USING SCIENCE DIPLOMACY
FOR ADDRESSING GLOBAL CHALLENGES

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ABSTRACT

The term science diplomacy has gained increasing attention both within academia and in the political agenda setting in recent years. In some cases, it has turned into a reference label when discussing the interaction between science and international affairs. S4D4C specifically wants to investigate how this interplay acts out on the European level and how European science diplomacy could be strengthened. Yet, from an analytical point of view, it still remains an open question what exactly the term denotes, how it is defined and conceptualized. Particularly, it seems to be both informed by an academic as well as by a political interests. This could compromise the analytical capacity of science diplomacy as a concept. This state of the art report examines these questions and provides a literature overview on the discussion and findings of the debate of EU science diplomacy. In doing that, we distinguish between science diplomacy as a discourse and existing activities and structures that could be potentially considered as science diplomacy but do not need to be.

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Content

1 Introduction

The term science diplomacy has gained increasing attention both within academia and in the political agenda setting in recent years. In some cases, it has turned into a catchy label when discussing the interaction between science and international affairs. In general, the interplay between science, foreign policy and science policy seems to be of increasing academic and political interest. S4D4C specifically wants to investigate how this interplay acts out on the European level and how, in the light of this, European science diplomacy could be strengthened. In this regard the consortium also makes use of the term science diplomacy. Yet, from an analytical point of view, it still remains an open question what exactly the term denotes, how it is defined and conceptualized. This state of the art report examines these questions and provides a literature overview on the discussion and findings of the debate of EU science diplomacy. In doing so, it also intends to inform the conceptual framework of work package 2. With regards to the working structure of the consortium, this state of the art report intends to support the case studies in work package 3. Apart from that, we hope to contribute to the general discussion of the science diplomacy concept.

Science diplomacy: between a labelled discourse and a set of practices

In the light of these objectives, it is important to first of all acknowledge that science diplomacy neither constitutes a ready-made empirical object nor provides a clear-cut definition. Having this in mind, it seems helpful to distinguish between the discourse of science diplomacy on the one hand and the broad variety of activities, structures and networks in place that could be potentially subsumed and studied (but do not need to be) under the heading of science diplomacy on the other hand. Consequently, providing a state-of-the-art-report on a concept such as science diplomacy cannot begin with answering the straightforward question of what science diplomacy is and what we already know about it. Instead, it seems appropriate first to reconstruct the concept and discuss its more or less implicit semantic content and separately from that, to look at practices at the interface between science, science policy and foreign policy. Therefore, this report also looks at science diplomacy as a discursive object (in contrast to 'material' practices), which is charged with different meanings by different actors and stakeholders.

In that, this paper deals in fact with two different objects of study: The first object of study is science diplomacy as a discourse. By discourse of science diplomacy we refer to the debates that utilize the term as a key reference and in doing so also equip the term with specific meaning and connect it to specific notions, narratives, strategies and other discourses. In that regard, science diplomacy is investigated as a term that is filled and associated with different meanings and ideas by social actors of all kinds and is applied

as a label to different activities. There are different actors or stakeholders (not only academic, but rather political) with various aspirations who have brought the idea of science diplomacy into being. We try to reconstruct the ideas, narratives, and strategies of that discourse in the tradition of the grounded theory methodology (Glaser and Strauß 1967; Strübing 2008). Apart from that, there is of course a whole range of social interactions, some of which have been studied from the perspective of EU science diplomacy and are of specific interest for the consortium regardless of the fact whether they have been already explicitly labeled as science diplomacy or not. These interactions and practices at the intersection of science and foreign policy are manifold. This can include among others for instance the appointment of science counselors or science attaché positions in embassies or consulates, the creation of international science and technology agreements (STA), the setting up of innovation centers abroad etc. More generally speaking, it can include all activities that are part of international joint research and innovation efforts and their effects on (foreign) policy goals as well as on national and supranational science policies, as well as politically involuntary effects and activities of the international science landscape etc.

Structure of the report

The report is structured as follows: First, I condense and discuss general definitions of science diplomacy and how science diplomacy is demarcated from other practices. I then provide a summary of different concepts of science diplomacy as specified in the literature and a concluding discussion on the state of science diplomacy as an analytical concept (Section 2). This is followed by a reconstruction and closer examination of the interpretative patterns and ideas constituting science diplomacy as a promising and appealing new foreign policy tool (Section 3). The report moves on from the reconstructive approach towards an affirmative stance and looks at science diplomacy as an empirical social phenomenon. As part of this, section 4 looks at research on the different science diplomacy approaches taken by individual countries. Section 5 condenses some of the literature on national (EU MS) and international science diplomacy practices. As part of this there is a focus on what could be regarded as EU foreign policy driven science diplomacy: What are the specifically European conceptions and aspirations involving science diplomacy? Who are the drivers/promoters of the concept? This is particularly intriguing against the background of science diplomacy potentially becoming the new kid on the block of the EU's global strategy discourse. The report concludes with a collection of different recommendations that can be drawn from the literature (Section 6).

2 Approaching science diplomacy

In this section we approach the concept of science diplomacy, first, via definitions of science diplomacy (section 2.1) and, second, via concepts of science diplomacy that are provided in the literature (section 2.1). It shows that the definitions are often followed by attempts to *conceptualize* science diplomacy. As distinct from definitions, conceptualizing means to more specifically open up systematic categories and subdividing the broad spectrum of potential activities of science diplomacy into categories. These concepts can provide heuristic tools to investigate science diplomacy activities systematically and empirically. In the literature, definitions and concepts of science diplomacy usually blend and inform each other. They are usually not differentiated. Yet, for the purpose of this report, it seems helpful to distinguish between definitions and concepts as a means to come to grips with the "fuzziness" of the subject matter, to provide a better understanding of science diplomacy and eventually to assess to which extent science diplomacy qualifies as a heuristic tool that can inform the research of the S4D4C consortium.

2.1 Definitions of science diplomacy

The term science diplomacy comprises various and often diverging perspectives, policy approaches and activities. Hence, there is no unambiguous or conclusive definition (Basha 2016; Copeland 2016; Flink and Schreiterer 2010). "Science diplomacy has become an umbrella term covering a range of formal and informal exchange, education, policy, and outreach efforts" (Basha 2016, 3). According to Berg, science diplomacy is "generally not restricted to one specific aspect (e.g. facilitating academic collaboration) but tends to cover a range of different activities" (Berg 2010, 72). These include support to academic exchange, networking and international cooperation, the exploitation of scientific networks for non-research purposes, the provision of scientific advice to foreign policy, etc. Interestingly, science diplomacy as a label is usually defined, first, by reference to global developments and, second, in terms of purposes, but not in terms of specific kinds of practices or activities, which would be, as we shall see, very diverse. In general, the common understanding and definition of science diplomacy is not based on analytical categories, but it primarily draws its meaning from narratives and ideas about global change.

One of the more succinct and most often cited definitions of science diplomacy (that highlights this finding) comes from the former US Secretary of State Clinton's Science Advisor Nina Fedoroff (Basha 2016; Copeland 2016). According to her, science diplomacy

is "the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships" (Fedoroff 2009). The World Academy of Science illustrates science diplomacy in the following way: "Humanity's greatest challenges – and some of its most promising opportunities – are regional and global. Increasingly, the world requires effective partnerships between scientists, policymakers and diplomats."[1] Also in other sources, science diplomacy is usually introduced and defined (if at all) with reference to the demands that come along with "the global challenges of the 21st century" (Copeland 2016; The Royal Society 2010).[2] In addition to that, it is claimed that "globalization has considerably enhanced and extended the importance of science and technology (S&T) for and in international relations (IR) beyond their traditional domains" (Flink and Schreiterer 2010, 665). Turekian et al. (2015) trace this development back to a general "erosion of the autonomy of the sovereign state". This development has increased trans-national interdependencies, which now require closer cooperation not only between states but also between the diplomatic and scientific communities. In line with this argumentation Copeland proposes an understanding of science diplomacy "as a diplomatic technique by which S&T knowledge is freed from its rigid national and institutional enclosures, thereby releasing its potential to address directly the drivers of underdevelopment and insecurity" (Copeland 2016).

Therefore, what seems to be key in defining science diplomacy is not a classical analytical object, but something that might better be termed a classifying background story: it is the seemingly indispensable reference to the changing role and relevance of science in world politics (Copeland 2016; Flink and Schreiterer 2010; Turekian et al. 2015). In that, the global challenges narrative is paralleled by the idea of the blurring of boundaries between science and diplomacy. Both perceptions heavily feed into the understanding of science diplomacy. In can be concluded, the term science diplomacy is primarily vested with meaning through ideas about global and systemic change (background stories), instead of being defined and delineated as a specific analytical object of empirical practices and structures.

In addition to that, science diplomacy is usually linked to social and political goals. It seems as if science diplomacy is even designed as the answer to exactly these

[1] https://twas.org/science-diplomacy

[2] „Inclusive and sustainable development is what the world really needs as of the current global situation. For that, policies and strategies need to be inclusive, action-oriented and collaborative. Science diplomacy has the potential to be considered as a medium to reduce the imbalances and as a vehicle to lift humanity up towards sustainable growth and development." (Basha 2016, 2)

background narratives and in that it carries a strong purpose dimension, such as "to address the common problems facing 21st century humanity" (Fedoroff 2009). In line with this stands the official statement of purpose of the AAAS' Centre of Science Diplomacy, which portrays science diplomacy generally as "the *overarching goal* of using science and scientific cooperation to promote international understanding and prosperity"[3] (emphasis added). Hence, while the practice dimension (use of scientific collaborations among nations) remains vague in the existing definitions, the purpose dimension (defining science diplomacy primarily with reference to overarching goals) seems to be just as central to the understanding of science diplomacy. The term science diplomacy is mainly used to describe (different) relationalities between science and foreign policy in the light of overall objectives that seem to require this form of collaboration (purpose dimension). The strong purpose dimension is reflected as well in the attempts to conceptualize science diplomacy in terms of a wide range of different purposes and intentions, like access, promotion or influence (Flink and Schreiterer 2010), national, bilateral or global interest (Gluckman et al. 2017; cf also UK Parliamentary Office of 2018) as shown in section 2.2. In general, the strong purpose dimension of science diplomacy might be also due to the fact that the term science diplomacy is coined to a large extent by practitioners (diplomats, science advisors, politicians, experts e.g. in international organizations etc.) and less out of a purely academic interest. Nevertheless, this has implications for the analytical capability and empirical applicability of the concept science diplomacy.

What seems to remain central to any definition of science diplomacy is an involvement of state actors or representatives of a supranational entity, respectively. In this context, some scholars/authors also explicitly propose to demarcate science diplomacy from international scientific cooperation or mainly commercially driven innovation networks (Copeland 2016). "Science diplomacy's direct relationship with national interests and objectives distinguishes it from other forms of international scientific co-operation, which are sometimes commercially oriented and often occur without direct state participation." (Copeland 2011; Turekian et al. 2015) "Science diplomacy, therefore, is the process by which states represent themselves and their interests in the international arena when it comes to areas of knowledge — their acquisition, utilization and communication — acquired by the scientific method." (Turekian et al. 2015)[4] Moreover, the central role of

[3] http://diplomacy.aaas.org/ about.shtml

[4] By contrast, the term innovation diplomacy, which is linked to trade and foreign economic policy, denotes the idea of diplomacy for innovation (Leijten 2017).

state actors (or representatives of a supranational public entity) is brought into definitions of SD in order to demarcate it from international scientific cooperation.

> „International science cooperation and science diplomacy are overlapping endeavours: they are related, yet analytically separate. International science cooperation is mainly concerned with the advancement of scientific discovery per se, while the central purpose of science diplomacy is often to use science to promote a state's foreign policy goals or inter-state interests. In other words, international science cooperation tends to be driven by individuals and groups, whereas science diplomacy, while it may derive from the efforts of individuals, often involves a state-led initiative in the area of scientific collaboration. International science cooperation, therefore, may or may not encompass science diplomacy." (Turekian et al. 2015)

Seemingly, this definition stands in contrast with the idea that scientists can themselves embark upon science diplomacy activities without states being directly involved. Yet again, if scientists do so without an explicit or official mandate, these activities are generally regarded as science diplomacy inasmuch as they affect international relations.

> "They [scientists] can intentionally act on existing diplomatic goals or what they do can have intended or unintended diplomatic effects. So Science Diplomacy is a concept used in either identifying ongoing activities as being of a diplomatic nature or as a term used to qualify certain policy actions in a certain way. In other words, Science Diplomacy can refer to both practices and discourses." (Van Langenhove 2016b)

It can be argued that what distinguishes science diplomacy from the object of international science collaborations (and what constitutes its added value) is exactly the involvement of political actors and interests and in that the dimension of (political) purpose (Copeland 2016; Gluckman et al. 2017). As a result, the broadest and maybe most general definition might have been suggested by Berg: "The term 'Science Diplomacy' can be used for a range of foreign policy aspects which share an engagement with science and related disciplines but whose aims, motivations and practices are quite different." (Berg 2010, 70) Apart from these rather general components that could be distilled from the literature, the common approach in defining science diplomacy is by means of *conceptualizing* the subject matter in a systematic and functional manner and in that by purposefully relating science to diplomacy and the other way around (Copeland 2016). This usually involves distinguishing between different functional relations: science for diplomacy (S4D), science in diplomacy (SiD), and diplomacy for science (D4S). In doing so, the term science diplomacy is given significance mainly through a purpose dimension, not through defining specific activities. This will be again highlighted in the following section.

2.2 Concepts of science diplomacy

Conceptualizing science diplomacy is typically based on ideas of functional differentiation. This means defining science and diplomacy as separate areas with own proficiencies and qualities. Science is regarded as a non-political, evidence-based and universal activity that is trusted and held in high esteem in public. "The scientific ethos of objective experimentation through trial and error has broad appeal: it promotes merit (through peer review); openness (through publication); and civic values and citizen empowerment (through the encouragement of respect for diverse perspectives)." (Turekian et al. 2015). In turn, diplomacy is ascribed to the political sphere and is defined as the representation and negotiation of state interests in the international arena. Science diplomacy is then conceptualized by correlating the two aspects, which is to say, by functionally relating these distinct areas. Turekian et al. for example speak of a "fusion of previously distinct elements" (Turekian et al. 2015) Often this is also problematized since science and diplomacy are seen as "two distinct spheres of human activity that have little in common" (Van Langenhove 2016b), or are considered at least an exceptional couple or "uneasy bedfellows".

The most prominent conceptualization of science diplomacy, which also emanates from this functional differentiation thinking, is the three-fold typology brought forth by the Royal Society's Report (The Royal Society 2010). In contrast to the wording in some of the literature quoting this three-fold typology ("three varieties", "three activities" etc.), it does not denote specific activities, but really and more precisely it designates different forms of functional correlations of science and diplomacy/foreign policy: 1) informing foreign policy objectives with scientific advice (science in diplomacy); 2) facilitating international science cooperation (diplomacy for science); 3) using science cooperation to improve international relations between countries (science for diplomacy). (The Royal Society 2010)

> "*Diplomacy for Science* is mainly about the facilitation of international scientific collaboration. Here classical tools of diplomacy are put to use to support the scientific and technological community. It is about using diplomacy in order to establish cooperation agreements at government or institutional level. The goal of actions of diplomacy for science is to benefit from foreign science and technology capacity in order to improve the national capacity.
>
> With *Science in Diplomacy* the roles are reversed: here the scientists are prompted towards supporting foreign policy. In times of war this has resulted in mobilising national scientific and technological resources for the development of arms. In times of peace this is about using scientific knowledge in foreign policy decisions. The goal of such activities is to improve Foreign Policy actions through the use of scientific knowledge.

> *Science for Diplomacy* goes one step further: here science is used as a tool to build and improve relations between states. This can be done when there are tensions in relations between certain states or when states are faced with common problems that they cannot solve on their own. Scientific collaboration is used here to provide collaborative relationships that are based upon a non-ideological basis. The goal is here to support Foreign Policy actions by mobilising scientific networks." (Van Langenhove 2016b)

This threefold typology is very well referenced in the literature. But is has been criticized, as well. The critique of this typology is geared towards the following aspects. First, it is criticized because the three different correlations cannot be as clearly distinguished from one another, are practically imprecise and never occur in such purity (Copeland 2016; Penca 2018). "Despite the breakdown into the three categories in theory, in practice the differentiation between the three rarely occurs and 'science diplomacy' functions as a proxy for all." (Penca 2018) Just to illustrate:

> "These three categories, while widely accepted and used, tend to overlap and have some weaknesses as heuristic tools. Many international S&T issues cannot easily be pigeon-holed: attempts to manage climate change have involved science advice (both to governments and the UN Secretary-General), science for diplomacy (the reports of the Intergovernmental Panel on Climate Change (IPCC)) and diplomacy for science (the meetings of the Conference of the Parties (COP)). Other science-based issues, however, such as weapons inspections or fisheries monitoring and surveillance, fall more convincingly under a single heading (science for diplomacy). For these reasons, as an umbrella term SD must be used with some care." (Copeland 2016)

Therefore, the RS/AAAS model is certainly encompassing enough to cover the major imaginable links between science and foreign policy. However, we doubt that it qualifies as a heuristic framework contributing conceptually beyond allowing for a certain degree of categorization. A second critique addresses the often unreflect premise that science diplomacy is supposedly naturally/inherently conducive to international cooperation. Among others, Penca argues that international scientific relations "are both cooperative and, increasingly, also competitive (including among the EU countries themselves)" (Penca 2018, also see Flink and Schreiterer 2010). Penca concludes: "It could essentially make more sense to distinguish between an actor's intention to make the scientific cooperation with partners its foreign policy objective and an actor's intention to use (or exploit) cooperation in science as a tool for another foreign policy goal, e.g. dominance." (Penca 2018)

Apart from this already well-known RS/AAAS conceptualization Flink & Schreiterer (2010) have proposed another substantive differentiation or typology to conceptualize science diplomacy for the purpose of their empirical study. Flink & Schreiterer distinguish

between three strategic purposes: *access*, *influence*, and *promotion* (Flink and Schreiterer 2010). Access refers to the aim of improving national innovation capacity and competitiveness by observing and seizing knowledge and technology markets elsewhere in the world as well as attracting talents and investments from abroad. *Promotion* covers the idea of marketing a country's achievements in Research and Development landscape and raising an interest in a country's S&T and improving its reputation. By contrast, *Influence* addresses the more explicit political and soft power aspect of SD, influencing "other countries' public opinion, decision-maker and political or economic leaders" (Flink and Schreiterer 2010, 669). Despite the fact that this study is widely cited this typology has remained surprisingly unnoticed in the literature. Yet, this typology differentiates science diplomacy activities in fact also as a matter of purpose.

Also in line with our observation that science diplomacy is mainly defined in terms of purposes, Gluckman et al. (2017) recently suggested to further develop the traditional taxonomy of science diplomacy by focusing more on the strategic dimension. Their "utilitarian framing" – as they call it – projects a spectrum of a country's strategic scope, which comprises the following three categories of science diplomacy (Gluckman et al. 2017): First, *actions designed to directly advance a country's national needs* comprise the employing science diplomacy as a soft power tool, and to serve economic and national security interests. Second, *actions designed to address cross-border interests* address such domains as the management of trans-border shared resources and ecosystems and necessitate scientific expertise also and particularly in cross-border jurisdictional efforts. Third, *actions primarily designed to meet global needs and challenges* is closest to the global-challenges-theme of science diplomacy and is concerned with topics such as global sustainable development (the SDGs), poverty reduction and ungoverned spaces (Gluckman et al. 2017).

It is interesting to note that in contrast to the conceptual approaches discussed so far and which depart from political purposes, there are only few attempts to conceptualize science diplomacy from an actor's and/or institutional perspective, which might seem just as "natural". This would include conceptualizing science diplomacy by departing from the institutional structures (positions, personnel, exchange formats etc.), most likely with a focus on the participation of foreign ministries and the ministries with executive competences in STI or/and education. One example that could be considered to fall under this heading is Berg (2010) who approached science diplomacy as an empirical object by heuristically focusing on "S&T networks" as staff working abroad (Berg 2010). He tries to trace science diplomacy, noting that "all Science Diplomacy networks primarily build and maintain contacts in order to facilitate reporting on science & technology topics

(often including environment, climate change or energy issues), scientific collaboration, government liaison, mobility of students or researchers and often contacts with business." (Berg 2010, 72) Apart from that there are little efforts to systematize and conceptualize science diplomacy as a heuristic tool.

Another very recent suggestion to conceptualize science diplomacy as a heuristic tool was proposed by Rüffin (2018). This is also designed as a three-dimensional typology, yet the categories are distinguished with regards to the challenges and conflicts arising from science diplomacy activities on different levels: „All science and innovation diplomacy agencies have to cope, and come to grips, with the tensions inherent to their objectives and setup." (Rüffin 2018a, 30) The three dimensions are Headquarters-Periphery, Diplomacy-Science and Basic-Applied.

In general, conceptualizing science diplomacy seems to be particularly intricate, when the concept is meant to provide a heuristic tool in order to investigate science diplomacy. This also has to do with the fact that the activities within the frame of science diplomacy – no matter how many there are – are "closely intertwined and appear in different configurations" (Rüffin 2018a, 13). Looking at concepts of science diplomacy from the empirical side indicates a considerable gap between theoretical aspiration/conceptual clarity and the complexity of practical cases to be described. "The great variety of approaches, both in goals and means, suggests it is futile to look for a one-size-fits-all model to deal with international S&T and SD. Instead, different institutional settings and political trajectories, interests and governance modes entail different approaches that are still difficult to clearly tell apart." (Flink and Schreiterer 2010, 676)

2.3 Interim reflection

Having a closer look on the definitions and conceptualizations of science diplomacy helps not only to clarify an understanding of the term, but more generally to get an idea of the scope and analytical level of the concepts provided so far. In this section we also wanted to examine to what extent science diplomacy qualifies as a heuristic tool and in that, if and how it could inform the research within the S4D4C consortium. We found that the science diplomacy discourse needs to be distinguished from the broad variety of activities, processes and structures that could be subsumed under its heading. The idea of science diplomacy still lacks some analytical precision. Science diplomacy has been criticized for its fuzziness or vagueness by several scholars (Flink and Schreiterer 2010; Penca 2018; Rüffin 2018b). The critique addresses not only the fact that science diplomacy is missing out on clear-cut demarcations but more generally on defining a

congruent level of analysis. This might have to do with the fact that it can potentially refer at the same time to a policy tool, to a "policy domain" (Van Langenhove 2016a) and to a fully-fledged strategic foreign policy discourse. The concept tries to bring together different practices across different policy areas under one umbrella. In that regard, science diplomacy can be regarded as an empirical term to describe the differentiation of political activities and agencies being established, such as the observation of states implementing hubs for science diplomacy (Rüffin 2018a). At the same time the science diplomacy debate also seems to be borne by the *hope to establish* such policy domains and to intentionally create new modes of governance. In that, the science diplomacy debate probably neither responds to a purely analytical appeal nor merely to a sense of political urgency that tries to shift awareness to the importance of scientific collaborations for the future of the planet, but it might be the result of both. It remains an open question what this means for the application of the term as a heuristic tool.

Then again, on a more abstract level, the concept of science diplomacy also reflects new formations of political and academic practices that do not fit into conventional distinctions anymore. In that, science diplomacy can be even regarded as an expression of tacitly shifting power relations between science and politics. This brings us to the question, if we should rather treat the concept much more cautiously and as a symptom of a relationship currently undergoing profound re-negotiation e.g. beyond the metaphor of a social contract for science? What about SD being but a fashion or a means for seizing political or organizational legitimacy? Of course, it might as well be, that science diplomacy is none of the above but simply an intriguing intellectual object, no more than a "rhetorical innovation capturing unavoidable processes" (Penca 2018). What is the more general idea or social purpose behind the term of science diplomacy? As Penca has previously questioned: "Is the concept identifying a novel practice and if so, what is it? If not, what is the reason for this new rhetoric?" (Penca 2018) There remains a considerable scope for understanding the relevance of the discursive innovation of "science diplomacy".

There might be some truth to all of these aspects and it is certainly not helpful to play the concept of science diplomacy off against the complexities that it so rightly reflects. Given the fact that science diplomacy could become a heuristic tool for our research it seems important to clarify the logic, ideas and assumptions of the term beforehand. For now, science diplomacy is rather defined in terms of political purposes, rather than in terms of other identifiers. This requires some reflection and preferably mindful predefinition of the intended purpose when doing research in the area of science diplomacy. If a certain understanding or definition of science diplomacy is adopted in S4D4C's investigations (such as for the case studies), how should it define the object of

study and does having a fixed definition pre-suppose a specific purpose? Is this in line with the intended purpose (if there is one)? Moreover, does this have an effect on the orientation of the research and its outcomes itself and how? This does not only refer to specific political objectives but more generally also to the premises of how science and foreign policy are functionally related to each other as part of science diplomacy definitions and concepts. Overall, it seems that there are further options to conceptualize science diplomacy worthwhile to explore. In any case, studying the intersection of science, science policy and foreign policy requires a good deal of conceptual reflection and awareness for implicit assumptions about these terms. This fact gets underscored once more when looking at the term science itself and how it is connected to more general ideas such as the character and role of science or political agendas in the global world order as it will be portrayed in the next section.

3 Reconstructing science diplomacy

In the previous section we have shown that there is no clear-cut definition of science diplomacy in the literature that demarcates a given set of political, scientific, or (more generally speaking) social practices. Questions regarding the scope, distinction and conceptual clarity are still open and contested. This section is interested in science diplomacy as a concept, which is formed and brought up for discussion through specific speech acts by specific actors apart from its analytical capability and apart from an interest in the broad variety of activities that it potentially covers and that existed long before the term became more popular (AAAS 2015). Of course, the term science diplomacy has a logic and history of its own. In this section we approach the topic of science diplomacy by reconstructing interpretative frames that have been lending significance to the concept and have established it as a meaningful, even popular discursive object in recent years (cf. Witjes 2017). We ask, which ideas, convictions, arguments, and maybe hopes can be identified to carry the idea of science diplomacy and to constitute it as a coherent and obviously appealing discursive object? Why has science diplomacy gained attention and popularity especially in recent years? Who is talking about science diplomacy and about whose science diplomacy are we actually talking? If we think of discursive objects as solving socially produced and discursively articulated problems, to which problem(s) would science diplomacy be the answer?

3.1 Formation of the term

Science diplomacy can be regarded as a discursive object that was originally coined in a specific historical context as part of a strategic foreign policy initiative. The origins of the term can be traced back to a US foreign policy initiative that tried to re-establish US soft power and particularly to restore the reputation of the US after the US-led invasion in Iraq in 2003 and its devastating effects on the image of the USA in the world (AAAS 2015; Fähnrich 2015; Fedoroff 2009; Lord and Turekian 2007; Zewail 2010). From there it has taken on a life of its own both as "an area of study and as a policy consideration" (AAAS 2015, 1). The first AAAS'-hosted meeting on science diplomacy (2008), the establishing of the AAAS' Centre for Science Diplomacy (2008), the conference on science diplomacy co-sponsored by the Royal Society and the AAAS (2009) fall in a time when the US' foreign reputation was considered to be on an all-time low[5]. It seemed to become apparent that the US would need to restore its image and to regain credibility and trust in order to be able to effectively pursue and implement its policies and interests in the international arena. The aim was to reclaim the US' global normative leadership

[5] https://www.aaas.org/program/center-science-diplomacy/about

role through the area of science. The US seemed to recall their "scientific identity", mainly that science constituted a central pillar in American society and that the US were a global leader in science and innovation (Hormats 2012).

The foreign policy initiative also rested on the idea to draw on the general image of scientists as impartial, credible and "undefiled" agents in international affairs. Scientists and scientific organizations were expected to act as balancing agents in US foreign affairs and to make up for the negative image of US foreign policy. This came along with significant expectations: "It is time for the scientific community to increase its role in diplomacy—and maybe even take the lead." (Lord and Turekian 2007, 770) Specifically in Muslim countries, science was expected to be able to restore credibility of US foreign policy and to win back the support of foreign populations (Obama 2009). Science and technology appeared to be one of the last realms of American society that was still respected in mainly in Muslim countries and scientific engagement was considered the last "signal of friendship between the United States and countries such as India, Egypt, and Pakistan" (Lord and Turekian 2007, 769)

> "Indeed, the subtext of the AAAS–Royal Society 2009 meeting on science diplomacy was the potential use of science to reduce tensions between Western and Muslim-majority countries, especially in the wake of the 9/11 attacks and the highly publicized war on terror. U.S. president Barack Obama's Cairo speech, delivered June 4, 2009, and aimed at reframing the relationship between the United States and the international Muslim communities, focused heavily on S&T, and highlighted these efforts at an official level" (Gluckman et al. 2017, 5)

Quite unsurprisingly, the science diplomacy initiative and more concrete outcomes of it such as the Science Envoy program were specifically geared towards Arab countries. Some were expecting from it "the potential to redefine the role of science in the landscape of diplomacy in general and to define a new beginning with the Muslim world of 1.5 billion people." (Zewail 2010, 204) Till this day, the concept of science diplomacy has a focus on US foreign policy towards countries in the Middle East in the US (AAAS 2015). While the origins of the term science diplomacy can be traced back and associated with a concrete political or even strategic situation in US (foreign) policy at about the years 2007-2009, the term itself has gained currency elsewhere since then. It has uncoupled from its original context to some extent. Nevertheless, it has stayed a term that is used mainly in a political context accompanied by a set of more or less implicit ideas and narratives that have stuck to it. Some aspects that were inherent in the term from the beginning can still be found to play a defining role in the science diplomacy discourse elsewhere outside of the US context.

In the following I will highlight the major narrative patterns associated with the term science diplomacy. First, science diplomacy turns out as a discourse of exigency, related to the need for urgent action (section 3.2). As a discourse of exigency, science diplomacy carries the notion of major risks and threats as part of global developments that require immediate (political) action. Paradoxically, science diplomacy as a discourse of exigency is acted out on two rather divergent stages. The first and very prominent one is the stage of "tackling global challenges". In this context science diplomacy is introduced as an important tool that speaks to the requirements of transnational, well-informed, effective and urgent action (3.2.1). The second stage that also draws on the gesture of exigency is the soft-power dimension of science diplomacy. In this context, science diplomacy is heralded as an innovative and much-needed soft power approach in the emerging world order, usually signified by the reference to the multipolar or heteropolar world. Yet, this narration eventually boils down to a conventional power play narration (3.2.2). These two narrations can be also considered to be somewhat contradictory or ambivalent at the same time: science diplomacy as a call for global scientific and political cooperation on the one hand, and the intention to employ science diplomacy as a means of political power in a competitive world order on the other hand. Lastly, science diplomacy carries a faith in science as a medium of universal understanding beyond political and cultural rifts (section 3.3). Science is supposed to be well-intended (3.3.1), non-normative (3.3.2) and universal (3.3.3).

3.2 Science diplomacy as a discourse of exigency

3.2.1 Tackling global challenges

> "We need to understand, at a deep gut level, that all our fates are truly intertwined. We must move quickly to develop the science that will allow us to model and understand the complex system that is our planet and its crust of human activities. Manage water, grow food, battle disease, and build economies into the next generation—and the next." (Fedoroff 2009, 10)

The term science diplomacy – as utilized and reproduced by politicians and practitioners – broadly draws on the grand challenges discourse. The increasing relevance of science diplomacy is introduced and continually tied back to the urgency of tackling the "defining challenges of the 21st century" to "address the common problems facing humanity" (The Royal Society 2010). Climate, food, energy, water and health are the topics among the 'usual suspects' that science diplomacy is expected to contribute to (Basha 2016). STI is deemed to have a central role in enabling the international community to respond to global challenges (Keenan et al. 2012; Schlegel 2017). Central to this narrative is the

idea that this set of complex global challenges requires an ever-closer cooperation between science and policy (Turekian et al. 2015)[6]. Moreover, since most of these global challenges are ascribed to the technological and scientific progress itself, science is somewhat held responsible in also alleviating its own negative consequences. It is considered imperative in tackling challenges it co-produced (Copeland 2011; The Royal Society 2010). This is highlighted by the impression of "a world of increasing scientific and technical complexity" (The Royal Society 2010). In that, the call for science diplomacy is built both on the idea that the pressing challenges are global in nature (and therefore require global action) as well as that they have become more complex and therefore require international scientific endeavours and expertise. In turn, they do not only require scientific exploration, but at the same time they have an international/trans-national dimension. Interestingly enough, this is taken as evidence for the fact that science and foreign policy cannot be clearly distinguished from one another anymore. Turekian has previously argued that: "A globalizing world has eroded the old dichotomy between science and diplomacy, and helped to facilitate the emergence of science diplomacy, whereby scientific collaborations among nation states are necessary to tackle increasingly common challenges." (Turekian et al. 2015)

Quite naturally, this perception usually comes together with a call for more science diplomacy of all kinds and the statement that it is still underutilized to address global issues (Copeland 2011, 2016; Keenan et al. 2012; Turekian et al. 2015). Furthermore, science is expected to contribute not only through its core competence (expertise) but in terms of agency and governance. Most directly, this has been described by Van Langenhove, who argues in his article „that the science and technology (S&T) community not only has the potential to play a significant role in addressing global problems but that it can help establish a multilateral governance structure fit for this purpose. In other words, the S&T community can be a change agent." (Van Langenhove 2016b, 1) While it may seem promising to include scientists as key actors in decision making and in international governance, empirical findings remain rather skeptical on the effectiveness of these arrangements (Lidskog and Sundqvist 2015). The lessons learnt so far from one prominent example, the IPCC (International Panel on Climate Change), hint to the fact that scientists can be quite successful in establishing awareness for a specific topic and also framing the problem definition of a "global" issues (Hulme 2010). Yet, their ability to push for the implementation of concrete measures and collective action deemed necessary remains confined (Lidskog and Sundqvist 2015). This raises the question of

[6] The fact that science has been a prime cause for the emergence of many „grand challenges" is however less discussed or regarded.

whether the call for scientists to "rule" the grand challenges is an exaggerated hope when confronted with the political challenge of addressing issues in the international arena. In this respect, it could be considered to reflect a "high degree of political rhetoric that is employed by stakeholders when referring to foreign science policies' capabilities to tackle global challenges or as a means of science diplomacy" (Witjes 2017, 82)

3.2.2 Power play (Science diplomacy in a multipolar world order)

Apart from the 'classical' global challenges discourse as an international scientific and collective action problem, the global challenges narrative also encompasses a second dimension. In this second dimension, challenges refer to the shift in global power relations and are usually subsumed under the axiom of the multipolar or hetero-polar world order. The two global challenges discourses are of course linked to each other in the sense that a shift in power relations affects the options and the likelihood of successfully governing specific global problems and thereby safeguarding national perspectives and interests. This notion of global challenges clearly denotes a different challenge that stands apart from the concerns for global common goods, it refers to the loss of the former traditional hegemony of the Western world. It reflects the understanding of an increasingly competitive world order, where new modes of power are sought after, though of course mainly by countries of the "Western world" that potentially suffer from this. In this regard, science diplomacy has entered a second stage, where the term is posited as a soft power tool of potential strategic relevance (Gluckman et al. 2017). In diplomatic terms this Western perspective on the role of science diplomacy to tackle "global challenges" reads like this: "Nevertheless, SD is important and is becoming more so in an increasingly heteropolar world order where the vectors of power and influence are characterized more by difference than by similarity and S&T based challenges are multiplying." (Copeland 2016) This perspective is particularly well received and incorporated into the incorporation of the term science diplomacy into the EU foreign policy agenda (see section 5).

In line with the pragmatic approach by Gluckman et al. (2017) science diplomacy can be looked at as another mechanism to establish or maintain influence on the international arena. Interestingly enough, this power-play dimension does not seem to contradict with the aforementioned idea of science diplomacy as a mechanism to strengthen the position of scientific evidence and raising scientists voice in the effort to govern challenges of global scope. "Science diplomacy is coming to the fore as a formidable dimension of interstate power relations. As the challenges of the world increasingly transcend borders, so too have researchers and innovators forged international coalitions to resolve global

pathologies." (Legrand and Stone 2018) In general, the relation between the national interest and power aspirations that are tied to the term science diplomacy on the one hand, and the idea of science diplomacy as the panacea of tackling global challenges on the other, seems to be at least under-problematized in the literature. For a more critical and in-depth discussion of science diplomacy as 'the soft power of science' consult for instance Witjes (2017; section 1.2.5 Knowledge and Governance in Global Politics, p. 26ff.).

3.2.3 Internationalization of S&T

To some degree, the attractiveness of the concept is certainly due to the fact that science diplomacy speaks to major transformations or at least macro trends of modern societies in a globalized world. First and most importantly, science diplomacy captures an awareness for the increasing relevance of science, technology and innovation (STI) in international relations (IR) (Gluckman et al. 2017; Krige and Barth 2006; Mayer, Carpes, and Knoblich 2014; Skolnikoff 1994; Wagner 2002; Weiss 2005). The complex and "pervasive mutual interplay" (Flink and Schreiterer 2010) of STI and IR holds true not only for traditional foreign policy issues (speaking mainly of security and economic competitive advantages), but increasingly more so for the extensive knowledge demands in tackling global challenges (Keenan et al. 2012). In that, the concept certainly corresponds with another macro trend[7] in modern societies: the blurring of boundaries between social systems, particularly the increasingly significant role of knowledge and expertise in basically every aspect of society (Stehr 1994). Expanding and deepening forms of governance of academia parallel this trend from the opposite direction. In other words, the emergence of science diplomacy might as well be considered a reflection of 'the knowledge-society going global' (Fähnrich 2015). Yet, the consideration of science diplomacy as a necessity that emerges from the globalization of science, technology and innovation is more common on the academic side. It appears less in practitioners' accounts of science diplomacy (Linkov et al. 2016; Schütte 2010; Witjes 2017) (Edler 2010). Particularly, Flink and Schreiterer (2009; 2010) investigate science diplomacy departing from the observation of an ever-increasing internationalization of science and technology that necessitates foreign policy agencies to respond in different ways (Flink and Schreiterer 2010).

[7] (or maybe this is the same trend, but here it is simply framed in a more abstract sense.)

3.3 The "good-science"-symbol in science diplomacy

This section sketches predominant ideas of science that play a major role in the public science diplomacy debate. Science comes into the picture in a utilitarian and normatively charged way - it is something useful, i.e. available and positive. The "good-science"-symbol can be divided into three separate strands of narrative patterns. The first is the idea of science as being inherently good and of scientists intending to improve living conditions and acting in the interest of common good (section 3.3.1). The second idea of science refers to its supposed non-normativity. This idea plays a crucial role in linking science to foreign policy (mainly science for diplomacy and science in diplomacy; section 3.3.2). Lastly, the idea of science as providing a common, even universal language adds a lot to the appeal to link science to diplomacy (section 3.3.3).

3.3.1 Well-intended science

The need for science diplomacy and in this case more specifically, the hope to leverage or exploit science for overarching political purposes, is argued on the basis of the supposedly and inherently good and/or apolitical intentions of science, that ostensibly set it apart from the political sphere. This feature ascribed to science seems to be important in the science diplomacy discourse. This idea will be referred to as the "good-science"-symbol. The following sequence taken from a comment on the role of science in diplomacy epitomizes this idea quite clearly: "The world goes through economic, political, and religious turbulence, but throughout history science has maintained a steady impact on improving human lives." (Zewail 2010) Against the backdrop of an unsettling scenario of increased political conflicts and global crises, science is perceived as the institution that stands out in an exemplary manner or – to put it more bluntly – as the beacon of hope, the key source of human development, well-being and global understanding. This goes so far as to credit science with all the merits of the modern world. "The developed world is so because of its scientific and technological power" (Zewail 2010). Therefore, our critical discourse analysis reveals that a central interpretative pattern behind science diplomacy seems to be the idea of science as good in and of itself, and of science being naturally geared towards the betterment of humankind. This is of course a very problematic assumption informed mainly by Western ideas of science and progress that neglects the imperial role of science in shaping world politics[8]. Though this critical stance is not reflected in the literature on science diplomacy.

This leaves aside the fact that most of the challenges the world faces today, are also science and technology-driven (they are also the results of technological progress).

[8] We thank our reviewer Jasper Montana particularly for stressing this fact.

Furthermore, the supposedly beneficial contribution of science to tackling global challenges is presented as a matter of scientific excellence and the effectiveness of advice mechanisms (The Royal Society 2010, 5). In that it neglects the agendas and interests as being part of the community of scientists. Last but not least, along with the good-science-symbolic comes a certain negation of risk, venture and potential failure of scientific undertakings. Discourse about science diplomacy even seems to pivot on a bromidic version of linear innovation along the lines of "if only you do scientific research, prosperity, health and all the good innovative things are just waiting round the corner" (Hennemann, Rybski, and Liefner 2012). Yet, the more central aspect of the "good-science"-symbol as part of the science diplomacy discourse is the idea of science as an a-political and non-normative arena. This is from where the concept scoops a great share of its meaning and popularity.

3.3.2 A-political and non-normative science

A central pillar of the concept science diplomacy is the idea of science as non-normative. Science is deemed to be a transnational arena by definition and in that it is held more suitable to tackle global challenges in that it seems to be able to circumvent political conflict lines. "Nongovernmental scientific organizations are more credible, more nimble, and—as honest brokers—in many cases more respected than the U.S. government overseas." (Lord and Turekian 2007, 770). The supposed a-political stance of science may stem from the notion of the disinterestedness of the ideal researcher and of the notion that science would not know national borders or a national identity. This interpretation of science is recorded prominently in the Royal Society's Report: „The scientific community often works beyond national boundaries on problems of common interest, so is well placed to support emerging forms of diplomacy that require non-traditional alliances of nations, sectors and non-governmental organisations." (The Royal Society 2010, vi)

The concept of science diplomacy clearly puts the focus on what this could mean in the international (political) arena. The hopes in the effectiveness of science diplomacy are clearly based on the idea that science transcends borders that by classical means of diplomacy cannot or are difficult to be transcended and in that sense would be a-political and non-normative. "Scientific partnerships are based on disciplines and values that transcend politics, languages, borders, and cultures. Processes that define the scientific community—such as merit review, critical thinking, diversity of thought, and transparency—are fundamental values from which the global community can reap benefits." (Hormats 2012, 2) To some extent, the idea of science diplomacy even builds

on the notion of a-political, good science that is juxtaposed in opposition to a messed-up political/global situation, which is sort of doomed to fail in the absence of the rationalizing and harmonizing virtues of science. "Scientific and technical cooperation is one important way to avoid wars in crises and to realize positive outcomes in an otherwise downward-spiraling policy environment." (Hayes et al. 2007)

Under the heading of science diplomacy in the 21st century Fedoroff outlines how she thinks the idea of nationality is intertwined with the capacity to solve global problems. "It seems to me that we must first become citizens not just of our own nations, but of this world without borders. We need to see, experience, and identify with the peoples and the problems of other nations and to recognize the complexity and interconnections among the challenges facing 21st century humanity." (Fedoroff 2009, 10) As a result, it can be stated that in some accounts of science diplomacy, non-normativity and disinterestedness of science are not only considered to be important as agency in a governance framework but already at the level of identification and images of the world as shown in the following section.

3.3.3 Universal science

Finally, the "good-science"-symbol is complemented by the idea that science is universal by nature and therefore transcends not only political but cultural differences. In that it is considered to contribute to a mutual understanding that is beyond political and diplomatic measures: "Science is an international language that is not colored by race or culture" (Zewail 2010). Or: "Science, of course, provides the common language to build bridges between cultures." (Fedoroff 2009, 10) Most prominently, "science and universal values" appear as the second major conclusion in the Royal Society's report right behind the three dimensions of science diplomacy: "Scientific values of rationality, transparency and universality are the same the world over. They can help to underpin good governance and build trust between nations. Science provides a non-ideological environment for the participation and free exchange of ideas between people, regardless of cultural, national or religious backgrounds." (The Royal Society 2010, 15) In this regard, science is also employed in a diplomatic sense that rather falls under public diplomacy. Yet the idea of science as a means of not only communication but identification beyond the confines of ethnicity, culture or nationality seem to act a crucial part in science diplomacy's appeal.

From the point of view of these narrations and ideas of science, it makes perfect sense to argue for the benefits of science diplomacy explicitly as a means of "non-governmental diplomacy" (Hayes et al. 2007). At the same time however this raises the question if this

idea is still met and can be fulfilled, if science diplomacy is actually employed as political agency and in some cases even being promoted as an outspoken political strategy (compare to Moedas 2016) or a soft power instrument (Van Langenhove 2016a). Similarly and more generally, arguing for science diplomacy on the basis of these ideas of science does not take into account that science is eventually funded not only by international donors but mainly by national governments and private investors and in that is linked to national and private interests (Wagner 2002). "Science's epistemic peculiarities no doubt limit the potential use and leverage of S&T for political purposes. While governments take them to be just means to pursue external political or economic goals, the scientific community, research agencies and research institutions are attracted and motivated to engage in collaborative projects by the prospects of gaining additional leverage, secure funding and support for their own endeavors but not serving national objectives." (Flink and Schreiterer 2010, 669)

3.4 Example: The Royal Society's Report "New frontiers in science diplomacy"

The Royal Society's report is the synopsis of a 2-day meeting in the United Kingdom that brought together foreign policy experts and scholars from different fields of expertise. The report is widely credited with having brought the concept into play and having opened it up for a broader discussion. While it is well known and often cited for the three dimensions that it introduces to the concept of SD, the constitutive narratives and patterns of that report are often overlooked and go unchallenged. Most importantly, while the famous three-fold typology purports a functional symmetry between science and politics (not only science for diplomacy, but also diplomacy for science), the general line of argumentation in the report and elsewhere tells a different story: Building on all of the narratives that have been reconstructed in this section, the report unfolds an understanding of science diplomacy on the grounds of the general optimism to employ science for the purpose of solving political intricacies in governing global commons. Science is generally expected to foster diplomacy and international cooperation where the involved national actors seem to have reached a stalemate. The report contains two case studies that illustrate this argument.

The first case study illustrates the US ambitions in 2009 to foster relationships with Islamic countries through the installation and support of educational exchanges and research collaboration. In this case the merit of science is located at the "soft-power" inter-societal level and is directed at re-establishing reputation and rebuilding societal

links. While this section deals more carefully and sceptically with the expectations on the peace-making effects of science diplomacy, it nevertheless represents the idea of science diplomacy as a highly intentional foreign policy tool of a nation state "to help rebuild trust and foster understanding" (The Royal Society 2010) by resorting to science where traditional political/diplomatic means seem to provide only little potential. This hope is arguably inflated as has been already discussed in section 3.

The second case study heralds the Antarctic Treaty as a means of a policy of détente during a period of nuclear armament and furthermore expresses the hope for a similarly harmonizing effect for the future of the governance of the Arctic. This case study illustrates the hope that science cannot only provide the starting point for the governance of the ungoverned and contested international spaces but to ultimately define the common interest and peace in these spaces(!). The line of argumentation why science should be able to systematically fulfil these high hopes yet remains untold. The optimism seems to be mainly based on the following mechanisms and channels: Research results can have a crucial impact on decision-making on these ungoverned spaces; research in these areas itself requires international collaboration (particularly of the neighbouring states); and most importantly: Science as a platform for the exchange of information, ideas and agendas can foster (political) discussion and even achieve consensus on the common interest (The Royal Society 2010).

Apart from that, the report is ambivalent with regards to the power dimension as discussed in section 3.2. While the overall presentation of science diplomacy speaks to the grand challenges discourse, the soft power dimension is considered equally important. The subtitle of the report "Navigating the changing balance of power" is probably often read over but speaks its own language. Science diplomacy is equally understood as a means to leverage influence in the interest of the (former) world powers faced with a "changing" equation of power in the international arena. The cover picture of the report also highlights this impression. The picture of a compass resembles a drawing from the 18th or 19th century and may have been chosen in a moment of unimaginativeness. Nevertheless, it does its bit in underlining the notion of a former world power that has not let go of the good old times as a naval power and is now in search for "new horizons". It can be concluded that the concept of science diplomacy as brought forth by the Royal Society's Report seems to be rather driven by a desire to navigate a rearranging space of power than by the desire to navigate the frontiers of science or any science related space.

To sum it up, the general notion is that the report has introduced the threefold typology of science diplomacy and in that it has made mainly an *analytical* contribution to the concept of science diplomacy. Yet, it just as much seems to have delivered the prevalent baseline narrative of science diplomacy and thereby coined the meaning of the concept in a specific way. This narrative is being reproduced in the literature as well, though possibly in a more implicit manner. The report's understanding of SD seems to be essentially driven by the optimism that science can intervene in "complex" (meaning "strained") bilateral/international relations and dysfunctional international governance frameworks to tackle global challenges and produce positive policy outcomes (S4D and SID, though to a lesser extent D4S)[9]. This optimism is however reflected neither in the report nor in the general debate on the term. Most critically, this implies the expectation that science could solve inherently political problems and is able to preserve western claims to power.

[9] "The meeting explored, how science can contribute to science policy objectives" (The Royal Society 2010)

4 National approaches and common challenges of science diplomacy

As has been highlighted particularly in section 2, the idea of science diplomacy can involve a vast range of different activities, some of which are studied and covered under different headings by different academic (sub-)disciplines or research areas. Investigating national science diplomacy approaches could of course imply to look at all these different aspects including such as national level research agendas, the landscape of collaborative research projects, international scientific and technological investment by developed countries in developing countries, even the political economy of international university educations or the mobility of scientists across research institutes. It goes without saying that it would go far beyond the scope of what this state-of-the art report can reasonably provide, if we tried to cover or even to touch upon all these aspects that can potentially play into science diplomacy and that are covered by different bodies of literature (even if it was "only" for all EU member states). What we provide in this section is to look at the (rather small) body of literature that has systematically studied national science diplomacy approaches with the aspiration to bring together all these different aspects under an explicit science diplomacy perspective.

There are only a few studies and resources that explicitly investigate national science diplomacy approaches (Berg 2010; Flink and Schreiterer 2009, 2010; Rüffin 2018a; Turekian and Wang 2012; Witjes 2017)[10]. However, these studies are particularly important for providing more concrete and thereby insightful examinations of science diplomacy. Furthermore, they are also interesting to look at from a conceptual perspective. They range from a collection of examinations looking at individual countries[11] to more systematic and fine-grained comparisons, and they differ with regards to the methodical approach and level of intricacy. Apart from the differences of the setups of the studies, it can be concluded from this body of literature that science diplomacy approaches are markedly different for each country and that there is no benchmark model (Berg 2010; Flink and Schreiterer 2010; Witjes 2017). "Their [the countries'; AN] individual perspectives, approaches, and practices differ widely from one another. In stark contrast to more conventional policy fields, there is no such thing as an acknowledged state of the art of how to do SD or a consensus on what SD could or

[10] In addition to that and quite specifically, Bonilla Aranzales provides another study on the role of scientists in the estbalishment of science diplomacy links of Germany and the US with Colombia (Bonilla Aranzales 2017). Furthermore Witjes (2018) also provides a section on comparing STI foreign policies of the UK and Germany.

[11] The AAAS report includes South Africa, New Zealand, Japan, the US and Canada.

should be — at least not as yet." (Flink and Schreiterer 2010, 675) This also applies to how an individual country interacts and maintains science relations with different foreign countries (Rüffin 2018a). "The difference between countries appears to be more in the emphasis on each of these activities, and often these vary depending on the host country." (Berg 2010, 72)

Flink and Schreiterer have provided one of the first and most systematic accounts of national approaches in science diplomacy comparing German foreign science policy with France, Switzerland, the UK, Japan and the US (Flink and Schreiterer 2009, 2010). They illustrate that different national science diplomacy approaches show a variety of programmatic and thematic focuses and greatly differ with regards to the political significance that is assigned to this field from homeland institutions (Flink and Schreiterer 2009). Countries differ with regards to their primary objectives or the composition of their "science diplomacy agendas", respectively. For instance, while Germany, France and Switzerland have a focus on promoting scientific interests, international scientific collaboration and bilateral agreements (focus on "promotion"), the United Kingdom employs science to pursue objectives as part of foreign policy agendas (focus on „influence").

In addition to that, the national approaches also differ with regards to which ministry is in lead of foreign science policy. There are usually several ministries involved in a country's science diplomacy setup, including: the foreign ministries, the ministries in charge of research, science and innovation, economics, health and environment, etc. A challenge that comes with the collaboration and shared competences of at least two, if not more, ministries can include being affected and having to deal with conflicts emerging from different political priority setting and administrative cultures (Flink and Schreiterer 2009).Obviously, since the distribution of executive competencies to individual governmental ministries or agencies varies according to the national contexts, there are different agencies involved in each case. Additionally, tasks of science diplomats can include to attend conferences and workshops and promoting own funding schemes etc. (Rüffin 2018a). This again makes it difficult to generalize findings and recommendations. Yet there are some practical consequences and challenges that can be drawn from this research in general and are worthwhile to be considered.

Professionals such as science attaches or science counselors involved in this area seem to face similar challenges in their daily lives apart from the different agendas and duties they are charged with. They are generally engaging in establishing and cultivating contacts such as with scientific agencies of their home countries, monitoring STI

developments in their respective host countries as well as preparing bi- or multilateral research projects and agreements and sometimes even monitoring joint research projects (Flink and Schreiterer 2009). This insight has been picked up by the S4D4C's international needs assessment survey[12]. This survey tries to get a clearer picture of the specific obstacles and prerequisites of so called "science diplomats", professionals with academic, management or diplomatic background.

Another common challenge stems from the fact that "science diplomats" need to be capable of acting in different arenas – the academic world and diplomacy –, being familiar with the specific logics and conventions and being able to easily switch between the two worlds. In addition to this, the scope of responsibility and the work-sharing with colleagues can vary a lot as well (Flink and Schreiterer 2009). In the case of some countries there are only one or two science attachés working in an embassy or consulate. Where attachés work in one of the science and innovation centres established by some countries in cities with highly innovative activities, i.e. apart from the diplomatic missions (e.g. swissnex, the Innovation Centres Denmark or the German Centres for Innovation), the duties are likely to be different. Size and composition of staff assigned to science diplomacy duties varies a lot from country to country (Flink and Schreiterer 2010, Rüffin 2018a). Rüffin has showed this also in his study delineating the innovation centres abroad of Denmark, Switzerland and the United Kingdom (Rüffin 2018a).

Berg (2010) has provided another empirical account on national science diplomacy approaches. While the study usually speaks of "Science Diplomacy Networks" (this is also the title of the study), it is specifically interested in the composition and structure of staff that is working abroad charged with SD tasks. The study looks at two categorizations; the first distinguishes SD positions that are held by seconded staff, recruited staff or by career diplomats. The second category asks if the positions are charged full time or part time with S&T responsibilities. The study results hint to the fact that the broad trend is towards more specifically recruited experts working in embassies instead of career diplomats taking over S&T related tasks (Berg 2010, 72). Most notably, the majority of countries employ a mix of different staff types and are expected to do so in the future as well. Apart from that, the major insight to be taken away from this study is that systematic structural similarities or patterns among the 20 countries' SD approaches being investigated do not exist. While some countries compare with each other with respect to one category (e.g. the proportion of seconded or recruited staff), these schemes fall apart when another category is added. A good deal of the literature

[12] Results will also be made available online (https://www.s4d4c.eu/).

endorses to recruit more scientists and integrate them into foreign services (Linkov et al. 2016). They "argue the role of science in diplomacy should be an effort that directly includes more scientists in top-down international endeavors while continuing to promote bottom-up projects and research encompassing" (Linkov et al. 2016, 3)

General challenges for the empirical study of national science diplomacy approaches stem from the fact that science policies can move fast and that national science diplomacy setups are just about to develop. Therefore the object of investigation is not fixed and may undergo some profound changes in each country. Maybe it seems unsurprising that national science diplomacy approaches or STI policies are ahead of the EU science diplomacy setup. Yet, the European Union can look back on a long history of institutionalizing scientific cooperation as well and in that has already developed instruments and mechanisms that can be fostered in the sense of science diplomacy. Equally significant seems to be a look on how the concept of science diplomacy is currently discussed and related to the EU foreign policy agenda.

5 EU science diplomacy

The EU can look back on its own history of scientific collaborations and some paradigmatic cases of science diplomacy. The European community has developed structures of science funding and coordination already at an early stage of its existence, which were always explicitly tied to political goals (Stein 2002). Therefore, structures, mechanisms and cases of what we would call science diplomacy today are everything but new to the European Union. They can even be considered as being ingrained in the genes of the EC (Flink and Schreiterer 2010). There are three relevant references on the emergence of EU foreign science policy and science diplomacy that are highly recommended for a broader overview. The first is provided by Wedlin and Nedeva (2015) and traces the emergence of the European Research Space. The second paper is provided by Stein and even though it dates back already to 2002, the article by Stein still represents an excellent account both in tracing the evolution of the intra-European S&T co-operation and relating it to EU integration and EU external relations. Science diplomacy was not yet a prominent concept then (the term occurs only once in the article), but it maps all the important dimensions and ramifications of what we might refer to today as 'EU science diplomacy' (Stein 2002). Furthermore, Edler provides an insight into how the European Union has dealt with the internationalization of science and innovation and addresses the challenges that arise with respect to the coordination of governance (Edler 2008). In addition to that, the EU, represented by the European Commission has concluded formal S&T agreements with a number of countries[13]. The EU also entertains programmes and other linkages to third countries and regions such as Latin America (Bonilla Aranzales 2017; Selleslaghs 2017), the Mediterranean region (Penca 2018) and others that can be regarded and studied as science diplomacy. In that sense, "the EU's external engagement in science and research can be described as developed" (Prange-Gstöhl 2018).

Though, what is missing up to today is a coherent EU science diplomacy understanding and a corresponding strategy to implement or tie together the relevant institutional elements in a coordinated manner. This goal might be still a long way to go. Yet, what arises clearly from the literature is the fact that some EU member states are far ahead of the EU in realizing their own coordinated science diplomacy approaches (Witjes 2017). This is also due to the fact that "strategic objectives of STI internationalization activities are inherently based on national political interest" (Witjes 2017, 78): „We have shown that while the EU clearly sets agendas and funding frameworks for STI

[13] See https://ec.europa.eu/research/iscp/index.cfm?pg=countries for a full list.

internationalization, Germany and the UK are one step ahead of the EU in building-up physical and virtual infrastructures for supporting the internationalization of their respective national STI portfolios. STI policies thus can be regarded as an arena in which foreign affairs are shaped on different policy levels (EU policies, national policies) and at a different pace and intensity in different member states." (Witjes 2017) In other words: while the EU is generally regarded as a "perfectly suitable" global science diplomacy actor (the EU identifies as a normative power with a value-based approach to foreign policy based on human rights democracy and the rule of law (Michalski 2005)) and shows an interest in it, it lacks an implementation agenda (Penca 2018).

This argument is also supported by a study of López de san Román and Schunz. The study investigates and systemizes different motivations of EU policy makers for science diplomacy practices. It develops nine role conceptions of EU external science policies with a discourse analysis approach and discusses them in the light of a ‚market power Europe'/‚normative power Europe' distinction. In that, it contributes not only to the discussion of science diplomacy as a concept but also advances the findings on the specific logic and main ideas behind evolving EU science diplomacy (López de San Román and Schunz 2017). The following section looks at EU science diplomacy from a foreign policy perspective and sheds a light on the practitioner's and political discussion of the concept on an EU level and in that identifies foreign policy driven SD-perspectives and discusses its implications. Within a specific political discourse political expectations on EU science diplomacy seem to be high and ambitious, particularly with regard to its soft power dimension in a multilateral world order.

5.1 The strategic discourse on EU science diplomacy

Most prominently, Carlos Moedas, the European Union's commissioner for research, science and innovation, has taken up a dedicated stance on the relevance of science diplomacy for the future of the EU. He has expressed his vision of how he would like to see science diplomacy being implemented in EU foreign policy in several statements (Moedas 2015, 2016). Three significant aspects deserve closer examination: First, it is interesting to note that Moedas outlines science diplomacy systematically in reference to the EU-US transatlantic relationship. According to him, the US and the EU are not only "instinctive and effortless partners in scientific endeavours", but even "make very natural allies" (Moedas 2015). Science diplomacy seems to be another lens through which to frame the US and the EU as natural partners in defending "western" values: "We are confronted by the same struggle to define our democratic roles in a paradoxical age of

peace and conflict, of poverty and wealth. I believe science diplomacy presents a matchless opportunity, to address the political, demographic and environmental challenges of the age through the universal language and expression of scientific endeavours" (Moedas 2015). Science diplomacy is introduced as a strategic tool in the future multilateral, undoubtedly competitive world order, where the EU in its self-perception as a democratic superpower hopes to find an ally on the other side of the Atlantic.

Secondly, this specific understanding consorts with the fact that science diplomacy is not delineated as an exclusively cooperative but also as a competitive instrument on the global scale. Moedas cherishes science diplomacy "for its ability to establish unity, as much as for its ability to stimulate intellectual and economic progress" (Moedas 2015). The competitive aspect does not appear as explicit as the former, but shines through in between the lines. "My hope is for the United States and the European Union to continue to lead by example in this regard. To use our soft power to compete, to succeed" (Moedas 2015). The competitive aspect of SD is clearly linked to the idea of science diplomacy in its soft power potential. This impression is enhanced when looking at what is meant by the cooperative and uniting dimension: "I want science diplomacy to play a leading role in our (US and EU; A/N) global outreach for its uniting power. Certainly with our closest partners, but, even more so, where it can make an even greater difference" (Moedas 2015). The uniting power relates to those countries that the EU considers already being its partners. In the case of those countries, towards which the EU-relations are strained, Russia being explicitly named, science diplomacy is expected to preserve the "link through the common language and ideals of science" (Moedas 2015).

This idea exemplifies the almost classical soft power aspect of science diplomacy, by the means of which a nation tries to promote core values and to influence the opinions and behaviour of other nation states in a non-coercive manner (Nye 2004). And indeed science diplomacy seems to perfectly fit the EU's soft power image (Van Langenhove 2016a). Yet, the soft power potential of SD should not be exaggerated. The self-image of a nation or supranational power does not necessarily correspond with the image that other countries have of it. "An actor attempting to be a normative great power may hold a role conception as ethically and normatively superior, but this need not be mirrored by others'" (Bengtsson and Elgström 2012, 95). For example, while many Eastern Europe countries may share the EUs positive self-conception as a friendly great power, countries in Africa, the Caribbean, and the Pacific also perceive the EU as patronizing and imposing their policies in a rather self-confident manner (Bengtsson and Elgström 2012). Most

importantly, Russia and Belarus perceive the same behaviour as hostile and normatively aggressive (Bengtsson and Elgström 2012).

The third decisive element of the Moedasian reading of science diplomacy refers to the eminent idea of universal values of science: "The scientific values of rationality, transparency and universality foster common understanding, build trust and promote cooperation between peoples, regardless of cultural, national or religious background" (Moedas 2015). While this figure of argumentation has already been reconstructed as central to the general science diplomacy narrative (see above), it is again twisted in the EU context. In his 2016 contribution to *Science&Diplomacy* Moedas draws the picture of the EU as a historical science power and with it, the universal ideals of science turn out to be viewed more and more as fundamentally European values or – as Moedas himself puts it – as a "natural extension of European values" (Moedas 2016). From my point of view, it remains doubtful if this specific self-image, which claims science as a European value eventually fosters the original political intention, especially towards countries such as Russia or China.

Another strand of the EU science diplomacy debate relates to the EU's soft power in the so-called multipolar world. In his more recent publication, Moedas reinforces his vision of utilizing European science and particularly the more recent developments of intra-European scientific integration for bolstering the EU's global leadership ambitions (Moedas 2016). In that, Moedas makes science diplomacy a part of the EUs global strategy agenda. Overall, science diplomacy is depicted as both an essentially European and profoundly strategic instrument in the international arena building on the democratic norms and values of the EU (Van Langenhove 2016a). Science is roped in for clearly political purposes, such as establishing effective European neighbourhood. While the Commission has rather focused on the economic growth and competitive aspect of the EU's innovative potential until then (European Commission 2014; Trobbiani 2017), Moedas has taken the EU science diplomacy approach one step further towards an outspoken political agenda in a multipolar world, regarding the scientific potential of the EU "as a strength that can be mobilised as a soft power tool" (Van Langenhove 2016a)[14]. In that, science diplomacy has the potential to be "the new kid on the block" of the EU's ongoing struggle to find its role as a global power. From this point of view science diplomacy should specifically contribute to the EU's multilateral action (Van Langenhove

[14] This should not pass over the fact that the EU has been concerned with securing its access to science and innovation markets in third countries as an aspect of securing its relative strength already before (European Commission 2012). The growing research and innovation systems of the so-called emerging economies have been well noticed by the EU as challenging its former research and innovation dominance and necessitating action.

2016a). In the overall view, the Moedasian science diplomacy interpretation reveals an almost bewildering attempt to employ science as an extension of political instruments to defend Europe's own interests in the world, tied to the geopolitical challenges the EU faces today[15].

5.2 Structural aspects of EU science diplomacy

Apart from the current debate on the concept of science diplomacy and how it is applied or adopted in the EU context, discussing EU science diplomacy requires to touch upon a variety of institutional aspects as well, which are presented and evaluated in great detail by Prange-Gstöhl (2018). One major aspect to consider in this regard is the role of the European External Action Service (EEAS). It is unclear how it is involved in science diplomacy, how its institutional framework allows for possible further entry points e.g. for STI internationalization policies. It is also an open question how it relates to other EU policy fields and areas of diplomacy (public diplomacy, innovation diplomacy, economic diplomacy) that intersect with science diplomacy (also STA-agreements (Rüffin 2017)). In that regard, one general critique addresses the missing link between EEAS and DG RTD (Van Langenhove 2016a). Yet, solving this might be particularly challenging since compared to national foreign ministries, the EEAS is a new body that is still about to find its institutional identity (Adler-Nissen 2015). Still, it seems interesting to note, that EEAS has not yet articulated a specific interest in science diplomacy itself (European Union 2016) but that the need for EU SD is rather articulated by actors in the field of EU science policy. This is of course not a requirement and does not obstruct the development of a genuine EU science diplomacy. Yet, this would clearly have an impact on the configuration and agenda pursued. For instance, the US science diplomacy is characterized by a low involvement and low responsibilities of the State Department in its science diplomacy approach (instead this had been located also at the White House Office for S&T (Flink and Schreiterer 2010; Wagner 2002)). Furthermore and in contrast to more and more of the industrialized countries, the EEAS does not have its own chief scientific advisor (Peter Gluckman 2016). Also, the potential role of EU science advisory bodies (JRC, Group of Chief Scientists) towards EEAS is not defined yet.

Sure enough, the EU science diplomacy is not confined to its linkage to the EEAS. There are more areas of diplomacy that are interesting to consider apart from classical foreign policy considerations, such as EU trade/innovation diplomacy. Trobbiani comes up with

[15] Witjes 36etc.

the following argument: Since the EU has exclusive competences in trade, the interaction between trade and Science and Innovation would be another and maybe effective means to address global challenges for the EU (Trobbiani 2017). According to him, "S&I should receive more attention within EU trade policy and vice versa in order to find solutions for global challenges." (Trobbiani 2017) Another field is EU public diplomacy: Research on digital diplomacy and on the question of how the EU reaches out via the Internet, especially via social media is still on an early stage. Collins and Bekenova show with the example of Kazakhstan that EU embassies are far from scooping the full potential of social media for policy dialogue but still use it mainly for one-way communication. (Collins and Bekenova 2018) More broadly, Legrand and Stone propose to look at "new channels of influence and opportunity that have opened up for states alongside the 'traditional' modes of foreign diplomacy" (Legrand and Stone 2018).

6 Conclusion

There is no such thing as a one-size-fits-all science diplomacy approach just as much as the evolution of scientific cooperation within and across national borders has always been an expression of historical contingencies, emanating from the specific political situations and the states of science systems at a given point in time and space. Science diplomacy in the United States is different from how it plays out in Japan, Germany or the UK or how it is now being discussed in the EU context. Particularly, the way in which a specific country performs science diplomacy seems to be not only a result of given political and administrative cultures but also responds to the distinct political self-understandings and foreign policy ambitions.

Science diplomacy is a concept that is utilized and coined both by practitioners as well as academics and covers a broad range of different aspects and activities. The fascination with science diplomacy as a concept might stem from its capability of projecting current, pervading and empirically traceable trends in modern societies and in a globalized world. Correlating science and foreign policy – the two traditionally distinct areas – while at the same time providing enough leeway to spell out this complex relationship in almost every imaginable way certainly acts as an important part of the concept's popularity. Yet, from an analytical point of view, science diplomacy does not provide a clear-cut definition or conceptual framework yet. This requires additional reflection when investigating science diplomacy as an empirical phenomenon.

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