Working paper

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Case Study

Science and technology agreements in the toolbox of science diplomacy: Effective instruments or insignificant add-ons?

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Content

Summary

- Both practitioners and scholars tend to regard Science and Technology Agreements (STA) to be important, prominent, and highly effective tools for science diplomacy (SD). Yet it is far from clear whether they form an integral part of strategic approaches toward SD or mostly remain rather erratic ad-hoc agreements with more probably vague or even insignificant roles. Since we know but little about the development of STA over time, it is very difficult to get data and a valid picture on what is going on there at all and what impact STA might have.
- Based on a working definition of STA, we conducted a quantitative study to map the STA that six countries (DK, FR, DE, CH, UK, U.S.) and the European Union have signed between 1961 and 2016. In addition, through a range of expert interviews, we tried to capture practitioners' views on the role and workings of STA in the realms of international science policy and SD in particular.
- What we see is a large increase in the number of concluded STA over time. While some of the countries in our sample made extensive use of STA, others were more hesitant or even reluctant to do so. Still, we witness a strong integration of G20-states in a network of bilateral STA. To illustrate the highly diverse uses and importance of STA, we present four cases of negotiations that point to their limited strategic use. From our expert interviews, we could differentiate between four types of views or opinions with regard to the uses of STA.
- If we view STA in their respective political context, some apparently erratic provisions turn into meaningful strategic instruments. Overall, STA may carry different meanings to different stakeholders engaged in the negotiations; this is why they always serve as boundary objects.
- For future research, it would be worthwhile to look into the interconnections, or interplays, between STA and other tools of SD on the one hand and contextual variables like geopolitical shifts and organisational backgrounds that shape negotiations and appraisal of STA on the other.

Introduction

In the wake of increasing global competition and challenges, science and technology (S&T) issues gain more and more attention in international relations and foreign policy. Eager for enhancing their S&T capabilities and international position, national governments, research organisations, foundations and companies engage ***Diplomacy for Science*** to stimulate and bolster global research collaborations and internationalisation. In addition, science has come to be seen as means to foster diplomatic relations between nations, following the idea of ***Science for Diplomacy*** (Royal Society, 2010).

Consequently, numerous countries are now engaging in what they consider Science Diplomacy (SD). However, the means and ends of their activities differ widely not just between countries but also compared to other stakeholders and players in that field (Flink & Schreiterer, 2010). While some governments focus on improving research excellence, business opportunities, and innovation, others like the U.S. leverage SD to sustain and enhance international relations and their international standing. Similarly, other stakeholders seize widely different means to pursue their objectives. Science and Technology Agreements (STA) are often regarded convenient tools to serve strategic SD objectives. For example, Van Langenhove (2017) counts STA among effective instruments of SD like S&T advisory boards, science counsellors deployed at embassies, or the opening of national research funding schemes to partners from abroad. In this view, STA are policy instruments whose well-defined means, resources and objectives make a clear difference to more general approaches or programs in the toolbox of SD. The literature on STA supports the view that they have become a flexible device of SD that may serve very different ends at the same time.

Dolan (2012), for instance, studied the STA that the U.S. government had entered, starting with an agreement with Japan in 1961. She identified four drivers for concluding STA: Transforming diplomatic relations, promoting public diplomacy, highlighting cooperation on the occasion of an official state visit, and protecting U.S. National Security. According to her, the conclusion of all current U.S.-STA can be traced back to different configurations of these four motives, what she demonstrated with several case studies. In a report to the Directorate General for Research and Innovation of the European Commission (EC), Fikkers and Horvat (2014) pulled up 11 additional reasons for signing STA that address different aspects of the research and innovation process, such as facilitating mobility of human capital or to get access to research infrastructures and new markets. Overall, the authors distinguished a narrow set of S&T-related objectives from a broader, fuzzier perspective on STA which also includes issues that are more related to the ***Science for Diplomacy*** side of SD. In particular, they tried to pinpoint the effectiveness of STA by a comparative analysis of 103 agreements; however, the heterogeneity of STA and diverging modes of evaluation and review procedures make it difficult to come up with sound outcomes, let alone a clear picture. Rather, the report suggests that–despite positive effects in individual cases–signing such agreements may even happen merely accidentally, lacking clear strategy and goals.[1]

In spite of such, after all, rather favourable general appraisals of STA, a few pieces are missing in the puzzle. In particular, we see three major shortcomings:

- The actual understandings, and uses, of STA differ as much as the definitions of, and approaches to SD. In particular, this holds true for their implementation and outcomes. It is always national governments that negotiate these agreements with one another. But apart from that we notice a great variety of types of contracts, treaties, and memoranda of understanding between all kinds of entities: National governments, individual ministries, provinces and states, funding institutions, research organisations, and universities all maintain their own network of collaborations. Partly, these are formalised by way of some kind of STA, but mostly, they are just informal.
- So far, literature has paid but little attention to the development and diffusion of STA over time. If STA were an operational tool for SD, however, we should be able to observe their diffusion occurring in lockstep with the expansion of SD activities in general. In a similar vein, we might presume there is a close correlation between the conclusion of STA and general trends in international relations.
- The great heterogeneity of STA across different cases, topics and stakeholders cast doubts on the claim that they are an essential part of each SD toolbox. While aims, motives, and drivers more often than not remain obscure, sometimes STA seem to hamper, or even contradict, a general SD agenda.

In this case study, we tried to tackle these shortcomings in the following way:

- To avoid the risk of not seeing the wood for the trees, first we settled for a working definition of STA as basis for a coherent analysis of STA as tools of SD.
- To amend recent studies on STA, we looked into their development over time. In addition, we linked the gist of STA with geopolitical trends so that we might be able to identify cases in which they clearly serve as a part of SD initiatives. Last but not least, we tried to map the diffusion of STA all across the globe.
- To tell if STA might be valuable tools for SD, we picked up on the views of practitioners in the field of SD who are familiar with different aspects and matters of SD.

Ultimately, we hope we could shed some new lights on both the general development of STA over time and their handling by SD experts.

Method

The landscape of STA is highly diverse: There are many different types of agreements in place between different actors in the field of S&T. To get a common base for our analysis, we looked for a working definition of the specific type of STA we wanted to investigate in more detail. In order to get there, we first narrowed down our sample according to the rationale of our case study. As we wanted to analyse the role of STA in national SD toolboxes, we dismissed all agreements between non-state actors or memoranda of understanding that lack a legally binding character. STA on interministerial or province-level were

left out as well because they do not necessarily follow, or reflect, governmental strategies. Likewise, we did not survey agreements that were negotiated on a multilateral basis such as, for instance, big science projects like ITER or the Large Hadron Collider at CERN. While we are aware of the fact that matters of science and/or technology may also be part of economic or cultural agreements due to national pathdependencies or idiosyncrasies, we are positive that these types of agreement tend to affect, and cope with, scientific collaboration in a rather indirect manner only. For example, free-trade agreements like CETA or TPP may easily impact scientific collaboration in that they set rules of investment and regulations for travelling. However, they are not genuinely designed to serve and shape S&T affairs or policies. Hence, we instead focused on agreements explicitly geared toward matters of scientific interaction and importance between the concluding partners.

For the sake of simplicity, we based our study on the following working definition:

> ***"STA are all agreements concluded in the name of the respective governments of two countries in a legally binding form (so called 'umbrella agreements')."***

This definition refers to formal elements (legal status, types of actors, bilateral activity) rather than the content of such agreements. As a matter of fact, however, most agreements qualifying for becoming part of our study were largely similar both in their features and content. Umbrella agreements of the kind we wanted to examine tend to be highly formalised (cf. Fikkers & Horvart, 2014). Instead of studying contents, we took it to be more interesting and fruitful to focus on the spread of STA across the globe, patterns and networks, and on their appraisal by practitioners in the field of SD.

For our analysis, we chose a group of six countries as a core: Denmark, France, Germany, Switzerland, the UK, and the U.S. In addition, we researched STA concluded by the European Union. All countries in the sample are engaged in SD for quite some time already, which makes it easier to monitor long term developments. While all of these countries command a strong science sector, their respective science systems differ widely in terms of available resources, ways of governance, and operating procedures. This allows us to track differences or isomorphic tendencies in the use of STA as an instrument of SD. We included the European Union to examine whether it reproduces patterns of engagement that are similar to those its member states pursue.

Our case study rests on both quantitative and qualitative analyses. For the investigation on the development of STA over time, we searched governmental databases and homepages for treaties and agreements that matched our working definition. Looking at the time between 1961 and 2016, we not just matched but extended the period Dolan (2012) had used in her study. In general, we tried to retrieve the original texts of the agreements. Where this was not possible, we relied on secondary sources to find out the exact dates that the STA were concluded. If possible, we also recorded the date of ratification. The retrieved information was analysed in sum as well as separately for each country over time. The data was searched for patterns of diffusion

with regard to similar partner countries or geo-political events.

To assess the value practitioners attribute to STA as instruments of SD, we gathered qualitative data from semi-structured expert interviews with representatives from the countries of our sample and the EC. The respective interviews took place in the second half of 2016 and the first half of 2017. Among the 38 interviewees were policy makers from ministries, representatives from research institutions, funding organisations, and science counsellors deployed at embassies.

Results

Quantitative Data

Our research findings indicate a steady increase of the number of concluded STA over time, a large diversity of involved states, and specific patterns of activity in some countries. In general, we see the development of a global network of STA over time (see Figure 1).

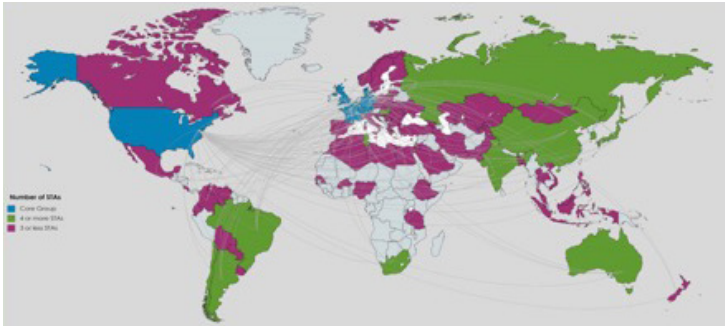

Figure 1: Concluded STA by members of the core group (blue: core group members; green: partners with four or more STA; purple: partners with three or less STA)

On a global scale, the core group has concluded ever more STA from 1961 onwards (see Figure 2). Even if one takes into consideration potential shortcomings and missing values in our desktop-research, the increase is remarkable.

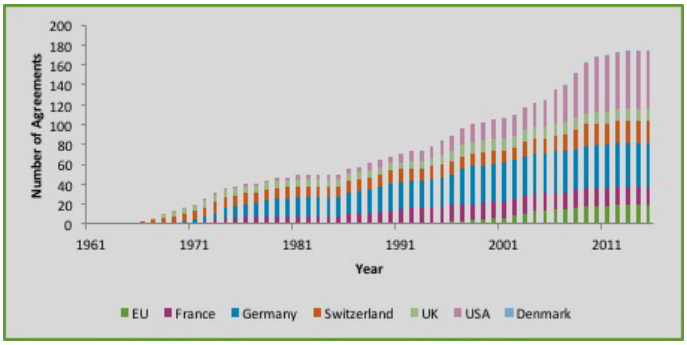

Figure 2: Number of STA concluded by the different countries (cumulated over time)

However, we also notice that the frequency of the use, as well as the number of STA differ widely across the sample (see Table 1). The U.S., for instance, concluded 58 agreements during the period under consideration while Denmark concluded just one. Though this was framed as memorandum of understanding, unlike several other memoranda of understanding it fits into our definition of STA. We will get back to this particular result in the analysis of the qualitative data.

Table 1: Number of recorded agreements between 1961 and 2016 per country

	Denmark	France	Germany	Switzerland	UK	U.S.	EU
Number of agreements	1	18	44	23	12	58	19

The EU began to negotiate STA not until 1994. Since then it has concluded 19 agreements,

most of them with countries that other members of the core group already had contracted. In terms of diffusion, Switzerland, the UK, and Germany were among the early adopters of STA while the U.S. and France started using them more frequently only later on. The relative frequency of STA for the UK and France has diminished over time while the U.S. made increased use of the instrument.

In our sample, we found a great diversity of collaborating parties. 83 countries were partners in at least one STA. In terms of geographic coverage, the Americas, Europe, and Asia account for the majority of signed STA. In particular, a group of states that is roughly identical with the G20 has developed a network of STA amongst each other. The BRICS (Brazil, Russia, India, China and South Africa) and some other states like Argentina and Tunisia are focal points of interest for the members of the core group (see Figure 3). Africa represents the continent least covered by bilateral agreements of the core group.

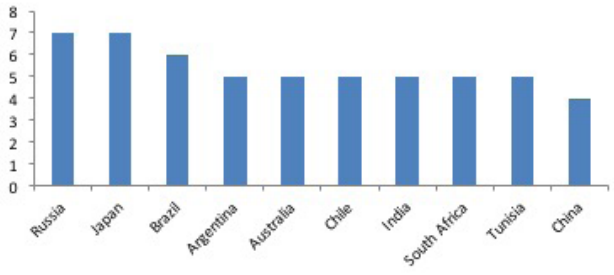

Figure 3: Top 10 partner countries overall (X-axis: Name of country, Y-axis: Number of agreements concluded between members of the core group and the respective country)

At first sight, core group members seem to resort to STA in erratic patterns across time; only the U.S. has steadily expanded the range of this instrument since the late 1990s. Still, some of the STA seem to match, and fit in, broader strategic or geopolitical patterns; in particular, this applies to four cases.

South Africa after 1995

The number of STA between the countries of the core group and South Africa has remarkably grown. Until 1995, none of the former carried an STA with South Africa. After 1995, this changed abruptly with Germany, the U.S., the UK (1995), and the EU (1996), signing STA. This clearly correlates with the process of ending apartheid in South Africa during the first half of the 1990s and the desirable reintegration of the country into world politics.

Germany and Eastern Europe

During the 1980s the Federal Republic of Germany concluded numerous agreements with various states in Eastern Europe. Starting with an STA with the Soviet Union in 1986, agreements with Hungary (1987), Bulgaria (1988), and Poland (1989) followed suit, the latter ironically just one day after the fall of the Berlin Wall. This engagement with Eastern Europe continued with an STA with Czechoslovakia from 1990 and Moldova from 1994. It is pretty obvious that these STA were not fuelled by scientific objectives in the first place but by efforts to ease tensions between Western and (former) Eastern Bloc states and to put inter-state relations on a new basis.

Switzerland and Latin America

A different pattern of STA-activities becomes evident with Switzerland's engagement in South and Central America. Within six years, the country signed seven agreements with several states (Colombia, 1967; Brazil, Chile, 1968; Ecuador, 1969; Costa Rica, Paraguay, 1971; Bolivia, 1973). In less than a decade, Switzerland concluded STA with about one third of the countries in the region. This pattern points to a strategic plan for scientific and technological collaboration and support. Yet at the same time, STA were apparently also meant, and designed, to foster developmental collaboration and capacity building within the universal framework of science outside of the richest industrialised countries. In any case, the Swiss activities seem to testify a strategic focus on a region of supposedly growing importance for both international politics and economics. At the same time, they do also demonstrate Switzerland's anxiety to leverage strategic niches in international S&T cooperation and/or innovation.

U.S.-engagement in the MENA-region

At the beginning of the 21st century, the U.S. put remarkable effort in striking bilateral agreements with countries of the MENA-region. While a STA with Egypt was signed as early as 1995, between 2003 and 2011 agreements with ten countries in the MENA-region and other countries with a Muslim-majority population followed suit. These activities clearly relate to the deteriorating relations between the U.S. and the countries of this region, particularly after the 9/11-attacks in New York and Washington in 2001 and the subsequently declared War on Terror.

Qualitative Data

While the quantitative part of the case study captured general patterns of diffusion, the qualitative part was meant to examine potential benefits and flows of STA for SD by way of experts' assessments and opinions.

The results indicate ambivalent appraisals of STA and different foci on diplomatic-political or scientific effects (cf. Table 2 for examples). In general, the recorded statements regarding STA can be sorted into a 4x4-typology.

Table 2: Typology STA-assessments (Statements are direct quotes from interview partners)

		Attitude towards STA	
		Positive	Negative
Main field of relevance	Political	"We have STAs with a great number of countries and that is an advantage because it is in a sense institutionalised..." [Interview Partner 1-2-17]	"The bilateral S&T agreements involving the (Ministry's name), to answer your question directly, is that it's a mixed bag. In other words, some of them are nothing more than a piece of paper, that's all they are." [24-3-17]
	Scientific	"...I have the feeling it's wanting to get everything set up clearly so that everybody knows what their responsibilities are and who will do what and how it will be funded." [Interview Partner 18-3-17]	"So in (country name) it's not something that we need in order to engage in a number of different *(scientific, authors' note)* activities" [17-3-17]

While some experts generally approved of STA as an important tool for SD, the scientific impact and importance clearly need to be kept apart from more general political effects. Some interview partners were truly enthusiastic about the opportunity to buttress bilateral scientific collaboration by means of STA. Other stressed the added value STA may bring to diplomatic relationships between states. In these cases,

they are seen as a vehicle to improve relations between state bureaucracies in charge of S&T, with STA serving as trust-building instruments. In contrast, other experts indicated strong scepticism with respect to the effectiveness of STA to pursue national SD-agendas. Concerns pertained to the ad-hoc character of the negotiations preceding STA, many of which are closely linked to events like ministerial visits in the partnering country. Some experts complained about the lack of continuous support and engagement from the side of the respective ministries and prevailing disinterestedness to keep up the interaction with the partnering country once STA had solemnly been signed.

Furthermore, our interview data clearly indicate an interesting divide between the perspectives of administrative bodies on the one hand and research organisations on the other respectively. While policy makers we interviewed across the board tended toward a positive appraisal of STA as a tool to foster bilateral relationships, representatives of science organisations pointed to the large number of agreements they concluded with counterparts abroad which they considered far more valuable for enhancing scientific collaboration than inter-state STA.

The varying number of STA members of the core group concluded may result from different general policies and political preferences with respect to STA. Representatives from the UK, for instance, acknowledged that their government were rather reluctant to conclude legally binding agreements without an explicit need to go for them. German interview partners from governmental bodies, on the other hand, stressing positive effects of STA, regarded them to be standard instruments of SD. Policy makers also differentiated between pull and push factors in STA-negotiations. If a member state of the core group had a high self-interest in the partnering country, it were inclined to initiate negotiations. Had a foreign country asked or even demanded STA-negotiations, forcing the core group member states to decide whether such requests were received positively, politely rejected, or in some cases even silently ignored, that decision would be mainly based on an assessment of the partner's excellence in research, the match of science capabilities in specific areas, or the general political situation.

Discussion

Our data provides ample evidence for a better understanding of the role STA might have in the SD-toolbox.

Fikkers and Horvat's (2014) view that EU member states lacked a strategic plan for the integration of STA into their international S&T portfolio does not stand up to the empirical evidence. When looking at how STA developed over time, we notice plenty examples of their strategic use. The cases of South Africa, policy of détente in Europe in the 1980s, the Swiss approach towards Latin America, and the MENA-engagement of the U.S. present widely differing validations for that. Each of these cases involved strategic consideration of the geopolitical setting and the role of STA related activities in it even though the individual agreement could have been concluded on the basis of erratic and ad-hoc assumptions. While it is definitely true that none of the countries examined showed a well-defined strategy for the use of STA, at some

point in time such agreements have come to be seen as helpful instruments that could stimulate and support further engagements and collaborations. At the political level at least, we concur with the assumption that STA were primarily serving ***Science for Diplomacy*** in accordance with the rationales Dolan (2012) and Fikkers and Horvat (2014) had pointed out.

Our data supports the assumption that it is primarily political considerations that lead to concluding STA: building trust, institutionalising contacts and providing entry points for subsequent communication and projects. Not least, concluding a STA provides a good opportunity to stage a signing ceremony that celebrates diplomatic relations between the signatories and yields plenty of nice photos or videos.[2] Seen from this angle, it is of only secondary importance whether or not STA might enhance scientific collaboration. Relating to another case of STA-negotiations, the Antarctic Treaty System, Elzinga (2009) distinguished ***practical-instrumental research*** from ***symbolic-instrumental research.*** While the former is concerned with substantial problem solving, the latter is of importance primarily to the political system in that scientific activities have become symbolic instruments to express a state's geopolitical interest in the Antarctic. The conclusion of STA represents a symbolic-instrumental action: The involved parties express their willingness to come together as equals, using scientific universalism as a vehicle for political objectives. Following this line of reasoning, the content of a treaty would be of only minor importance compared to the act of signing it. Hence STA serve as a kind of ***boundary object***, allowing the different parties involved in the process of negotiating and signing it to attribute, and associate their own understandings, beliefs and interests to the abstract object of a treaty (cf. Star, 2010).

If a substantial STA would be more effective in inducing scientists to enter international collaborations than a primarily politically motivated one is up to speculation only. In this respect, governments are stuck between a rock and a hard place. If they spell out concrete objectives, roadmaps, and maybe even funding schemes to stir or intensify scientific cooperation, the treaty may become too narrow and no longer serve as an umbrella agreement that allows for different stakeholders to participate with their own agenda of SD or understanding of international collaboration. Umbrella agreements are far more easily becoming boundary objects than more specific, content driven ones. Yet on the other hand, the latter might attract more attention from scientists and research organisations that look for funding opportunities and help facilitate and intensify collaborations with a partner country. At least this is what some of our interviews insinuated when they called for more resources to strengthen STA as a tool of SD. Vice versa, an umbrella agreement with 'soft wording' gives the signing parties way more leverage to react flexibly toward newly arising challenges and S&T trends. Yet this flexibility comes at a price; scientists and research organisations more interested in substantial programs and funding to support their global outreach will be less easily enticed to get aboard.

Regarding the second dimension of STA, the support of scientific projects and international collaboration, our interview partners unanimously

commended bilateral agreements between research organisations or funding institutions as most effective formats. Unfortunately, we could not include these to our study. Nevertheless, it is highly reasonable to assume that such agreements and memoranda of understanding provide much better frameworks and opportunities for scientific interaction between individual researchers and research groups from two different countries.[3]

While we have shown that the countries' motives to conclude STA are not always erratic, we particularly want to highlight the strategic interests that the countries of the core group have shown in the BRICS-states. Clearly, close scientific connections and common research agendas are prevalent among many highly industrialised countries, mostly, of course, among the members of the G8-group. Yet rising economies like the BRICS become more and more integrated into this network of bilateral treaties, collaboration and exchange. STA represent a first step or entry point to tap into new markets, raise attention for collaboration, and foster economic and scientific ties. Moreover, from our interviews it becomes very clear that there is a considerable demand for legally binding agreements from the side of at least some of the BRICS-states. One has to keep in mind that in the field of diplomacy, agreements have a symbolic value that many countries hold in high esteem regardless of any substantive effects; once again this echoes our finding that STA tend to be more important for the political side of international science policy than for the scientific agenda. Concluding STA provides emerging economies with an opportunity to enhance their position in the diplomatic sphere, put themselves on the global map of S&T, and subsequently accumulate prestige or reputation. Mutual interests—even though they may follow very different rationales—of industrialised and newly industrialised or rising economies thus seem to be the main drivers of the development of a network of STA that we can see emerging all around the G20-states.

Yet our findings have also shown many differences between the investigated countries. Referring to Table 2, we need to tell apart organisational types (research vs. ministerial) and different national approaches. Obviously, the number of treaties covered in our sample does not correlate with either the size or scientific performance of the countries we looked at. Once again, this supports our proposition that the uses of STA do not follow any automatism but rather reflect national idiosyncrasies and strategic preferences valid for at least a period of time or a specific area of the world. Denmark and the UK, for example, prefer other instruments of SD; they concluded only one STA-like agreement (DK) or opted out of signing new STA a long time ago (UK). Germany and the U.S. on the other hand have taken a continuous and vivid interest in this instrument. The literature on U.S. engagement in SD counts STA among its important tools (Dolan, 2012). STA activities between the U.S. and countries in the MENA-region might be a case in point for a broader, embedded strategic approach to SD, accompanied by highly symbolic political actions like President Obama's Cairo speech in 2009 (Holt, 2015). Yet our interview data also supports the view that it is primarily different national strategies that guide the negotiations of STA. In a large number of cases, they seem to simply in-

dicate that they are regarded a customary part of international science policy and SD. A long history and continuous sequence of STA backs this interpretation. Yet this does not mean that the absence of these factors may indicate a government's lack of interest in SD since the country may prefer other instruments than formal agreements for its SD. The UK, for instance, is strongly engaged in promoting international collaboration through the Newton Fund (cf. Grimes & McNulty, 2016). In contrast to a legally binding umbrella agreement, its design is based on bilateral co-founding mechanisms that combine the ***symbolic-instrumental*** level with resources for ***practical-instrumental research.*** In Denmark, bilateral cooperation is organised more on the ministerial level; memoranda of understanding with Brazil, India, and South Korea, once again illustrate the core group's interest in the BRICS. In a similar vein, the EC acts in more than one way to buttress bi- and multilateral international relations in S&T. The pattern of its STA coincides mostly with that of the EU member states. Yet we have to keep in mind that the EC also negotiates other agreements, in particular those regulating access to the Framework Programs, thereby preserving additional leverage, and power to pursue the EC's objectives in international S&T policy. That these kinds of agreements were not covered by our study does not mean there is no bilateral scientific interest or interaction. Rather, Denmark, the UK, and the EC tend to handle it in other ways than the U.S. or Germany prefer.

It is beyond the scope of our study to tell if umbrella agreements are more effective–bearing in mind all the difficulties of measurement–than treaties between individual ministries or research organisations. Neither could we assess possibly different effects depending on which ministry is in the lead in negotiating and concluding science-related agreements. However, it is highly plausible that national idiosyncrasies make a lot of differences even though we could not examine their impact thoroughly.

The bottom line is that we see STA provide an opportunity to pursue very different approaches, experiments, and rationales for international S&T development. Some features of STA-activities serve general political, only partly S&T-related, foreign policy goals. When it comes to the uses of, and interests in, STA, there is a great diversity of national idiosyncrasies regarding both expectations and approaches. STA are just one instrument for SD among a range of others. Depending on political preferences and local conditions, they may be more or less important. But in any case, STA are far from being a cornerstone of SD practice.

Outlooks for research and practice

Our case study provided new insights into the handling, role, and uses of STA-activities in different states that pose a number of further questions.

Unfortunately, so far we know but very little about the effectiveness of STA indeed. Whether or not they facilitate the exchange of students, scholars, or ideas, stir cooperation or enhance academic performance is difficult to capture. Although many countries use indicators to monitor their international S&T activities, it would be very far-fetched and misleading to explain any development in that field as resulting from

the conclusion of STA. The reality is way more complex; confounding factors impinge on the measurement of STA-effectiveness. While our interviewees suggested some positive effects following the conclusion of STA with respect to trust building and communication, for researchers and practitioners the effectiveness of STA remains an open question or even doubtful. In the light of recent discussions in bibliometrics about the limits and unintended consequences of measuring research outcomes or research excellence, we cannot but strongly advice against any effort to come up with new metrics of STA.[4] Instead, qualitative assessment processes and quality assurance could and should be strengthened. Integrating different stakeholders from the field of SD into a dialogue about the strengths and weaknesses, potentials, and limits of STA would also be far more promising to monitor their effect and efficiency.

In terms of future research, we recommend to shift the focus of attention from individual instruments of SD, like STA, to toolsets and the interplay of different parts, or components, of SD. STA, like all other policy-instruments, need be viewed, interpreted, and assessed in a broader context of activities and science-related policies. Erratic patterns that seem to indicate a lack of strategic planning, may turn out to be highly important, and valuable, instruments of SD to address a specific policy target.[5]

In this general regard, we spot two main types of questions. First, it would be worthwhile to further explore the relation between intergovernmental STA and the abundance of other oftentimes semi-official or even informal agreements between research facilities or funding organisations. In our study, we have seen that both groups of actors lack information about what is going on at the other side of the aisle. Science diplomats would be well advised to look beyond formal regulations and legal caveats when seeking to strike agreements with partner countries; they also need to reflect and serve the interests of their own research community in the management of international S&T activities. Umbrella STA could play a more important role if they are combined and tuned with more specific agreements and programs in individual areas of research and innovation. At the same time, exchange and collaboration programs might raise attention for the potential uses of STA.

A second entry point for further investigation results from our findings that the history of STA—at least to a certain degree—reflects constellations and shifts in world politics. The reintegration of South Africa into a system of international relations after the end of apartheid represents a good case in point. We could only study such correlations and connections on a very general level without examining the underlying processes in detail. For a better understanding of the workings and potential benefits of STA, researchers should look into the specific conditions under which they were concluded, particularly into interdependencies with variables like (regular or irregular) government changes, disruptive geopolitical events like the end of the Cold War or the start of the 'War against Terror' in the 21st century, or changing power balances or strategies in the global sphere.

Last, but not least, it would be useful to further elaborate on the divides between ministerial and scientific as well as different national ap-

proaches that we touched upon in our interview analysis (see Table 2). Sociologically speaking, variables like organisational and national identity heavily impact the style of how STA are negotiated and what they cover in more than one way. National and organisational idiosyncrasies like differences in the division of labour, tasks and procedures, or between epistemic communities more often than not affect the formation of STA. Micro-analyses could illuminate these facets of STA way better and more informative than our case study. It may also be worthwhile to tap into the research on the negotiations of international agreements, for instance from the economic area (e.g. Crump, 2017). At least we need to know much more about how different variables play into, and influence, the uses of STA in international science policy in general and SD in particular. By engaging in this line of research, scholars would render a valuable service to practitioners and help them enhance the use of STA as an instrument of SD.

Footnotes

1 The report states that ***„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."*** (Fikkers & Horvart, 2014, p. 41) It remains a mystery to us, how "ad-hoc reasons" and "strategy" could possibly match.

2 See, for example, the signing ceremony between the U.S. and Serbia in 2010, https://www.youtube.com/watch?v=LUnBQvTUd7g , last access 18.08.2017.

3 This rests, of course, on the assumption that organisational support for such interactions is needed at all.

4 See for example the debate on the assessment of research output, excellence, and performance: San Francisco Declaration on Research Assessment, http://www.ascb.org/dora/; Leiden Manifesto for Research Metrics, http://www.leidenmanifesto.org/.

5 Even though, contextual factors might explain a great deal of the large typological variance, we agree with the literature that quite many STA are concluded on an ad-hoc basis.

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