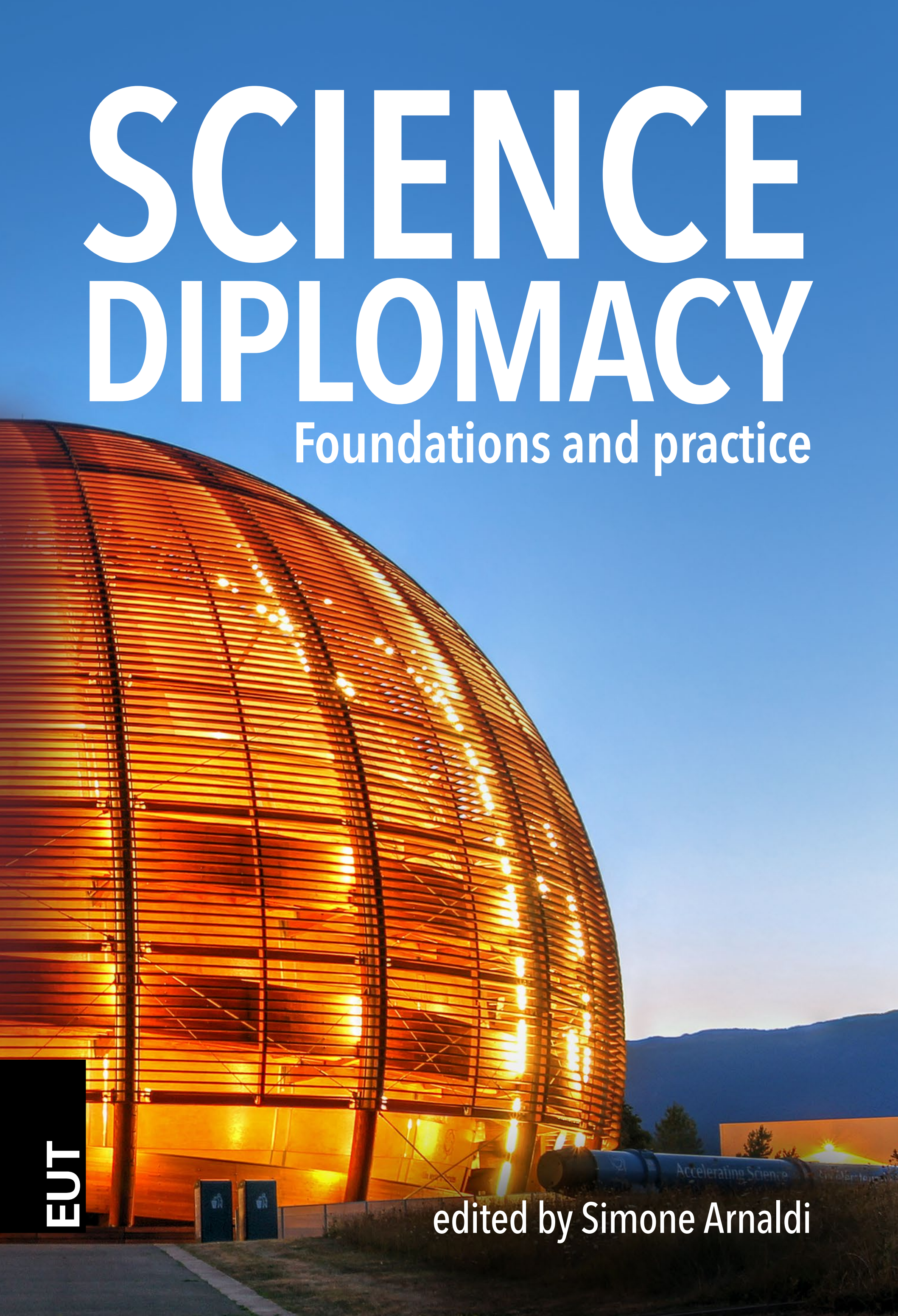

SCIENCE DIPLOMACY

Foundations and practice

edited by Simone Arnaldi

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What is science diplomacy? Why is it important in a world marked by global challenges such as climate change and confrontation between great powers? What knowledge can be mobilised to study this emerging field of practice and research? The chapters in this volume provide initial answers to these questions, examining different aspects of science diplomacy, both from a theoretical point of view and by presenting real world case studies. The intent of the book is to offer an introduction to an increasingly important theme in the relations between science, society and politics. Consequently, it is addressed to all those (students, researchers, decision-makers) who are approaching science diplomacy for the first time.

Simone Arnaldi is associate professor of sociology at the University of Trieste. His main research interests concern responsible innovation, science policy and science diplomacy. His publications include: *Co-creation and responsibility in techno-scientific innovation from below* (in Italian, Mimesis Edizioni, 2023, with Stefano Crabu and Paolo Magaudda) and *Responsibility in science and technology. Elements of a social theory* (Springer VS, 2016, with Luca Bianchi).

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The science diplomacy discourse and science policy

Simone Arnaldi

Abstract

This chapter discusses the convergence between the discourses of science diplomacy and science policy, highlighting the possible influence of the latter on the former. After presenting the concept of science diplomacy, the chapter goes on to illustrate the main characteristics of four models of science policy as described in the literature: the linear, demand pull, systemic and transformative models. Three themes common to the two domains of science diplomacy and science policy are then listed and discussed – namely, the representation of the scientific community, the social relevance of scientific knowledge and the role of stakeholders in the processes of scientific research, technological development and innovation – showing how science diplomacy draws on the discourse of science policy for their framings.

1. Introduction: looking at science in science diplomacy

«Science diplomacy» has recently emerged to describe the «field of international relations in which science and foreign policy interests intersect» (Ruffini, 2017: 3). Although these intersections are far from new, interest in this field of activity has grown significantly, among practitioners and scholars, in the recent past and has gained an increased recognition precisely through the introduction of the vocabulary and concept of «science diplomacy» (Ruffini, 2020). In defining it, one can say that science diplomacy includes both diplomatic activities supporting international collaborations in science and technology, on the one hand, and scientific research activities fostering diplomatic relations or facilitating policy collaborations between states, on the other hand. This twofold nature of science diplomacy distinguishes this field from the «normal» international scientific cooperation, as the former does not focus primarily on scientific and technological advances as such, but on science and technology as a means to achieve national or international foreign policy objectives (Turekian et al., 2015).

Within this generic framework, there have been many attempts to define science diplomacy, but the results have not always been convergent. The classic definition by the Royal Society and the American Association for the Advancement of Science (AAAS) classifies science diplomacy activities into three groups: «scientific advice to foreign policy activity (science in diplomacy); facilitation of international scientific cooperation (diplomacy for science); and use of scientific cooperation to improve international relations among states (science for diplomacy)» (Royal Society and AAAS, 2010: 32). According to Ruffini (2020), this definition exemplifies a diffused, «mainstream» representation of this field, whose key assumptions are: (1) the belief that science diplomacy can transform international relations through the application of science's own normative principles of disinterestedness, objectivity and rationality; (2) the conviction that, because of this very reason, science diplomacy can successfully address global challenges transcending national borders. However, as Ruffini notes, these definitions fail to consider the essential role played by national interests in science diplomacy initiatives, lacking a meaningful recognition of the political and power dimension that is characteristic of this field (see also Turekian et al., 2015). Other definitions consider this (geo) political dimension in a more explicit way. For instance, Gluckman et al. (2017: 3) differentiate three types of science diplomacy actions according to the different scale of the interests at stake, by distinguishing: «(a) actions designed to directly advance a country's national needs; (b) actions designed to address cross-border interests; and (c) actions primarily designed to meet global needs and challenges». Flink and Schreiterer (2010) place as much emphasis on the type of activities implemented to pursue them. Accordingly, the Authors differentiate between initiatives: (1) aimed at gaining access to researchers, findings, resources and markets related to science, technology and innovation (Access); (2) aimed at promoting a country's achievements in R&D to attract foreign partners for collaborations, to gain, regain and retain talent and to attract foreign investments for R&D (Promotion); (3) aimed at projecting influence on other countries' public opinion, decision-making and leadership (soft power) (Influence). The recognition of competition as a driver of science diplomacy becomes manifest in approaches focusing on innovation rather than scientific research cooperation. The more recent concept of *innovation diplomacy* is telling, as it emphasises international competition to connect «new knowledge with markets and investors in order to foster a return in terms of trade, investment, and technology» (Leijten, 2017: 19). Despite science diplomacy being at the intersection of foreign policy *and* science, this field has primarily been studied from the viewpoint of international relations. Instead, this chapter applies insights from science and technology studies (STS) and science policy to look at science in science diplomacy, thus exploring how science and society relations are represented and constituted in science diplomacy discourses. Science and Technology Studies (STS) is a research area that explores the interactions between science and society, studying, on the one hand, how social, political and cultural dimensions influence the trajectory of scientific research, technological development and innovation, and investigating, on the other hand, how technological artefacts and scientific knowledge influence society, politics and culture (Rohracher, 2015). In the study of these relations, STS has emerged as an interdisciplinary field, connected and partially overlapping with, among others, innovation studies (Martin, 2012), history (Dear and Jasanoff, 2010), philosophy of science and technology (Moreno and Vinck, 2021) and international relations (Orsini et al., 2017; Kaltofen and Acuto, 2018; Lidskog and Sundqvist, 2015). The relationship between science and policy is also among the areas of interest of STS, both in terms of the role played by scientific knowledge in decision-making processes (Weingart, 1999), and in terms of policies that address science, technology and innovation (STI) as their specific object, here referred to in brief as «science policies» or «research policies» (Lundvall and Borrás, 2005; Hofmänner and Macamo, 2021).

Drawing on this research perspective, the chapter makes the case for a closer investigation of science policy, acknowledging its influence on the discourse and practice of science diplomacy. In so doing, it focuses on one of these potential directions of influence, arguing that the framings of science-society relations developed in the science policy discourse have affected how science diplomacy conceives and represents the connections between scientists, policymakers and other social actors. It is important to state that these frames and framings have been shifting over time; in order to explore these changes, the chapter reviews four different models – linear, demand pull, systemic and transformative – of science policy (Section 2) and investigates how science-society relations are framed (see Arnaldi 2020a, 2020b for a more extensive analysis of some of them). While these models are analytical constructs, and their features are imperfectly implemented in actual policy decisions, their framings of science and society relations – and of science policy's role in their rapport – have been crucially influential in legitimising specific constellations of policies and practices, which makes them useful to identify *the essential elements* of science policies.

After this review, the chapter explores the subject of whether and to what extent these essential elements can be found in science diplomacy discourse to confirm the influence of science policy models (Section 3). This exploration results in the identification and brief examination in this section of three of these «essential elements» that appear in both science policy and science diplomacy discourses. The first element is the depiction of science as a universalistic, dispassionate and impartial social institution and of scientists as bound to normative principles that privilege autonomy, cooperation and disinterest; the second is the coexistence of and sometimes conflict between a view that prioritises the production of new scientific knowledge per se and an alternate perspective that emphasises the social utility of applied knowledge and innovation as a driver of diplomatic actions; and the third is the sharing by science policy and science diplomacy of an inclusive view of STI and their advocacy for the inclusion of a wide variety of stakeholders (i.e. beyond the scientific community, industry and policymakers).

Finally, a brief concluding section (Section 4) discusses some of the implications of this analysis, both in terms of research themes and in terms of disciplinary perspectives that are useful for the study of science diplomacy.

2. Science policy from the linear model to systemic transitions

Sarewitz and Pielke (2007) define science policies as the set of processes and tools used to reconcile the meeting of demand and supply of scientific knowledge, articulating the relationship between the needs and the social aims to which science is called to respond, and the knowledge that can be used in those responses. It is certainly true, and the two authors are aware of this, that this clear distinction between the demand and supply of knowledge represents a simplification of the relationship between science and society, for at least two reasons. First, while scientists have, by definition, an essential place in producing scientific knowledge – determining its «supply» –, the scientific community is also involved in articulating the «demand» of science, because of the relative autonomy that scientists, individually or collectively, have to define the research questions to be answered (see Miller and Neff, 2013), and because of the important role they have in defining the problems they themselves help solve (Hoppe, 2005; Weingart, 1999). Second, thinking in terms of supply and demand overshadows the fact that the influence of science on society is often indirect and dispersed, far exceeding the intentional effects of specific research results (Latour, 1998; Nahuis and van Lente, 2008). Despite these clarifications, it is nonetheless undeniable that analytically, (1) we can distinguish between «people, institutions, and processes that have to do with the supply of scientific knowledge, and others that have to do with its use»; (2) it can be argued that science policy choices are based on the definition of hypothetical links between investment in a research activity and its expected results; and (3) we can recognize the existence of «feedback between the (perceived) demand for science and the (perceived) characteristics of its supply» (Sarewitz and Pielke, 2007: 6).

By following this simple but useful approach, we can try to distinguish different models of science policies, starting from how they frame the relations between science and society by reconciling, in different ways, the demand and supply of scientific knowledge. Drawing from existing literature, four distinct models are briefly described and examined: linear, demand pull, systemic, transformative. As already clarified in the introduction, it is important to underline that these alternative configurations of science policy are, in fact, models, so that their characteristics do not always find an exact empirical correspondence, nor have any of them known a generalized application during a particular period of time nor have been completely replaced by another. Nonetheless, it is indisputable that all of them have exercised, to varying degrees in different geopolitical contexts and in different historical periods, a considerable legitimizing influence on specific constellations of policies and practices in the domain of scientific research, technology and innovation (Flink and Kaldewey, 2018). Examining their features is therefore useful to identify the essential elements attributed to research policies, albeit in the face of imperfect implementation.

The best known model is probably the so called «linear model of science policies» (or, more frequently, «linear model of innovation») (Godin, 2006) that characterized the debate on science policies in the United States and, subsequently, in the other industrialized, market-economy countries, immediately after the Second World War. The linear model makes basic research a priority for public policies, since it is considered a source of new knowledge that can be used in applied research and technological development to produce economic and social benefits (Logar, 2011). According to this model, if these benefits are seen as certain, however, the ways in which scientific knowledge produces them are largely unpredictable. As a consequence, public policies are called upon to financially support the scientific community, ensuring ample freedom in the choice of research questions and guaranteeing decision-making autonomy in resource allocation, so that knowledge can be expanded in the most diverse and potentially fruitful directions. Academia has a key role in scientific research and universities are entrusted with the main responsibility in conducting basic research (Hessels, 2013).

In the 1960s, the linear model is challenged in both scientific and political terms (Brooks, 1996; Godin and Lane, 2013). The growing public visibility of problems such as industrial pollution fuels the critique of the model, which targets especially the assumedly unproblematic link between new knowledge and societal benefits. This criticism results in a request for a more accurate assessment of the impacts of scientific knowledge and technological development on society and the environment, as well as in the search for a closer connection between scientific research and technology, on the one hand, and social, political, and industrial needs, on the other. As a consequence of these shifts and unlike what happens in the linear model of innovation, the crucial element in science policies becomes the demand for socially relevant knowledge, instead of knowledge production per se. «The most critical element [...] is need-pull forces (opportunities pulling from peoples' needs and the market) rather than by supply-push forces (technological opportunities pushing forward from scientific discoveries)» (Godin, 2017: 9). For public policies, therefore, the support of socially relevant knowledge becomes a strategic priority, with the goal of maximizing the return on investment (Johnston, 1990). In defining what social relevance means and what research and development priorities are, the concept of social need ends up being translated into the much narrower concept of market demand. Therefore, the task of aggregating and selecting social expectations regarding new applications of scientific knowledge and innovative technologies is entrusted to market mechanisms and institutions (Godin and Lane, 2013).

The problem of efficiently linking knowledge (market) demand and supply, as well as of effectively maximizing the diffusion and application of relevant scientific knowledge, leads to a further shift towards a systemic and processual view of research and innovation (Smits and Kuhlmann, 2004). An important codification of this model is the concept of «national innovation systems». This notion came to maturity in the context of the Organization for Economic Cooperation and Development (OECD) in the 1990s (OECD - Organisation for Economic Cooperation and Development, 1997). According to Lundvall, one of the architects of OECD's innovation policies in that period, innovation systems are «constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge» (cited in Godin, 2009: 478). In the systemic model, the relations between the elements of the system become the target of public policies, which are oriented to building the necessary conditions (economic, social, and regulatory) to foster the effective collaboration of the actors in the system. The creation of intermediary structures to bridge the gaps between knowledge, skills, and needs of the system actors (science parks, industrial liaison offices, etc.) (Howells, 2006), as well as the creation of «protected» spaces and structures (incubators, fablabs, makers' space, acceleration programs, etc.) to favour the experimentation of new collaborations and new entrepreneurial ideas, become tools widely used for this purpose (Smits and Kuhlmann, 2004). In this systemic model of innovation, scientists find themselves in an almost opposite position to the one they had in the linear model of science policy: from being the dominant protagonists in the production of scientific knowledge, they become (just) one of the many actors in a system in which knowledge and its production are «socially distributed» (Gibbons et al., 1994). The general political-economic framework of this model is market-oriented and seeks to expand the role of the market as a regulatory mechanism of the economy and society. Once again, the market articulates the social demand for innovation and is «driven by the dynamics of economic globalization and the growth of international competition, especially in advanced technology sectors» (Ancarani, 1999).

Discontents with the economic and social consequences of market-driven globalization, the negative impact of economic growth on the environment and climate, and a series of crises undermining the public confidence in science and technology (for example, the Chernobyl nuclear disaster, the so called «mad cow disease», and controversies over genetically modified organisms in agriculture), however, challenge the close link between scientific knowledge, innovation, and the market. The conviction that research, technological development, and innovation must be normatively oriented toward achieving socially desirable objectives that are not formulated solely in market terms, found legitimacy in research, in public opinion, in the scientific community, and among decision-makers. A fourth model of science policy, which Schot and Steinmueller call «transformative», emerged from this belief. This new policy approach does not limit itself to introducing more or less radical innovations, but aims to initiate a real socio-technical system transition: «it is about radical change in all elements of the configuration», it is «about changing skills, infrastructures, industry structures, products, regulations, user preferences, and cultural predilections» (Schot and Steinmueller, 2018: 1562). The explicit normative orientation of this transition is a response to the perceived directionality failure of the previous models, their lack of «means for making social choices over alternative pathways of development» different from economic competitiveness. Participation of stakeholders is a key feature of this model, as «it involves multiple actors in negotiating alternative pathways that have the potential to achieve system change [and it] is only through the accumulation of experience by a variety of actors with different motivations and priorities that an acceptable pathway or pathways can be discovered and pursued» (Schot and Steinmueller, 2018: 1563). While, as in the previous cases, one cannot say that this approach to science policy is dominant or exclusive, there is no doubt that several important policy initiatives refer to this logic of systemic transition. For example, the Sustainable Development Goals (SDGs) of the United Nations (http://sdgs.un.org/goals) define a general framework for radical change towards greater sustainability. In that framework, the topic of STI is included in a specific goal (SDG#9, Industry, innovation and infrastructure), but, more importantly, it is also seen as a means to achieve most, if not all, of the SDGs (United Nations Industrial Development Organization and United Nations InterAgency Task Team on Science, Technology and Innovation for the SDGs, 2022). A second example is the notion of Responsible Research and Innovation (RRI), which was introduced in the EU research and innovation funding program for the 2014-2020 period to support the realignment of STI process and outcomes with social values, needs and expectations. This approach identified key areas (Ethics, Science Education, Gender Equality, Open Access, Governance and Public Engagement) to address in order to help solve the grand societal challenges for European societies in the 21st century (European Commission, 2012b). A third and last case in point regards again the EU context, where the 2021-2027 STI funding program has prominently embraced the notion of «mission-oriented policies», that are «systemic public policies that draw on frontier knowledge to attain specific goals» (Mazzucato, 2018: 8).

3. Science diplomacy and science policy: three convergent elements

After briefly presenting alternative policy models, this section of the chapter looks at their influence on science diplomacy. This analysis is meant to highlight how the framings of science-society relations developed in the science policy discourse have affected the ways in which science diplomacy conceives and represents the connections between scientists, policy makers and other social actors. Acknowledging that this is a partial and preliminary analysis, three elements of convergence between science policy and science diplomacy discourses stand out to suggest the possible existence of such a connection.

The first element concerns the representation of the scientific community. As Rungius and Flink (2020) noted, the narrative that science diplomacy would be capable of fostering international collaborations and of solving global challenges is deeply rooted in a view of science as a universalistic, disinterested, and impartial institution capable of bringing together (political) actors who would act otherwise out of self-interest. This view of science recurs frequently in the representations of science diplomacy made by practitioners, so much so as to become a sort of canon (Ruffini, 2020). The same perspective returns in various policy documents, which often refer to the «universality» of science and of its language (European Commission, 2016: 7; Royal Society and AAAS, 2010: vi). Such a universal nature of the scientific enterprise makes science a «common language and [a] common basis for relations and trust» (European Commission, 2016: 74), even between conflicting parties. This vision of the scientific community and of science reflects closely the views developed in the linear model of science policy: (1) science is an institution with a normative structure that differs from that of society as a whole (Merton, 1973); (2) it freely and selflessly pursues the knowledge of nature; (3) decisions about the use of of this knowledge is a responsibility of politics, which is the realm of particular values and partisan interests.

The second element of convergence regards the valuation of scientific knowledge. The description of science policy models has shown the transition from the centrality of pure research which is characteristic of the linear model, to the importance of producing socially relevant knowledge. This transition is accompanied with the increasing significance of technological innovation over fundamental research, the latter untethered from a defined application context and practical considerations. The expected benefits of knowledge and innovation have taken on different characteristics, either as economic returns in the demand pull or systemic models of science policy, or as broader socially desirable outcomes, such as sustainability and equity, in the transformative model. Again, these two framings of socially relevant knowledge can be found in the science diplomacy discourse, too. The focus on innovation that is typical, for instance, of innovation diplomacy (Leijten, 2017; Carayannis and Campbell, 2011), prioritizes the potential returns in terms of trade, investment, and technology over international scientific collaboration per se. In doing so, science diplomacy adopts an emphasis on competitiveness that is typical of the demand pull and systemic models of science policy. In a similar way, science diplomacy shares with the transformative model of science policy an often explicit normative orientation which is well described, for instance, by the notion of «challenge». As Flink and Kaldewey note, the concept of «grand challenges», «societal challenges» or «global challenges» does not fit with the classical distinction between pure and applied research as defined in the linear model. Rather «the concept is embedded in a discourse about the role and future mission of the scientific community. Most definitions conceive of grand challenges as long-term and large-scale research goals, determined by heterogeneous societal stakeholders. Thus, communicating grand challenges is a way to talk about the goals and ends of scientific research» (Flink and Kaldewey, 2018: 17). These challenges are part of a systemic transition narrative that: (1) depicts a looming crisis «that do not only affect a single nation state anymore but the entire mankind» (Rungius and Flink, 2020: 3); (2) advocates for a cooperative response on the international level; and (3) envisions a desirable final state of the normatively oriented transition realized by way of this cooperative response.

The third and final element concerns participation of stakeholders in science, technology and innovation processes. Inherently diverse because it concerns scientists *and* policy makers (Lord and Turekian, 2007; Langenhove, 2016), the circle of the social actors involved in science diplomacy is now significantly larger and goes beyond states and research organizations to include business and civil society (Chaban and Knodt, 2015; Pearlman et al., 2016). The enlargement of participation is consistent with the gradual inclusion of more numerous and more diverse stakeholders in STI that followed the succession of science policy models. Whereas in the linear model the scientific community, and academia in particular, played an outsized and unique role in knowledge production, the broadening of participation that accompanies the emergence of the systemic and transformative models makes policy, and STI in general, much more open to a variety of actors, so that the benefits of STI can be effectively delivered to society through collaboration.

4. Closing remarks

This work makes the case for examining the influence of science policy on the discourse and practice of science diplomacy. In so doing, it focuses on one of these potential directions of influence, arguing that science diplomacy draws on science policy discourse to i) outline the representation of the scientific community, ii) address the issue of stakeholder participation in policy design and implementation or iii) explain the tension between collaboration and competition in STI.

First, the science diplomacy view of science as a universalistic, autonomous, disinterested and impartial institution has its roots in the linear model of innovation and its framing of academic research as a self-regulating endeavour, free from external influence and obeying peculiar norms that set science apart from society. Second, in both science diplomacy and science policy, this view of science as a disinterested enterprise coexists and collides with an alternative one that prioritises the social relevance of scientific knowledge – where the social relevance is also differently understood. The representation of science diplomacy either as a tool for fostering economic competitiveness or for solving societal challenges rests upon this second perspective regarding the valuation of scientific knowledge, which ultimately results from the demise of the linear model of science policy. Third, both science diplomacy and science policy adopt an inclusive stance on the social actors that can (and must) be involved in STI. Just as science policy has gradually expanded the number and diversity of the stakeholders to be included in the deliberation and implementation of science-related decisions, so does science diplomacy acknowledge the utility of engaging and empowering stakeholders to leverage their resources and expertise for a greater impact of international collaborations.

Overall, this discussion indicates a potentially useful direction of study on the subject of science diplomacy, suggesting how our knowledge of this field can be improved by looking more closely at «science» in science diplomacy. In terms of disciplinary perspectives, this effort invites the collaboration of multiple disciplines, including STS. In terms of content, it suggests the need for a closer examination of STI policies in order to chart the similarities, convergences and genealogies that influence the discourse and practice of science diplomacy.