ways of arranging IPR in a bilateral STI agreement. Our data show that the USA has a strong preference for the two most elaborate types of IPR arrangements. The EU is less elaborate than the USA in its IPR arrangements. Member States pay little attention to their IPR arrangements.

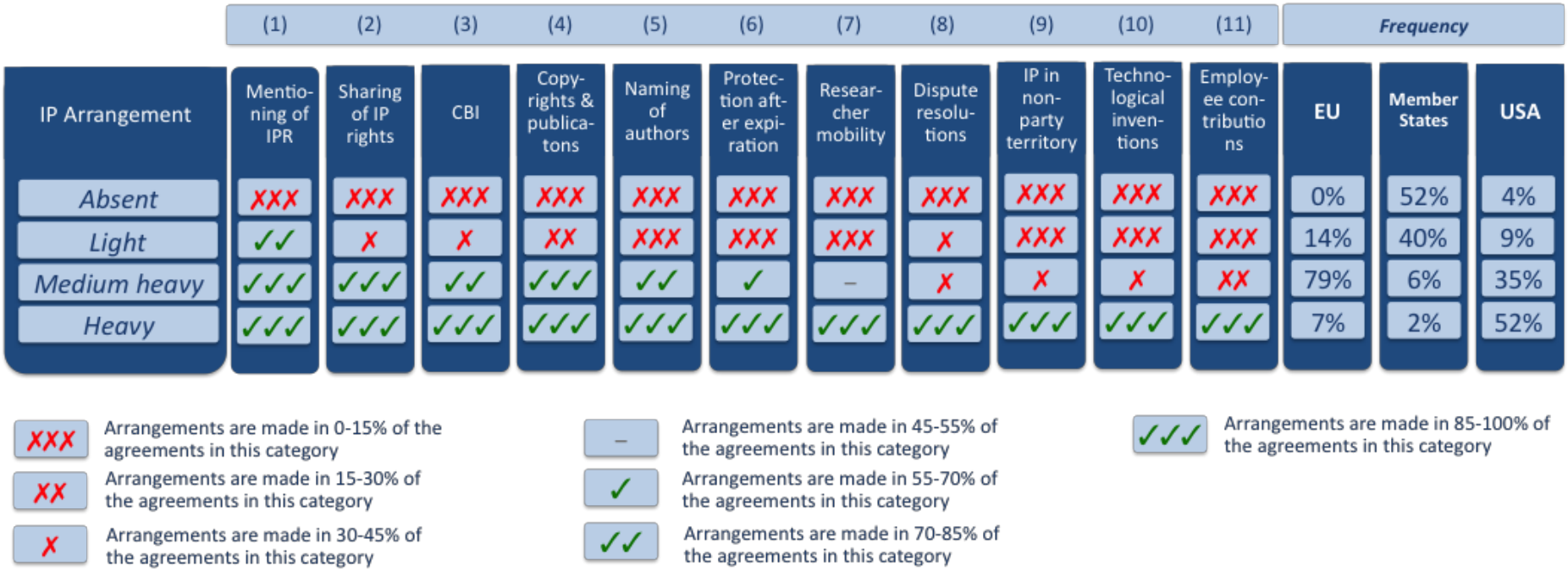
For the typology of IPR arrangements we analysed all agreements across nineteen potentially explanatory regulations, all related to the arrangement of intellectual property rights. The table below presents the regulation that we used for assessing IPR arrangements in bilateral STI agreements.

(1) Scope of meaning of IPR / mentioning of IPR	**(8) Provisions regarding dispute resolutions present (UNCITRAL)**	(14) Treatment of IP regulations not found in the other party's territory
(2) General Provisions with regard to obtaining and sharing of IP rights	**(9) Treatment of exploitation of IP in non-party territory**	(15) Treatment of exploitation of IP in the territories of each Party
(3) Treatment of confidential business information	**(10) Treatment of technological inventions**	(16) Call for Technology Management Plan (TMP)
(4) Treatment of copyrights, particularly license for publication activities	**(11) Treatment of IP rights for employee contributions**	(17) General Ownership and access rights provisions for parties engaging in collaboration
(5) Naming of authors required in copyrighted Works	(12) General Provisions with regard to IP enforcement or commercialisation	(18) Special rules on open source and open access.
(6) Guarantees for continuation of IP protection after agreement expiration	(13) Relationship to other IP treaties specified	(19) Treatment of software
(7) Treatment of IP rights in researcher mobility		

The first eleven regulations are used regularly in bilateral STI agreements. They are relevant to the typology of IPR arrangements.

The figure on the next page shows the respective regulations and their impacts of the typology of IPR arrangements in STI agreements. In the first type (*Absence*), no reference is made to IPR in the agreement. The *Light arrangement* do mention IPR, but for most of them that is about it. The *Medium heavy arrangements* include some important regulations on IP, but they usually do not include provisions regarding dispute resolution (#8), the treatment of IP regulations that are not found in the other party's territory (#9), treatment of technological inventions (#10), and IP rights for employee contributions (#11). The *Heavy arrangements* are most extensive.

Figure 11. Typology of IPR arrangements in the STI agreements of the USA, EU and Member States



The typology on the previous page shows that when it comes to IP arrangements, the USA, the EU, and EU Member States all follow their own approaches. Member States usually include no IPR arrangements, or include arrangements that cover at most a mention of IPR and to an even lesser extent provisions with regard to obtaining and sharing IP rights, references to UNCITRAL, and references to confidential business information. The EU usually covers many of the variables identified. The USA is most elaborate when it comes to IPR arrangements in STI agreements. An in-depth analysis of the process that underlies the USA choices for IPR arrangements is presented in section A, page37.

Our statistics show that third countries have a modest influence on the type of IPR arrangements in an STI agreement. The size of the third countries is not a relevant factor in the way policy dialogues are arranged: there is no significant statistical relationship between the size of a country and the type of IPR arrangements set up in the agreement. The same holds true for the science base of the third country and the business R&D and innovation systems. On the other hand, the higher the GDP per capita of the third country[7], the more Top-500 universities a third country hosts[8], and the more trademarks registered in a third country[9], the more detailed are the IPR arrangements. Moreover, more recent agreements contain more detailed types of IPR arrangements. [10]

[7] ρ=-.321 ; p<.001

[8] ρ=-.524; p<.01

[9] ρ=-.659; p<.01

[10] ρ=-.493; p<.001

What we know about the impacts of STI Agreements

V. IMPACTS OF STI AGREEMENTS IN TERMS OF STI COOPERATION

In this chapter we assess the impacts of bilateral STI agreements on STI cooperation. The chapter contains a literature survey of evaluations, reviews, and assessments of the impacts of STI agreements used by the EU, EU Member States, and the USA. We define the scope of the chapter in two ways:

- When defining impacts, we follow the definition of the World Bank. We define impact as 'the change in an STI system that is caused directly by the bilateral STI agreement, and by other, external, factors' (cf. World Bank, 2010);
- Information and data are collected from two categories of sources. The first is all academic literature on the impacts of bilateral STI agreements. The second is all policy evaluations of impacts of bilateral STI agreements. For both categories, we focus on sources that discuss STI agreements of (a) the EU, (b) Member States, or (c) the USA.[11]

Key findings: We have analysed both academic sources on impacts of STI agreements and most publicly available policy evaluations and impact assessments of STI agreements. We found that the practice of analysing impacts of STI agreements needs further development. Only very few countries have developed structural reviews of STI agreements; and too little effort is made to identify causal relationships between the agreements and change in the STI system. The European Commission's evaluations of the EU STI agreements use different structures and methodologies. This makes it more difficult to compare and aggregate them.

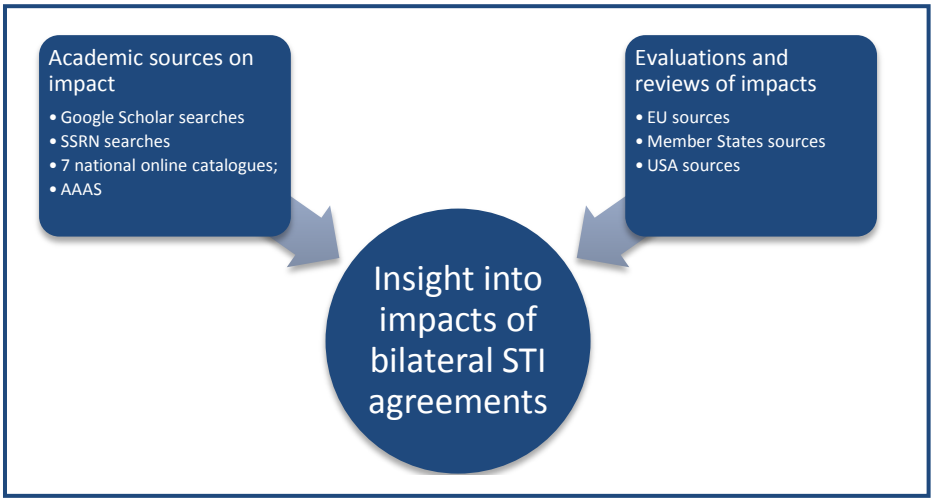
Our overall analysis of the impacts of EU STI shows that participation at the project level seems to have increased. Reciprocity increases only slowly, which also goes for researchers' mobility. Most evaluations indicate that awareness of the bilateral STI agreements amongst researchers and policy makers is still low. The intensity of most policy dialogues seems to decrease shortly after signing the agreement.

A. Two categories of sources were used to gain an insight into impacts of STI Agreements

As noted earlier, we focused on two categories of sources. Both were assessed simultaneously. We have sought relevant academic literature via Google Scholar, SSRN databases, and on-line academic catalogues in Germany, the UK, France, the Netherlands, Belgium, Spain, Italy, and the USA. All databases were scanned for papers and books on impacts of STI Agreements. Contacts were also sought with the AAAS and the editorial board of the journal *Science & Diplomacy*.

Parallel to that, we have scanned for evaluations and reviews of the impacts of specific bilateral STI agreements. Our scan focused on on-line available studies conducted in the EU, in all EU Member States included in our sample, and in the USA. The figure below presents our data collection methods.

[11] Depending on the year of signing, EU Agreements can also be referred to as agreements signed by the European Commission or the European Community.



B. The availability of reviews, evaluations and assessments is limited

Above we have presented our data collection methods. The results of this process were disappointing. Even though we intended to include all available academic literature on STI agreements and their impacts, as well as all relevant evaluations, reviews and impact assessments, only little literature and data turned out to be available.

In the first place, an academic body of literature on the impacts of STI agreements appears to be virtually non-existent. On the other hand, we were able to identify a total of eighteen evaluations and reviews of bilateral STI agreements that were relevant to our analysis of impacts. However, there are two observations that should be made on the available evaluations and reviews of impacts:

- First, most of these eighteen evaluations and reviews focus on bilateral STI cooperation in general and not only the bilateral STI agreements that are relevant for this study (see also: Gnamus, 2009).[12] This is not entirely surprising, as the agreements themselves – especially in the case of the EU agreements - only cover a part of the STI cooperation activities. The Framework Programmes, and bilateral cooperation at the Member State level, are 'parallel worlds' that are subject to the same evaluations;
- Second, all evaluations and reviews are conceptually fuzzy about what they refer to as 'the impacts' or 'the effects' of bilateral STI agreements. In some cases this involves the 'entrance to STI programmes' (as a binary parameter) that is being evaluated. In other cases it concerns the STI programmes or the funds themselves that are being evaluated.

This is mainly due to the Terms of Reference of these evaluations and reviews. The Terms of Reference usually do not ask for the types of study that for instance the World Bank (2010) would refer to as 'impact assessments'.

[12] Only the European Commission intends to structurally perform reviews of the STI agreements in which it is a party. So far, eight of such reviews have taken place.

C. A total of eighteen reviews were assessed in this study

This section discusses a total of eighteen reviews of bilateral STI agreements. The EU publishes most of these reviews. Others are by the USA or by individual EU Member States. They are discussed in chronological order.

The first review of the Agreement between the **European Commission and the United States** was published in 2003 (Kettunen et al., 2003). The authors made use of desk studies, structured interviews, and two independent missions to the USA. They found that the number of projects with USA collaborators was relatively low at around 140. The awareness of the agreement – especially in Europe - was considered low. The evaluators also noticed that there was quite some confusion in the USA about the differentiation between the EU–USA STI Agreement and other analogous agreements with individual EU Member States.

The review stated that the Agreement 'had a direct impact on the extent of scientific cooperation achieved'. The evaluators were positive about the agreement, even though indicators such as the share of co-publications by EU and US researchers, and project participations were not optimal. Kettunen et al. (2003) recommended that every effort should be made to accelerate the cooperative process. That included a renewal of the Agreement. Communication on the Agreement should however be improved, and the European Commission should ensure that it puts in place the appropriate level of direct communication with key USA government departments.

The 2004 review of the STI Agreement between the **European Union and the Republic of China** (Watson et al., 2004) was more positive than the first review of the Agreement between the European Commission and the USA. Similar to the reviewers of the EU-USA Agreement, Watson et al (2004) found that it was 'not easy' to assess the impact of the agreement in terms of co-publications, project participations, and mobility issues. The importance of mobility schemes, co-authorship, and project participations are mentioned briefly, but they are not treated as indicators for measuring impacts of the agreement.

Nevertheless, the most important conclusion was that stakeholders at all levels were satisfied with the Agreement. The Agreement was felt to have been a major factor in generating a higher profile for science and technology in EU-China relations. Therefore, the Agreement should be renewed without any particular textual changes, according to the evaluators. But at the implementation levels, changes were required. The evaluators found that there needed to be wider communication of the opportunity presented by the Agreement. This should not be limited to the public sector domains. At the same time, the lack of awareness of EU researchers regarding opportunities in Chinese research programmes should be addressed as well. These were similar conclusions to those in the 2003 review of the Agreement with the USA.

The bilateral STI cooperation between the **United States and Japan** was assessed in 2006 (Heaton et al., 2006). This agreement is interesting since it was explicitly signed for solving a geopolitical issue, and not for the sake of STI cooperation (Blanpied & Loretz, 2005). The reviewers state that since the first STI agreement was signed between Japan and the United States, the two countries have formed a deep and lasting relationship in science and technology. The evaluators discuss the impacts of the agreement. They do so in terms of institution building and not only in terms of direct STI. They find that the agreement, and in particular its 1988 renewal, 'has provided NSF (National Science Foundation) with both the experience and organizational ties with the Japanese Government and Japanese research system' (Heaton et al., 2006).

Apart from the impacts in institutional terms, the evaluators find that the relationships between USA and Japanese researchers are strong and growing. Nevertheless, barriers do exist that hinder further USA-Japan cooperation in Science and Technology. The main barriers are (1) differences in the two nations' research systems, (2) differences in government accounting rules, and (3) language and cultural differences. The reviewers conclude that the future of USA-Japan STI cooperation looks good. But they also state that global research is changing. This implies that Japanese and US researchers have increased possibilities to work with scientists from other countries in addition to each other and Europe. This is expected to influence Japan-USA cooperation activities.

Vijay Pandey (2006) conducted the first impact assessment of the STI Agreement between the **European Commission and India**. Pandey concluded that the impact of the Agreement from a scientific and political point of view is more than satisfactory. More specifically: the Agreement has contributed to an increase in collaborative scientific activities and has a positive impact on policy while to a lesser extent on economic issues, according to the authors. There had been a significant increase in the number of research projects with Indian partners in FP6 compared to FP4 and FP5. The evaluators state that the Agreement seems to have contributed to this increase.

But there was also less positive news. First, Pandey makes the principal remark that the research activities might 'have taken place anyway in India even without this Agreement or involvement of the EU'. He finds that several EU Member States have a much better science collaboration with India than with the EC. These Member States have developed trust and established a good working relationship, which the European Commission has not yet been able to do. Panday also finds that the agreement has not been able to improve researcher mobility. Moreover, awareness of the EU-India STI Agreement remains low both in India and Europe, according to the evaluator. The Agreement has not been able to change that.

That same year the activities under the STI Cooperation Agreement between **Germany and New-Zealand** were reviewed. The review briefly describes the six science areas identified as being those in which BMBF (the German Ministry of Education and Research) and MoRST (the New Zealand Ministry of Research, Science, and Technology) see maximum mutual benefit from cooperating. BMBF itself considers the collaborations over the past 29 years to have been 'valuable and productive'. Moreover, it states that the agreement is complementary to New Zealand's participation in the Framework Programmes. The review identified a number of mutual benefits that, according to the review, would not have been reached otherwise. One of the benefits explicitly mentioned was the exchange of government officials. That resulted in a vivid policy dialogue, according to the evaluators. But there was also room for improvement. Again, awareness of the agreement among officials and researchers was not optimal.

Horvat & Lundin (2008) conducted the 2008 review of the science and technology cooperation between the **European Community and China**. This review discussed the cooperation activities of China with the entire European Community. It does not only focus on the agreement between the EU and China. The review is positive about what has been achieved since 2004. The participation of China in FP6 and FP7 has shown a positive trend in terms of number of participations and coverage of thematic areas and for researcher mobility.

The review also pays substantial attention to governance aspects. In comparison with the 2004 review of the EU-China Agreement, the STI policy dialogue between the two entities has grown significantly, according to the evaluators. Meetings of Steering Committees have greatly improved both regarding scientific content and participation of high-level stakeholders. But still, further openness in communication between the European Commission and Chinese officials is necessary, according to the evaluators. This is also the case for awareness: increasing awareness and information on the STI Agreement outside the Steering Committee is still an area where improvements are possible. There is also a methodological issue raised by the evaluators: the management of the agreement should pay more attention to the assessments of the impacts of the EU-China agreement.

In 2008, **Ireland** published a review of its bilateral STI agreements (Forfás, 2008). The evaluators find that there is relatively poor coordination of activity across the Irish Government system and, there are weaknesses in terms of the formal evaluation and review of many agreements and activities. But in the partner countries the impact is not optimal either. Partner countries, according to the evaluators, find it hard to develop objectives and priorities based on broad national priorities and to improve coordination between different actors within the context of the STI agreement signed with Ireland. Ireland's partner countries find it hard to realise a systematic, evidence-based prioritisation of themes or activities, according to the Irish. This hinders the genesis of a policy dialogue.

From a review point of view, the study is not very useful. Potentially interesting impact indicators, such as publications with partners from third countries; project participations; and increased mobility were not discussed in descriptive terms. The impacts of the agreements were not discussed.

The second review of science and technology cooperation between the **European Community and the United States** was conducted by Horvat and Harrap (2009). Like the 2008 China review, this review focused on the STI cooperation activities of the US with the European Community. An impact analysis of the bilateral STI agreement was not the purpose of the review. This implies that indicators such as co-publications, project participations, and mobility issues were not discussed in direct relation to the agreement.

Horvat and Harrap (2009) were very clear about the importance of the agreement: it should be 'regarded as important to the ongoing transatlantic STI policy dialogue'. The agreement itself was analysed in terms of e.g. appreciation by the policy actors involved, participation in the Framework Programme, and participation of EU Member States in the implementation of the agreement. This implies that the focus was on governance aspects and not so much on impacts in terms of STI. The evaluators concluded that - compared with the previous period - meetings of the governance bodies had greatly improved regarding scientific content and participation of high-level stakeholders. But the top-down communications of the Steering Group to policy makers and scientists could still be improved.

The evaluators found that participation of USA partners in European research activities and vice versa was low. They identified a substantial potential for further development when it comes to participation. They also concluded that there was still a lack of awareness of the state of the Agreement and the EC-US cooperation in STI amongst both policy makers and the STI community. Mobility of researchers, according to the evaluators, was one of the most successful activities in the realm of the STI agreement between the USA and the EU.

In May 2011, the European Commission published the review of STI cooperation between the **European Union and Argentina** (Clar & Schmidt-Lainé, 2011). The study did not assess the impact of the agreements in terms of e.g. awareness, mobility or project participation. Even though it does contain an analysis of changes in the share of co-publications, it is not made clear to what extent these changes are due to the STI agreement between the EC and Argentina. Nevertheless, the awareness of the agreements amongst researchers and policy makers from both signatories could be improved, according to the evaluators.

In 2011, the National Research Council organised a symposium on the STI Agreement between the **United States and China** (Wessner, 2011). The impacts of this agreement were not made explicit at the symposium. But it was made clear that the bilateral STI agreement between the USA and China had resulted in various cooperation activities, and increased exchanges between U.S. and Chinese scholars and technical experts. These cooperation activities and exchanges have drawn the bilateral relationship closer, according to the authors. But even more importantly, they state that the agreement has contributed to the exchange of ideas on science and technology policy (a policy dialogue). Impacts in terms of STI indicators such as participation, and mobility are not mentioned in descriptive terms. But it is stressed that they will increase in the future. The USA, in the study, has increasingly shifted its focus on cooperation with China. The most important arguments for this conclusion are the growth identified above and the rising costs of doing research in the West.

The Bureau of Oceans and International Environmental and Scientific Affairs (OES, 2012) draws similar conclusions. The China-USA agreement was perceived to advance a range of US objectives during the reporting period. Particular benefits were identified in terms of (1) policy discussions on the protection of intellectual property, (2) scientific merit review processes, and (3) transparent publishing of scientific data that encouraged China to support democratic and meritocratic principles in project evaluation and selection. Issues such as mobility, joint projects, and awareness were out of scope for this short study.

In December 2011, the review of STI cooperation between the **European Union and Chile** was published (Bernaras & Clar, 2011). This extensive review discussed the number of Chilean participants in FP6 and FP7. It was noted that there had been some increase in project participation. Mobility of researchers was not discussed. One of the main reasons was that Chilean researchers, according to the evaluators, had a preference for Chilean funding. The STI Agreement was not broadly known amongst relevant stakeholders in Chile. The evaluators explicitly recommended a stronger focus when it comes to aspects of the Chilean STI system to be targeted. Moreover, the evaluators stated that the policy dialogue between the two countries should receive more attention from both sides.

The Review of the STI cooperation between the **European Union and Brazil** was published in June 2012 (Bernaras & Zickler, 2012). The evaluation concluded that the participation in projects increased, but differed significantly throughout the country. The list of priority areas in the Agreement was considered too broad and the activities executed during the period were therefore scattered across several thematic areas. This made it hard for their results to have an impact on industrial competitiveness and economic and social developments, or on global challenges.

The evaluators state that the Brazilian partners found it hard to contribute to a STI policy dialogue. Such a dialogue is not viewed by Brazil as having had an important impact. This is partly due to the difficulties in focus, and partly because the political gain for Brazil is not clear. The highest level of political representation at the Steering Committee meetings has decreased over the years, which clearly annoys the Brazilian partners.

Also in 2012 the second review of the STI agreement between the **European Commission and India** was published (Basile & Régnier, 2012). It officially assesses the impact of the bilateral STI agreement and not of the cooperation in general. The review discusses the number of participants and mobility of researchers. In the first place it concludes that the number of Indian participants in FP projects is too low. Also, the mobility of EU and Indian scientists is perceived as unsatisfactory by the evaluators.

Some growth in terms of cooperation of Indian researchers in EU programmes was signalled, but at the same time the review states that this might have only little to do with the agreement under review: it does not establish the funding of the EU-India STI cooperation, and it 'only mentions India's possible participation in FP calls and vaguely refers to other possible modes of cooperation'.

Also, three fundamental weaknesses of the agreement are identified. First, the agreement does not establish the funding of the STI cooperation. The Framework Programmes themselves are widely perceived (on the Indian side) as an initiative outside the scope of the agreement itself. The agreement looks like a generic MoU according to the reviewers. Impacts are therefore limited. Second, the symmetry and reciprocity principles established in the Agreement are not applied. Finally, significant discrepancies exist in the ways the impact of research and innovation on economy and society is analysed in EU and India's official documents.

The review of the STI agreement between the **European Union and the Republic of Korea** was published in 2013 (Bobe & Chehan, 2013). Even though the review considers interesting components such as the purpose of the STI agreement, the Korean STI system, and the positioning of a number of EU Member States vis-à-vis the Republic of Korea, no such thing as the impact of the agreement is assessed.

The level of cooperation in the Framework Programmes from Korean researchers was far lower than expected by the evaluators. They made a plea for better, and more intensive cooperation. The policy dialogue was not optimal: the overall approach to STI cooperation between the EU and South Korea has been 'at best ad-hoc and opportunistic'. Nevertheless, the evaluators concluded that there was slow progress, but hope for more in the future.

Apart from the reviews described above, two delegations of the EC to third countries have published reviews of EU Member State cooperation with these particular third countries. The **Delegation of the EC to Russia** (2009) published an extensive overview of bilateral relationships between Member States and Russia. But no reference to impacts was made. Three years later, the **Delegation of the EU to China** (2012) published a similar review of agreements between EU Member States and China. The review considered activities conducted under the agreements, but impacts or effects of the agreements were not discussed.

D. There are six reasons why little can be said about quantitative impacts of bilateral STI agreements

Even though a number of specific reviews thoroughly analysed issues such as the context of the agreements, specific bottlenecks, and room for improvement, the impacts of bilateral STI agreements in general cannot be assessed through a literature survey of evaluations and reviews of the impacts of individual bilateral STI agreements. There six reasons for this:

1. Very few countries have developed structural reviews of STI agreements;
2. Too little effort is made to identify causal relationships between the agreements and change in the system;
3. Discrepancies in the interpretation of 'impact';
4. Objectives are often set very broadly, which makes impacts hard to measure;
5. Low structural usage or performance indicators;
6. Narrow scoping of the reviews.

Only **a small number of countries structurally perform reviews of STI agreements**. Virtually all reviews available are published by the EU. Only a small number of USA reviews and reviews by EU Member States exist. Korez et al. (2010), find that one of the main weaknesses of bilateral STI cooperation is the lack of project evaluation at the aggregated level. Technopolis (2013) shows that constant and sustainable systems for evaluations or impact assessment systems of international extra-EU cooperation are not optimal. Terms of Reference often ask for broad reviews and not for impact assessments in the methodologically correct terms. This makes it difficult to draw conclusions about the impacts of STI agreements based on a literature survey.

The second reason raised by many of the evaluators that we interviewed and referred to is the fact that **often too little effort is made to identify relationships between the agreements and change in the systems**. We already indicated that these causal relations are hard to identify, as bilateral STI agreements themselves in most cases do not create specific programmes. Hence, due to the relatively small weight of their intervention is not easy to trace back at the systems level. They might arrange (reciprocal) access to programmes that exist already, but such access might be arranged in different ways by governments as well. These governments take on several other roles when it comes to international STI cooperation. They provide funds, regulate STI cooperation activities[13], they sign other agreements with STI components that might have a more specific focus, and they manage labour migration and visa requirements for researchers.[14]

Third, **'impacts' are interpreted differently from country to country**. Especially striking differences are identified between the USA and the EU. The reviews of USA agreements, usually

[13] E.g. when they touch, say, defence R&D, national security, export sensitive technical information, or public health issues.

[14] We agree that it is often challenging to identify causal relationships between a particular bilateral STI agreement and change in the system. Entering into bilateral STI agreements is only one policy instrument in a larger set of instruments that national governments have in the field of international STI cooperation. In other words, a bilateral STI agreement is not always a *conditio sine qua non* for STI activities. Often bilateral STI activities are carried out without regard to any bilateral STI agreement. Simultaneously, individual laboratories, universities or non-university research institutes enter into specific private bilateral agreements that are not at all related to the bilateral agreement, but also have in impact on STI cooperation activities. The impacts of such private agreements are sometimes wrongly included in the reviews as impacts of bilateral STI agreements.

stress the impacts in diplomacy terms[15] (e.g. Heaton, 2006; Jones, 2010; Wessner, 2011; Dolan, 2012). EU reviews, on the other hand, are restricted to purely STI topics, such as success factors and bottlenecks for cooperation, assess the activities of some EU Member States with that particular third country and discuss the extent to which the cooperation is beneficial. The essence of impact is perceived differently from country to country (see e.g. Basile & Régnier, 2012; or Panday, 2006). [16]

Fourth, the **objectives of the agreements are often set very broadly**, which makes them hard to measure. Objectives are set in abstract terms such as 'strengthening the links of the scientific community with partners abroad in developing research and exchanging knowledge' (Clar & Schmidt-Laine, 2011*).* This applies to EU agreements, but also to most agreements signed by Member States. These abstract objectives make it hard to measure the impacts of STI agreements.

The fifth reason is the **low structural usage of performance indicators**. Most reviews do not use indicators in a systematic way. This cannot be solved easily, since most countries do not routinely collect information about the international STI activities they carry out with other countries (Horvat & Remøe, 2012). Up-to-date reliable and comparable indicators for the assessment of STI collaboration-related impact are rarely applied (CREST, 2009, see also Gnamus, 2009). This makes it hard to measure the outcomes, let alone the impacts of bilateral STI agreements in general. The ERA Expert Group (2008) refers to this as 'the risk of empty words': as no clearly defined monitoring procedures and evaluation criteria are put in place for even the most concrete rationales and objectives, attribution becomes dangerous.

The sixth problem is related to **the scope of reviews**. In the rare cases where indicators are used in a structured and systematic way, the indicators themselves are conventional (e.g. mobility, access to infrastructures, joint research projects and co-publications). Even though such indicators might give a good overview in terms of activities, they cannot be used to measure the impact in terms of e.g. public-private partnerships, lasting networks, dissemination of knowledge, or, even more difficult, measuring impact in terms of coping with issues such as low growth, insufficient innovation, and environmental and social challenges (Boekholt et al., 2009; Gnamus, 2009). This might be partly due to a general lack of the political scope in the definition of national strategies. In most countries, there is no explicit national RTDI strategy toward international STI cooperation (Bernaras & Clar, 2011). In those cases where there is a national strategy on international STI cooperation, this strategy is often more generic than specific. As a consequence, priorities are hardly defined (Clar & Schmidt-Laine, 2011).

When it comes to the evaluations of EU agreements, a similar issue can be distinguished. Methodologically, and in terms of scope, the evaluations of the respective EU agreements differ significantly. As the evaluators follow the Terms of Reference presented to them by the European Commission, these Terms of Reference can be used to improve and to harmonise the evaluations. Ultimately, this would give the European Commission a better insight into the effects of its bilateral STI agreements.

[15] The reviews of the USA agreements show that the US has a strong tendency to look at these agreements in terms of 'science diplomacy'. The best example is the first bilateral STI agreement between Japan and the USA that was signed in 1961 to mend the broken Relationship (Turekian & Neureiter, 2012). More than 50 years later, the agreement is still reviewed primarily through diplomatic lenses (Heaton, 2006). The Agreement between the USA and China shows a similar pattern (Jin, 2003; Dolan, 2012).

[16] A good example is the EC-USA Impact Assessment from 2003. Even though the name of the study suggests that it measures the impacts of the agreement, the Terms of Reference asked for an assessment of the ongoing activities. The term 'impact' is not used in the Terms of Reference.

E. Nevertheless, five important observations can be made from the evaluations

Despite the fact that impacts of STI agreements cannot be assessed, six important remarks should be made on the evaluations of STI Agreements and STI cooperation:

1. **Bilateral participation at the project level seems to have increased**. But the results differ from third country to third country, and, in addition, it is difficult to clearly relate and attribute such an increase to the STI agreement. Especially in the third countries that are (1) less mature in terms of their STI systems, and (2) that show only a small increase in terms of expenditures on STI, there seems to have been an increase in terms of project participation.
2. But in these cases, the evaluations indicate that, **in terms of reciprocity, impacts are still low**. Most EU agreements mention the importance of reciprocity. But in actual practice, the evaluations do not find proof of substantial increases in terms of reciprocity. It is important to mention that – unlike the EU STI agreements - the US agreements usually do not mention reciprocity as a guiding principle.
3. The **mobility of researchers increases slowly**. This is striking since it is one of the primary goals of most agreements. Most evaluations do not identify major growth in terms of mobility of researchers. Similar conclusions were drawn by the ERA Expert Group (2008) that found 'practically no progress in researcher mobility'. The 2013 evaluation of the STI Agreement between the EU and the Republic of Korea identified some reasons for this slow increase. The most important one was probably the increasing possibilities to arrange mobility in a more informal way via e.g. social networks.[17]
4. The **awareness amongst policy makers and the STI community should increase**. The evaluations indicate that most third country policy makers and most researchers do not think of a specific bilateral STI agreement when they consider to seek cooperation. They, of course, think much more pragmatically. This might have a consequence for the implementation of the principles in the agreements.
5. We discussed the **policy dialogues** in section A, page23. A typology was presented of the arrangements of policy dialogues in STI agreements. Evaluations of STI agreements all indicate that these policy dialogues are potentially very important benefits of the agreements. The EU often sets up a system of yearly summits with representatives from the third country to discuss the developments in the form of a regular dialogue. Meetings of the Steering Committees might then be instrumental for the follow up and implementation of the decisions made during the summits. We expect that the USA has a similar approach, even though the meetings of political representatives might have a stronger agenda-setting character in terms of sectors to be targeted (e.g. Xiaomin, 2003).

   But then the basic question for signatory countries in all STI agreements with a policy dialogue is: 'How intense should this policy dialogue be?' This intensity can vary in terms of meeting frequency and the selection of representatives. Evaluations of EU agreements often indicate that – without clear reasons - the intensity of the policy dialogue decreased shortly after the signing of the agreement.

   Our interviews show that – as far as it concerns EU agreements - this is partly due to a lack of involvement of EU Member States in these policy dialogues by the EU. This is partly a configuration problem. As we noted in section C, page16, the EU identifies with DG RTD a research-oriented organisation as the executive agent, whereas EU Member States often identify other types of administrative organisations as executive agents. One might expect that this has consequences for the impact of the agreement.

   The USA, on the other hand, has a broader perspective. The USA seems to have three reasons for focusing policy attention towards specific third countries in the realm of an STI agreement: (1) to use the STI agreements as a vehicle to improve overall relations; (2) because it might serve the political interests of key US officials, especially the President; and (3) because certain problems in the STI relation are identified, e.g. IPR issues (NSB, 2001; Heaton et al., 2006; Dolan, 2012).

[17] This has already resulted in the discontinuation of mobility schemes between Italy and Korea.

VI. OTHER PRACTICES WITH REGARD TO IPR ARRANGEMENTS, AND THE LIMITED RELEVANCE OF IP ARRANGEMENTS IN STI AGREEMENTS

In section H, page20 we explored IPR arrangements in STI agreements. In section B, page25 we constructed a typology that shows how the USA, the EU, and EU Member States deal with IPR arrangements in different ways. In this chapter we explore the process that the USA uses to 'tailor' its IPR arrangements per STI agreements based on third country characteristics. Secondly, in section B, page39, we assess the relevance of IPR arrangements in general, and in both the EU and the USA.

Key findings: The USA uses the so-called C-175 process to identify the best IPR arrangements for each third country.

However, from our analyses of the role of IPR arrangements in STI agreements we conclude that the impacts of this process in terms of differentiation between countries are still low.

More importantly, we conclude that IPR arrangements in general are of rather limited relevance. The arrangements usually consist of obvious and generic IPR rules that seem to be copied from one STI agreement to another. Moreover, it is hard to find evidence of an actual case of a transnational STI collaboration project, where the IPR rules from the STI agreements played a role in litigation procedures or in disputes on IP ownership.

A. With the C-175 process, the USA follows a different strategy when it comes to setting up IPR arrangements

Section H, page20 and in section B, page25 showed how the USA IPR arrangements in STI agreements differ significantly from the arrangements used in EU agreements. USA IPR arrangements are usually more elaborate than EU IPR arrangements and especially arrangements in agreements signed by EU Member States. Most USA agreements fall under the detailed C and D types that we identified in section B, page25.

In this section we present the process that is used in the USA to identify IPR arrangements to be used in specific STI agreements. The types of arrangements theoretically depend on the level of IPR protection in a third country, the expectation that IP is created under an agreement, and the extent to which a third country is in compliance with international IPR practices.

All falls under the realm of the ***Circular 175 procedure***[18]***.*** The Circular 175 procedure is a set of regulations developed by the State Department to ensure the proper exercise of the treaty-making power. According to the US Department of State, the Circular 175 procedure seeks to 'confirm that the making of treaties and other international agreements by the United States is carried out within constitutional and other legal limitations, with due consideration of the agreement's foreign policy implications, and with appropriate involvement by the State Department'.

In 2001, following the recommendations of a report of the National Research Council (NRC, 1999), an **Interagency Working Group on Intellectual Property Rights Provisions in International Science and Technology Agreements (IWG)** was established under the direction of the Committee of International Science, Engineering and Technology (CISET) of the National Science

[18] http://www.state.gov/e/oes/rls/rpts/175/

and Technology Council. Its aim was to improve the IPR annexes used in international S&T agreements, which were at that time mostly based on a 1990 model agreement/annex, and the respective parts of the C-175 process. The aims were three-fold:

- To better facilitate and promote international S&T cooperation while providing for a fair allocation of any intellectual property rights (IPR) that may result;
- To take into account the need for effective protection of IP; and
- To accelerate the internal USG review process with regard to the determination of IPR Annex language in international science and technology agreements.

The overall main result of the IWG was a call for more flexibility for drafting the IPR arrangements in the C-175 process. This call was based on the assessment that 'one-size-fits-all' approaches should be avoided. The IWG chose to increase this flexibility by creating **different types of model IPR annexes that could be used according to needs and the characteristics of the third country**. Such model annexes would act as starting point for drafting tailored IPR annexes. The new IPR annex 'package' includes:

- the original 1990 IPR annex that should be used for treaties with countries with inadequate IPR protection;
- a slightly updated 1990 IPR model annex;
- a newly developed 2000 IPR model annex which could be utilised for S&T treaties where there is the expectation that no IP is created OR where the prospective collaborator is in compliance with international IPR practices;
- the NASA IPR annex text;
- the DOE IPR annex text and other options/annexes that are added by the request of government agencies.

The 2000 IPR model annex differs from its cousin from 1990 particularly with respect to two features: the **geographic allocation clause and the equity clause**. With respect to the former, the wording has been changed for example in that each Party has a right in its own country (in the 1990 IPR annex, the regulations stipulated that each Party has all rights and interest in their own country). With respect to the latter, the 2000 IPR Annex text '…requires that in cases where IP is likely to lead to, or has led to, the creation of intellectual property not protected by the laws of the other Party, the parties shall immediately hold discussions to determine the allocation of rights to the intellectual property…'. This new language is substantially different from the 1990 Model Annex which stipulates that 'if protection of a type of intellectual property is available under the laws of one Party but not the other Party, the Party whose law provides for this protection shall be entitled to all rights and interests worldwide.' The updated 1990 IPR model annex retains the original geographical allocation and equity clauses, but includes other improvements such as the clarification of the rights to be afforded by institutions to visiting researchers. Another improvement suggested by the IWG relates to enhanced processes for examination and clearance of draft contract texts. Against this backdrop**, the U.S. Trade Representative and the U.S. Patent Office have important roles in checking the validity and usefulness of the draft IPR arrangements in STI agreements**.

This has resulted in **the USA having the most elaborate IPR arrangements** in its STI agreements. In section B, page25 we showed that almost all USA IPR arrangements can be labelled as either *Medium heavy arrangements* or *Heavy arrangements*. However, the question remains to what extent the C-175 actually succeeds in differentiating between the types of IPR arrangements used and important characteristics of the third country, such as level of IPR protection, the expectation that IP will be created under an agreement, and the extent to which a third country is in compliance with international IPR practices.

The table below gives us an answer to that question. For the countries that have signed bilateral STI agreements since 2001 with the USA, it shows whether the IPR arrangements in the agreement are either *Medium heavy arrangements* or *Heavy arrangements*.

Figure 12. The C-175 process in actual practice: the USA IPR approach vis-à-vis its third countries

Medium heavy IPR Arrangements (cf. SectionB, page25)	***Heavy IPR Arrangements*** (cf. Section B, page25)
Australia	Algeria
Mexico	Denmark
Romania	France
Spain	Germany
Ukraine	India
	Morocco
	Sweden
	Tunisia

B. But in general, IPR arrangements in STI agreements seem to be of limited use

In section H, page20 we explored the use of IP regulations in STI agreements. In section B, page25 we presented a typology of IPR arrangements in STI agreements. In the previous section we showed how the USA identifies the appropriate IPR arrangements per third country. In the present section we show that most IPR arrangements in STI agreements are in actual practice of little use.

The analysis of the IPR annexes, and regulations of the STI agreements, as well as our interviews and our Expert Workshop, lead us to conclude that the **respective IPR arrangements are in practice of rather little relevance**. This conclusion is based on the following three observations:

1. A first observation is that many IP arrangements quote **obvious and generic IP rules**, such as the ownership rights for copyrighted material. For countries that are signatory to an international treaty dealing with IPR - such as the Berne Convention or the TRIPS Agreement – the question is whether stating obvious rules is of any additional benefit to the STI agreements.[19] After all, STI agreements cannot be in contradiction to the IPR treaties administered by the World Trade Organization (WTO) or the World Intellectual Property Organization (WIPO).
2. Second, it is **hard to find evidence of an actual case** of a transnational STI collaboration project where the IPR rules from the STI treaties played a role in litigation procedures or in disputes on IP ownership. Such cases are unknown to at least some of the major law and patent attorney practices that are active in the field of IP litigation and in brokering/negotiating collaboration agreements between international research partners.
3. Third, it seems that many such IPR texts have been just **copied from one STI agreement to another** without appropriate questioning of the utility and appropriateness of the regulations in the context of a specific agreement.

Having said that, IPR arrangements in STI agreements nonetheless have the potential power to specify in further detail access to and use of intellectual property rights. This means that these arrangements could potentially have an impact on international STI collaborations. They are potentially important when it comes to commercial exploitation of STI efforts. There is hence also an objective need to specify in more detail what the collaboration partners own and how the STI results can be exploited (EC, 2008b; IPR Helpdesk, 2013). It must also be said that it is in the nature of things that regulations which act as failsafe are, under normal operations, seldom called upon.

[19] The situation might be different if the country of a prospective collaborator has not signed all relevant treaties or is known for an unreliable IPR system/difficulties for enforcing IPR.

The question that needs to be answered is whether IPR regulations for international STI collaborations should be dealt with at the level of public international law in STI agreements, and, if so, to what extent. The answer to this question also needs to cater for the fact that, despite the USA efforts discussed in section A, page37, not many STI collaboration agreements and their respective IPR parts are specifically tailored to the needs of the respective collaboration partners. At the same time, outside the framework of STI agreements, even within Europe, we find different sets of IPR rules governing collaboration in different institutional set-ups. For example, the currently existing three Knowledge and Innovation Communities (KICs) of the European Institute of Innovation and Technology (EIT) – all thematically collaboration endeavours – have three distinctively different IPR strategies and rules for common collaborative R&D projects (Radauer & Moody, 2013).

THE FEASIBILITY OF AN 'UMBRELLA STI AGREEMENT' AND RECOMMENDATIONS

VII. THE CURRENT SITUATION AND THE ALTERNATIVE: AN EU 'UMBRELLA STI AGREEMENT'

A. The current situation

The world of bilateral STI agreements is currently a fragmented one. The situation is that the EU has signed 20 bilateral STI agreements. The EU usually signs bilateral STI agreements with third countries that are either EFTA countries, enlargement countries and countries covered by the European Neighbourhood Policy (ENP), or that have relatively well developed STI systems as industrial countries and emerging economies**. EU Member States on the other hand, follow a different strategy. They sign STI agreements with a myriad of third countries, often because of ad-hoc reasons or because of historical ties**.

In terms of content many of these Member States agreements show a similar heterogeneity. More than the USA and more than the EU, individual EU Member States sign STI agreements also for non-STI purposes (section A, page13). Also in terms of STI focus, the Member States agreements remain relatively broad: compared with the EU, EU Member States do not often mention thematic priorities (section A, page13). A similar difference can be seen when it comes to setting up policy dialogues (sections C page16; D page17; A page23). Agreements signed by Member States are relatively loose in that respect in comparison with those of the USA, and especially those of the EU. The differences in terms of cooperative activities are marginal, but the EU is unique in its ability to provide access to large STI programmes through its STI agreements (section E page17). EU Member States use their agreements to improve framework conditions for cross-border mobility, but not to the same extent as the USA (section F page19). Member States hardly pay attention to IPR in their STI agreements compared with the EU and with the USA (sections H page20 and B page25).

In general, **agreements signed by EU Member States are of relatively little weight** in comparison to agreements signed by the EU. Due to the investment needed for signing new agreements, many are relatively old, and therefore not specific enough. The impacts of the agreements are modest. Their evaluations show that they usually contribute to an increased bilateral participation at project level, but also that in terms of reciprocity impacts are still low; that the mobility of researchers increases only slowly; that awareness of the agreements amongst policy makers and the STI community is still too low, and that the intensity of the policy dialogue decreased shortly after the signing of the agreement.

This analysis leads to the conclusion that **in Europe more coordinated approaches towards third countries would lead to increased efficiency and effectiveness in international STI cooperation**. Coordinated action would enable both EU Member States and the EU to invest in intelligence needed for setting up effective agreements. This would result in agreements that are better tailored to the needs and abilities of third countries. It would also enable the EU and Member States to invest in a continuous policy dialogue in which both the EU and the relevant Member States can actively participate. In addition, third countries would certainly welcome the reduced disparity of bi-lateral agreements and the resultant complexity of working with Europe. Our interviews show that such a coordinated approach towards international STI cooperation would be welcomed by large EU Member States, as well as by some large third countries.

B. Pros and cons of the alternative: a Basic Principles Umbrella

In the introductory chapter we discussed the Europe 2020 flagship initiative Innovation Union that stressed that the EU must further deepen its international scientific and technological cooperation. Moreover, it stated that Europe should act as one to achieve a global level playing field for research and innovation. The Innovation Union Commitment 31 specifically states that the European Union and its Member States should treat scientific cooperation with third countries as an issue of common concern and develop common approaches. This should contribute to global approaches and solutions to societal challenges and to the establishment of a level playing field. This implies that the potential scope for umbrella agreements between the EU and EU Member States with third countries should be explored.

An STI umbrella agreement is an ambiguous concept. Often, an umbrella agreement is defined as a bilateral, government-wide agreement, framework agreement, or simply STI agreement (Georghiou, 1998; Dolan, 2012). From this perspective, an umbrella agreement does not differ from any of the individual STI agreements that we analysed in this study.

However, together with the European Commission, we take a different perspective. We use the adjective 'umbrella' to refer to the fact that **such an agreement is the effect of a concerted 'umbrella action', a joint approach or joint actions by (a group) of EU Member States, and the European Union** (Cf. Gnamus, 2009; European Commission, 2010). Basically, two interpretations of the concept are used in the following. We refer to these as (1) a joint consent-umbrella, and (2) a basic principles-umbrella. Both are defined in the table below.

Figure 13. Introduction of the two types of umbrella: joint consent umbrella and the basic principles umbrella

Joint consent umbrella	Basic principles umbrella
An agreement between two or more governments, research funding bodies, research agencies, or other research actors, that provides overarching or framing conditions for international STI cooperation. The joint consent character stems from the fact that it is a **binding agreement** between governments or government bodies (European Commission, 2010). It might also be referred to as a multi-lateral agreement.	This is not an agreement under legal conditions. It can be defined as an informal model or a set of basic principles which might be used as the basis for future STI agreements by the EU and EU Member States in their respective relations with specific third countries. The basic principles umbrella has the characteristics of **recommendations and voluntary guidelines**. (European Commission, 2010). From a content point of view it can develop, for example IPR, private actor involvement, ways to arrange policy dialogues, mobility issues, reciprocity, evaluation, and IPR arrangements. From a process point of view it can help EU Member States and the EU to arrange their third country intelligence in a more concerted and effective way.

Even though the possibility of a Joint consent umbrella agreement has dominated the policy debate for a couple of years, room for implementation of such an agreement is limited. The Treaty of Lisbon identifies research and technological development activities as a parallel competence. This implies that the EU has competence to carry out activities and conduct a common policy, but that this does not prevent Member States from exercising their policies (Article 4(4) TFEU). It also implies that the EU has little room to act. In close cooperation with the Member State, the Commission may take any useful initiative to promote coordination. This goes in particular for initiatives aiming at the establishment of guidelines and indicators, the organisation of exchange of best practice, and the preparation of the necessary elements for periodic monitoring and evaluation (Article 181(2) TFEU). **This implies that the alternative, a basic principles umbrella (BPU) seems to be the only feasible alternative for the current situation.**

In our interviews, desk study and our expert workshop the following pros and cons of such a BPU were identified from respectively the perspectives of both active and less active EU Member States in the field of international STI cooperation, and the third countries.

Figure 14. Pros and cons of a Basic Principles Umbrella (BPU) from three perspectives

	Most active Member States	Less active Member States	Third Countries
Pros	**More efficiency in setting up the agreement**. Large Member States estimate that setting up an Agreement takes them 1-2 years and substantial budgets. Hence, many agreements are relatively old, and therefore not specific enough with regard to current and future needs. Combining resources, intelligence and experience of MS in a BPU would solve this. **Tuning cooperation activities with other Member States and EU**. A BPU might imply that individual MS would improve the tuning or alignment of their bilateral cooperation with each other and the EU or be encouraged to join forces under joint agreements. **Improved STI cooperation**. A BPU would facilitate and improve the researchers' opportunities for international STI cooperation.	**Professionalisation of negotiating**. For less active Member States it is often hard to really know the co-signatory country, in terms of STI strengths, weaknesses, strategies and agendas. A BPU agreement would allow them to learn from more active Member States, improve their intelligence, the professionalism of the negotiating process as well as the quality of the agreements. **Improved STI cooperation**. A BPU would facilitate and improve the researchers' opportunities for international STI cooperation.	**Efficiency**. Our Expert Workshop concluded that 3rd countries find it increasingly harder to manage a myriad of bilateral STI agreements with different EU Member States. 'Working with Europe is becoming too complex.' An EU-level BPU would increase the efficiency of implementing STI agreements with EU individual Member States, with groupings of Member States and with the EU. Ultimately, also fewer agreements might need to be signed and operated. **More simultaneous involvement of Member States in policy dialogues**. 3rd Countries now complain about having to deal separately with the EU and 28 MS. **Potentially increased focus on reciprocity**. Section G page20 showed that an EU-coordinated umbrella might result in an increased focus on reciprocity. Our interviews show that this is welcomed by many 3rd countries.
Cons	**Potential thematic inflexibility**. Larger Member States fear that any EU-coordinated umbrella would find it hard to go beyond DG RTD's priorities and address also the thematic interests of Member States. **Centralisation**. Any significant Umbrella Agreement comes with a certain centralisation of power. European added value should be made clear.[20] **Sceptics regarding the resources and intelligence**. Large MS spend more resources on agreement intelligence than the EU. They might have little to gain with an EU umbrella. **Loss of science diplomacy tools**. Signing STI agreements is considered an important tool in science diplomacy (cf. Bolan, 2012). Member States may fear that this instrument might be weakened or lost.	**Loss of science diplomacy tools**. Signing STI agreements is considered an important tool in science diplomacy (cf. Bolan, 2012). Member States may fear that this instrument might be weakened be weakened or lost.	**The big machine**. From the point of many 3rd countries, especially the smaller ones, the EU is like 'a big machine' that is not able to move towards the needs of smaller 3rd countries. Instruments such as Framework Agreements and Steering Groups are considered by smaller 3rd countries as heavy and inflexible. **Decreased Flexibility**. MS are considered 'better listeners' than the EU by many 3rd countries. The EU has difficulties in understanding the current transition the 3rd countries are in. They fear an umbrella would decrease their operational flexibility. **Loss of science diplomacy tools**. Signing STI agreements is considered an important tool in science diplomacy (cf. Bolan, 2012). Our interviews stress that certain 3rd countries attach great value to this bilateral process. They fear that this instrument might be weakened or lost.

[20] For more details: Technopolis Group (2014)

VIII. RECOMMENDATIONS

In this chapter we present the five concluding recommendations of this study. They are based on our analyses, the interviews and inputs from our Expert Workshop.

A. Regarding the current agreements: Harmonise and improve the terms of reference for the reviews, evaluations and impact assessments of STI agreements.

The European Commission is recommended to reconsider the way the reviews or evaluations and impact assessments of the bi-lateral agreements are set up.

We found that, even though the reviews give the impression that they want to measure also impacts of agreements, in addition to reviewing the implementation of the agreements, they actually do not measure impacts of agreements. It was clear that (1) the scope of many evaluations was broader than just the agreements, and (2) there was no methodological framework for the measuring of impacts. This hinders a clear insight into the impacts of bilateral STI agreements. At the same time, we found that most evaluations clearly just followed the demands set out in the respective terms of reference. If the European Commission continues to set a high value on measuring and monitoring the impacts of its STI agreements, it is recommended that it harmonises and elaborates the terms of reference that are to be used by the evaluators accordingly.

B. Regarding the current agreements: Be flexible and minimalist towards IPR arrangements in STI agreements.

Any sort of IPR arrangement in an STI agreement should be kept as minimalist as possible.

As stated in section B page39 there is not much practical relevance of the IPR texts of the STI agreements. As remedy, we suggest that the IPR arrangements call for the implementation of IPR regulations at the level of projects or other activities as appropriate. STI Agreements should ask specifically the contracting parties in the STI projects to deal with, and regulate, a number of issues typically found in STI collaboration contracts, e.g. in Technology Management Plans.

The European Commission is recommended to check IPR annexes so that they do not restrict the freedom of European research organisations and firms to apply IP laws that are implemented in the EU and in Member States.

The EU has some IPR regulations that are unique with respect to, for example, database rights, geographical indications (which are probably less relevant in the context of STI projects) or utility models (which exist in many EU Member States). A clause that would grant the collaborator immediate and free access to data in a database established in the course of a project could, for example, in principle, nullify IPR protection options as provided for by the database rights.

C. Regarding the Basic Principles Umbrella: Explore the possibilities at a more concrete level and set up the proper institutions to ensure Member States' involvement.

EU Member States, together with the European Commission, are recommended to set up a body that would explore the practical possibilities of a Basic Principles Umbrella (BPU).

We refer to this body as the BPU Steering Group. The BPU Steering Group should consist of representatives from both the Member States and the European Commission. One can consider using the Strategic Forum for International S&T Cooperation (SFIC) as (a part) of the infrastructure for the BPU Steering Group.

In this report we have presented several advantages of a Basic Principles Umbrella (BPU). First there is the Member States perspective. Negotiating, signing and operating an effective STI agreement take a Member State 1 to 2 years and substantial investment. As a consequence, most Member States have substantial numbers of outdated agreements that are not specific enough for the current situation. Our study has clearly shown that Member States agreements therefore often lack weight and potential impact. Concerted action will lead to better intelligence, better agreements, and to improved impacts. Moreover, it will substantially contribute to the Innovation Union Commitment 31, more specifically the treatment of scientific cooperation with third countries as an issue of common concern and the development of common approaches in this cooperation.

There is also the third country perspective. Agreements with individual EU Member States are appreciated by third countries because of the flexible and pragmatic approach of Member States and the funding possibilities offered by some larger Member States. But our interviews also indicate that in a number of important third countries worries arise over the costs of signing agreements and operating them with both the EU and with large numbers of Member States, mainly because all differ with regard to rules and procedures of implementing collaborative activities. Our interviews show that many third countries would appreciate seeing 'Europe' act in a more coherent and concerted way.

From the perspective of the Member States, a BPU would allow Member States to achieve economies of scale in terms of intelligence and negotiating power. We expect that this will lead to more up-to-date STI agreements that show significant improvements in terms of e.g. thematic priorities (cf. section B page14); policy dialogues (cf. sections C page16; D page17 and A page23); cooperative activities (cf. section E page17); framework conditions for cross-border mobility (cf. section F page19); IPR arrangements (cf. sections H page20 & B page25); and evaluations and reviews (cf. section I page22). From the perspective of a third country, a good bilateral STI agreement should (1) allow a certain 'tailoring' to the third country involved; and (2) be flexible regarding thematic priorities and, especially, not be restricted to the Horizon 2020 areas. A BPU also has this potential.

Even though the added value of a more concerted action under a BPU is clear, the BPU Steering Group could explore and support the willingness of individual EU Member States to invest in such a concerted action.

This willingness will depend on the following variables that the BPU Steering Group should explore at a relatively early stage:

1 *Geographical scope of the BPU*. A BPU might be generic in the sense that it can be applied to all third countries. Even though this would be efficient, it would not be the solution with the optimal impact;

2 *Power of the BPU*. The BPU can range from either a set of best practices, to a model agreement that can be used by Member States. The first extreme would be relatively light, and might therefore not grasp its full potential impact. The second extreme might miss the flexibility that should be an important asset of any BPU. This flexibility can be increased by decreasing the geographical scope that we discussed under E1. The discussion on the power of the BPU should also include the positioning of a BPU vis-à-vis multilateral agreements (groups of EU Member States and a third country);

3 *Governance of the process*. In any form, a BPU would ultimately become a 'living document' that needs updating every now and then. This process can be coordinated by the EC. But our interviewees state that when an umbrella agreement would cover the EU and EU Member States, their involvement in all steps of the process should be ensured 'from the beginning of the negotiating process and not from the moment that we can sign'. Moreover, involvement should also be covered in the policy dialogue process. This implies that appropriate well-defined conditions for the involvement of Member States are necessary.

   But the process might also be coordinated by an individual Member State, or perhaps by one Member State per group of third countries. This would ensure Member States' involvement. Our interviews suggest that at least one or two large EU Member States might be willing to take on this role. The identification of the coordinating Member State could depend on third country characteristics.

4 *Top-down versus Co-creation*. The set of basic principles can be presented top-down by a coordinator that we discussed under E3. But one can also opt for a co-creation. This might be compared to certain aspects of the C-175 process in the USA.

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A.2 Agreements included in our analysis

Austria - China	Italy - India
Austria - Russia	Italy - South Africa
Austria - Ukraine	Netherlands - Indonesia
Belgium - Vietnam	Netherlands - Japan
Czech Republic - Argentina	Netherlands - South Africa
Denmark - China	Poland - Egypt
Denmark - India	Poland - Russia
Denmark - Japan	Poland - Ukraine
Estonia - China	Republic of Portugal - Brazil
European Community - Argentina	Republic of Portugal - Tunisia
European Community - Brazil	Romania - India
European Community - Chile	Slovakia - Ukraine
European Community - China	Spain - Algeria
European Community - Egypt	Spain - Argentina
European Community - India	Spain - Brazil
European Community - Japan	Spain - Morocco
European Community - Mexico	Spain - Uruguay
European Community - Morocco	Sweden - China
European Community - Russia	Sweden - Japan
European Community - South Africa	United Kingdom - Belarus
European Community - South Korea	United Kingdom - China
European Community - Tunisia	United Kingdom - India
European Community - Ukraine	United Kingdom - Indonesia
European Community - USA	United Kingdom - Russia
Finland - China	United Kingdom - South Africa
Finland - Russia	United Kingdom - South Korea
Finland - South Korea	USA - Algeria
France - Algeria	USA - Argentina
France - Brazil	USA - Australia
France - China	USA - Brazil
France - Japan	USA - Chile
France - Mexico	USA - China
France - Morocco	USA - Denmark
France - South Korea	USA - Finland
France - Tunisia	USA - France
France - Turkey	USA - Germany
Germany - Argentina	USA - India
Germany - Brazil	USA - Italy
Germany - Chile	USA - Japan
Germany - China	USA - Mexico
Germany - Egypt	USA - Morocco
Germany - India	USA - Poland
Germany - Japan	USA - Romania
Germany - Mexico	USA - Russia
Germany - Russia	USA - South Africa

Germany - South Africa	USA - South Korea
Germany - South Korea	USA - Spain
Germany - Ukraine	USA - Sweden
Ireland - China	USA - the Slovak Republic
Ireland - India	USA - Tunisia
Italy - Algeria	USA - Ukraine
Italy - Argentina	

A.3 Experts consulted

Expert	Organisation
Amaia Bernaras	IDOM
George Bonas	CeRISS
Günter Clar	Steinbeis-Europa-Zentrum,
Anca-Adriana Cucu	European Commission, DG RTD
Inna Dimova	European IPR Helpdesk
Anne Haglund Morrissey	European Commission, DG RTD
Susanne Madders	European Commission, DG RTD
Olaf Heilmayer	German Aerospace Center
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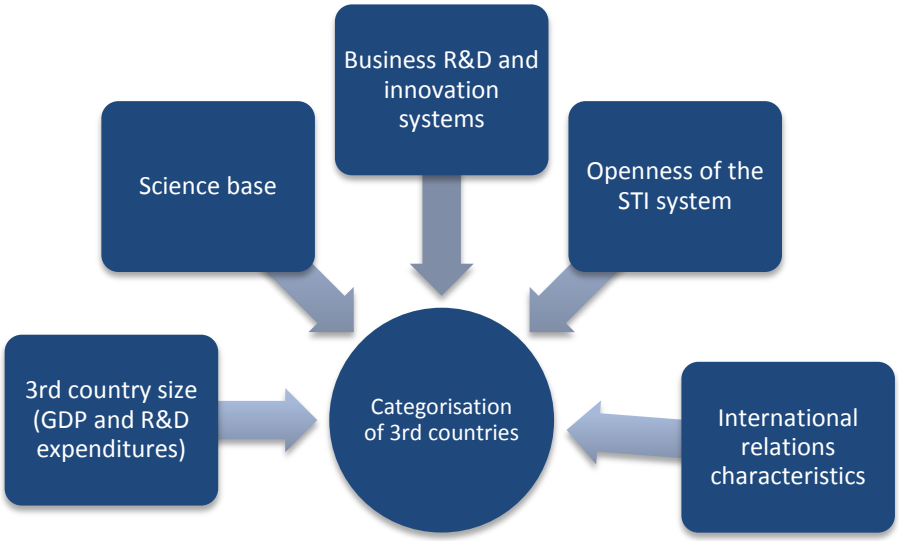
Marvelix Roa	
Klaus Schuch	Centre for Social Innovation
Sylvia Schwaag Serger	Vinnova
Daniel Strugariu	Council of the European Union

APPENDIX B TYPOLOGIES OF THIRD COUNTRIES (USED FOR CHAPTER THREE)

In this Appendix, we statistically identify clusters of third countries. Our study has analysed the agreements with a total of 32 third countries. Ten of them are only third countries from a USA point of view since they are Member States. That leaves us with 22 third countries for further analysis.[21] This includes all countries with which the EU has currently a bilateral STI agreement, except for three. For this clustering we use five different dimensions. These are presented in the figure below.



The dimension '*Third country size'* is an absolute dimension. It will show clear differences between large countries on the one hand and the smaller countries on the other hand. The dimensions '*Science base'*, '*Business R&D and innovation systems'*, and '*Openness of the STI systems*' are relative parameters. Since we correct for GDP, small third countries can easily compete with the larger ones. The last dimension, '*International relations characteristics*' covers diplomatic and geopolitical characteristics of the third countries.

For the clustering we use a statistically straightforward method of agglomerative hierarchical clustering. This implies that, for each of the five dimensions, every third country is initially considered a cluster itself. At about 15 to 20 successive steps, clusters of similar third countries are merged.

Some dimensions are presented as scatter plots, while in other dimensions the clusters are presented over a clear line. We use the first approach in those cases where the indicators underlying a specific dimension are also worth presenting.

[21] Algeria; Argentina; Australia; Belarus; Brazil; Chile; China; Egypt; India; Indonesia; Japan; Mexico; Morocco; Russia; South Africa; South Korea; Tunisia; Turkey; Ukraine; United States of America; Uruguay; Vietnam

Key findings: Analysis of the size of third countries results in four statistically significant clusters. These are: (A) the USA cluster; (B) a combined cluster of Japan, and China; (C) a cluster with most other BRICS and large countries; and (D) a cluster of smaller countries.

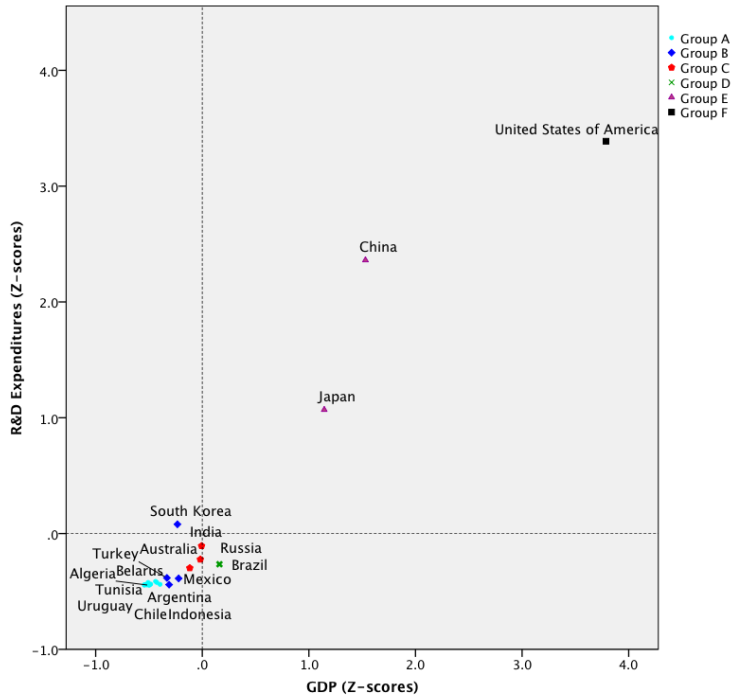
Analysis of the science base results in five separate clusters of third countries. Australia has the most developed science base. Analysis of business R&D and innovation results in four clusters. Japan has the most developed business R&D system. Analysis in terms of openness shows that there are basically five clusters. Indonesia has the most open STI system.

The analysis of third countries in terms of geopolitical categories shows a more diffuse pattern. In the total population of third countries, the European Neighbourhood Policy (ENP) countries are among the smallest ones in terms of GDP and R&D expenditures. Looking at third countries in terms of Horizon 2020 categories shows a diffuse image. There is no correlation with GDP or R&D expenditures.

B.1 In terms of size (both GDP and STI), six clusters of third countries can be distinguished

For classifying the third countries in terms of size, we use two indicators: GDP, and R&D expenditures.[22] When looking at these basic indicators we can statistically distinguish between six clusters of third countries.[23] We refer to these as Group A to Group F.

Figure 15. Third country clusters in terms of size



[22] The nominal GPD data are retrieved from the United Nations Statistics Division. R&D data are retrieved from the World Bank.

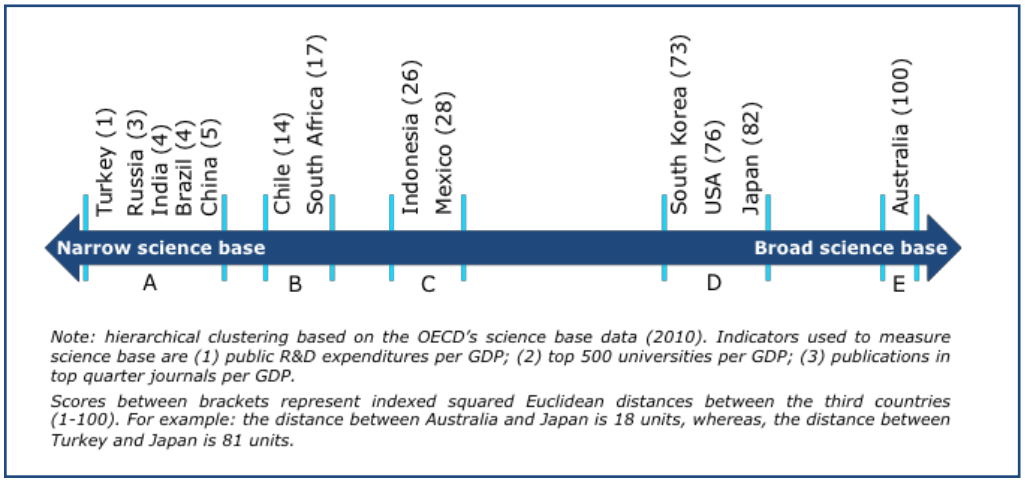
[23] Based on Euclidean distance method of determining distance between clusters. We used the furthest neighbour method for clustering.

Figure 15 shows that in terms of size, the USA is in its own cluster. China and Japan together form the second significant cluster. The third cluster consists of only Brazil. Even though Brazilian absolute R&D expenditures are less than e.g. Korea's or India's R&D expenditures, nominal GDP figures clearly outweigh the Group C figures.

B.2 Analysis of the science base of the third countries results in five clusters that range from Turkey to Australia.

For assessing the science base in the third countries we use three OECD indicators. These are '*public expenditures per GDP'*, '*the number of top 500 universities per GDP*', and '*the number of publications in top-quarter journals per GDP*'. Whereas the previous dimension (size) gave an absolute indication, this dimension is relative. Since we correct for GDP, small third countries can compete with the larger ones.

Figure 16. Third country clusters in terms of science base



Note: hierarchical clustering based on the OECD's science base data (2010). Indicators used to measure science base are (1) public R&D expenditures per GDP; (2) top 500 universities per GDP; (3) publications in top quarter journals per GDP.

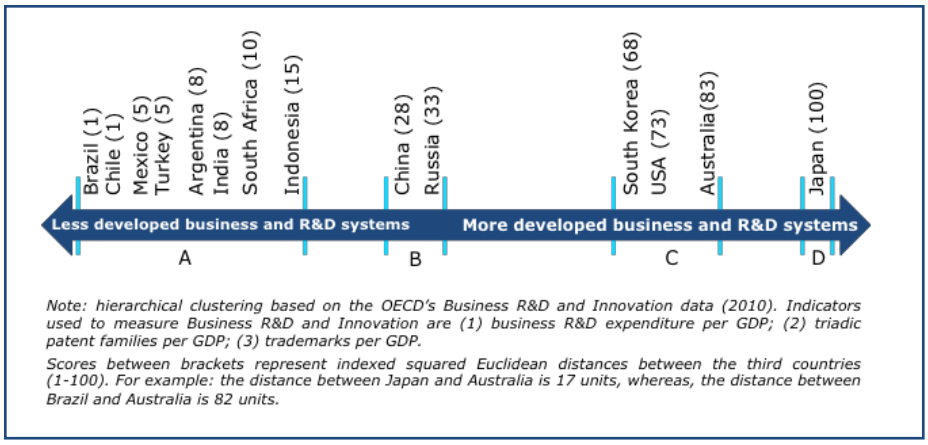
Scores between brackets represent indexed squared Euclidean distances between the third countries (1-100). For example: the distance between Australia and Japan is 18 units, whereas, the distance between Turkey and Japan is 81 units.

The A Cluster contains most BRIC countries. They have relatively narrow science bases. This implies that '*public expenditures per GDP'*, are low, which also goes for the '*number of top 500 universities per GDP*', and '*the number of publications in top-quarter journals per GDP*'. Australia (Cluster E) is the third country with the broadest science base. It scores best on the three science base indicators.

B.3 An analysis of business R&D and innovation systems, results in four clusters. They range from Brazil and Chile to Japan.

Business R&D and innovation systems are measured with three indicators. These are business R&D expenditure per GDP; triadic patent families per GDP; and trademarks per GDP. Again, since we correct for GDP, small third countries can compete with larger ones.

Figure 17. Third country clusters in terms of business R&D and innovation systems



Note: hierarchical clustering based on the OECD's Business R&D and Innovation data (2010). Indicators used to measure Business R&D and Innovation are (1) business R&D expenditure per GDP; (2) triadic patent families per GDP; (3) trademarks per GDP.

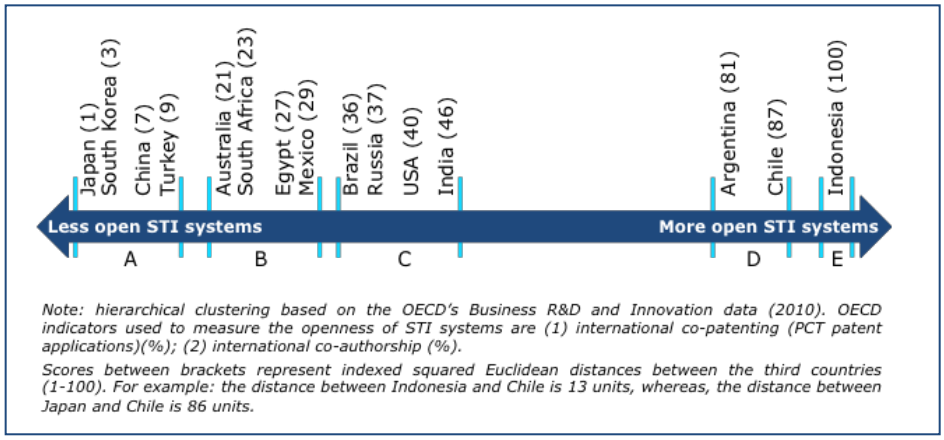
Scores between brackets represent indexed squared Euclidean distances between the third countries (1-100). For example: the distance between Japan and Australia is 17 units, whereas, the distance between Brazil and Australia is 82 units.

In terms of business R&D and innovation, four clusters can be distinguished. The least developed cluster consists of most Latin American countries, and some Asian countries. China and Russia are close together in Cluster B. Japan has the most developed business and R&D system, followed by Australia, the USA, and South Korea in Cluster C.

B.4 In terms of openness, five clusters of third countries can be identified, ranging from Japan to Indonesia.

We measure openness of a third country's STI system with two indicators: international co-patenting as a percentage of total co-patenting, and international co-authorship as a percentage of total co-authorship. Both indicators are relative indicators.

Figure 18. Third country clusters in terms of openness



Note: hierarchical clustering based on the OECD's Business R&D and Innovation data (2010). OECD indicators used to measure the openness of STI systems are (1) international co-patenting (PCT patent applications)(%); (2) international co-authorship (%).

Scores between brackets represent indexed squared Euclidean distances between the third countries (1-100). For example: the distance between Indonesia and Chile is 13 units, whereas, the distance between Japan and Chile is 86 units.

Five clusters can be distinguished. The least open cluster consists of some well-developed third countries, e.g. Japan and Korea. The fact that they are less open might also be interpreted in terms of development and independence. Nevertheless, the fact is that they have low shares of international co-patenting and co-publications, which might have an impact of international STI cooperation policies. Argentina, Chile, and Indonesia are relatively open STI systems.

B.5 Clustering in terms of international relations parameters shows a diffuse image

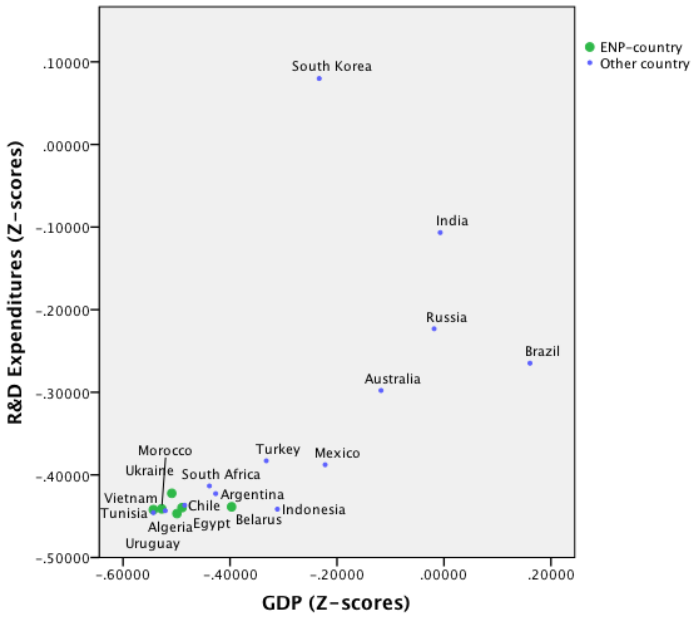
In the previous section, we statistically identified four clusters of third countries. Clustering was based on GDP and on R&D expenditure in each of the third countries. In this section we will identify third countries along a number of international relations parameters. These are:

1. The European Neighbourhood Policy (ENP);
2. Horizon 2020 Categories of third countries.

The European Union uses its European Neighbourhood Policy (ENP) to work together with southern and eastern neighbour countries and to achieve a certain level of political association and economic integration. Partner countries agree an ENP action plan with the EU. Such a plan would contain goals on human rights, rule of law, good governance, market economy principles and sustainable development. The EU helps the ENP countries in achieving these objectives.

The figure below shows the third countries that fall under the ENP regime, versus the third countries that do not fall under the ENP regime. For reasons of clarity, Group A and Group B (USA, Japan, China) that we identified earlier, are left out of the figure. Third countries under the ENP regime have relatively low GDP figures. Also their R&D expenditures are low in comparison with most other third countries.

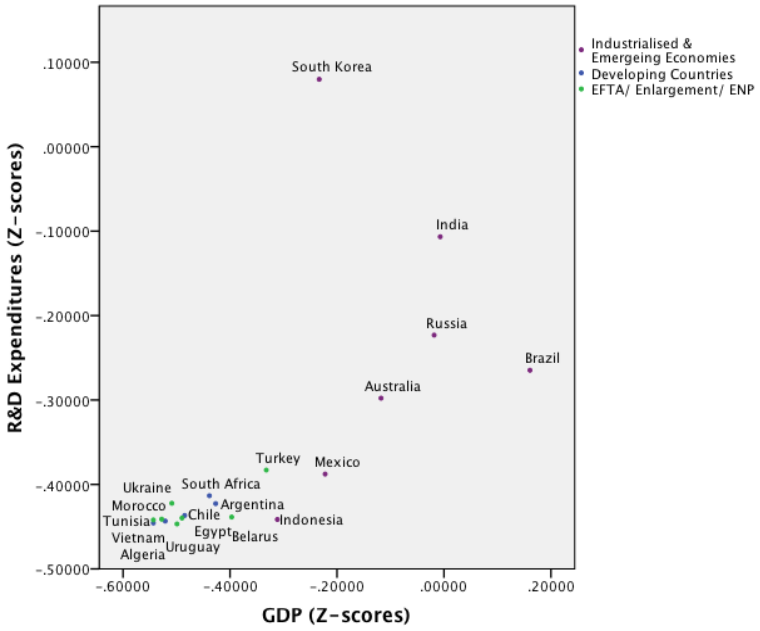
Figure 19. Third country clusters in terms of ENP status



There is a significant correlation between GDP on the one hand, and being an ENP country. In the total population of third countries, ENP countries have relatively low GDP figures ($F=5.906$; $p<.05$). There is also a significant correlation between expenditure on R&D on the one hand, and being an ENP country. In the total population of third countries, ENP countries have relatively small R&D budgets ($F=3.091$; $p<.10$).

The second categorisation is based on Horizon 2020 third country policy. Horizon 2020 distinguishes between three groups of third countries: industrialised and emerging economies; enlargement and neighbouring countries; and developing countries. The figure below plots the respective groups in terms of GDP and in terms of R&D expenditure.

Figure 20. Third country clusters in terms of Horizon 2020



The differences between developing countries on the one hand and EFTA/ Enlargement/ ENP countries on the other hand are small. On average, both groups are more or less equal in terms of GDP and in terms of R&D expenditure. As expected the group of industrialised and emerging economies is a category of its own in terms of R&D expenditure and GDP.

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Summary

This study assesses the characteristics of bilateral Science, Technology and Innovation (STI) Agreements and explores the scope for 'umbrella agreements' between the EU and its Member States on the one hand and third countries on the other hand. We find that EU STI Agreements differ significantly from USA agreements and Member States' agreements, for instance in terms of thematic focus, policy dialogue, and IPR arrangements. Most bilateral STI agreements signed by EU Member States are of limited use. Their potential impact on STI cooperation is very small.
Both the EU and Member States want to treat scientific cooperation with third countries as an issue of common concern and intend to develop common approaches. Our study shows that a so-called ´Basic Principles Umbrella´ would be the best way to do so. This would result in a pragmatic approach towards third countries in terms of what is offered, and in terms of coordination mechanisms on behalf of the EU and Member States.

Résumé

Cette étude évalue les caractéristiques des accords bilatéraux sur les STI et explore la portée des "accords cadres" entre l'UE et ses Etats Membres d'une part, et les pays tiers d'autre part. Nous pensons que les accords sur les STI de l'UE diffèrent considérablement des accords américains et des accords des Etats Membres, par exemple en terme d'approche thématique, de dialogues sur les politiques et en ce qui concerne les arrangements relatifs aux DPI. La plupart des accords bilatéraux sur les STI signés par les Etats Membres de l'UE sont d'une utilité limitée. Leur impact potentiel sur la coopération en matière de STI est très faible.
L'UE et les Etats Membres souhaitent faire de la coopération scientifique avec les pays tiers une question d'intérêt commun et ont l'intention de développer des approches communes. Notre étude montre que les soi-disant «principes cadres» seraient la meilleure façon d'y parvenir. Cela se traduirait par une approche pragmatique à l'égard des pays tiers en termes d'offre, ainsi qu'en termes de mécanismes de coordination au nom de l'UE et des Etats Membres.

Zusammenfassung

Die vorliegende Studie untersucht die Eigenschaften bilateraler WTI-Abkommen sowie die Bedeutung von Rahmenvereinbarungen zwischen einerseits der EU und Drittstaaten sowie andererseits EU-Mitgliedsstaaten und Drittstaaten. Wir zeigen, dass WTI-Abkommen der EU insbesondere im thematischen Fokus, im politischen Dialog sowie in den Vereinbarungen zum Schutz geistigen Eigentums erhebliche Unterschiede gegenüber Abkommen der USA sowie der einzelnen Mitgliedsstaaten aufweisen. Die Mehrzahl der von EU-Mitgliedsstaaten mit Drittstaaten unterzeichneten bilateralen WTI-Abkommen weist lediglich einen geringen Nutzen auf und hat dementsprechend keine große Auswirkung auf die WTI-Zusammenarbeit.
Sowohl die EU als auch ihre Mitgliedsstaaten betrachten die wissenschaftliche Zusammenarbeit mit Drittstaaten als ein gemeinsames Anliegen und beabsichtigen die Entwicklung gemeinsamer Ansätze. Unsere Studie zeigt, dass eine sogenannte «Rahmenvereinbarung über Grundprinzipien" den besten Weg dazu darstellt. Dies würde hinsichtlich der Kooperationsinhalte sowie der Kooperationsmechanismen eine pragmatische Herangehensweise seitens der EU und ihren Mitgliedsstaaten gegenüber Drittstaaten ermöglichen.

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