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## Science Diplomacy

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### Introduction

Science diplomacy emerged in the early years of the 21st century as a new vocabulary and a new concept in international relations, although the practice of science diplomacy has deep historical roots and various forms that were not labeled as such before. Science diplomacy refers to professional practices at the intersection of the world of science and that of diplomacy. It is also a subject of study that gives rise to a scholarly literature. Basically, the rationale of science diplomacy is twofold: advancing a country's national interest and addressing global challenges. Science diplomacy encompasses a great range of activities to promote and secure a state's foreign policy objectives and of activities to secure global public good at the transnational level, such as using scientific advice and expertise, enabling international scientific cooperation, bringing scientists on board of diplomatic negotiations, or appointing science attachés to embassies. International scientific cooperation is sometimes confused in the discourse with science diplomacy. However, if scientific cooperation is possible only with diplomatic assistance, serves a nation-state's foreign policy objectives, promotes national interests, or aims to address global issues, then it is science diplomacy. Otherwise, it is not. Science diplomacy is also closely related to a state's political system and beliefs because the effective use of science diplomacy contributes a great deal to a state's power and influence in world politics and in international relations, and it helps to generate soft power of attraction and cooperation. A few notable institutions are active in science diplomacy, promote international dialogue on global issues, disseminate practices, and take part in the debate of the science diplomacy concept. They include the Center for Science Diplomacy of the American Association for the Advancement of Science (AAAS), the International Network for Government Science Advice (INGSA), and the Science Diplomacy Center of Tufts University, and multilateral scientific organizations, such as the International Institute for Applied System Analysis, the International Science Council, and the Science Diplomacy Thematic Network at the University of the Arctic. National and international academies of sciences sometimes intervene in this debate. Professional literature on science diplomacy is abundant and academic literature is growing as well, which has not led, however, so far to the emergence of a genuine theory of science diplomacy. This article aims to guide readers in their comprehension of science diplomacy and of the related debates through a selection of sources that shed light on science diplomacy both in theory and in practice from various viewpoints.

### General Overviews and Concepts

A basic view of science diplomacy is to consider it as a particular variation of a country's diplomacy as a tool of its foreign policy. This true but partial view has been greatly enriched by the founding report Royal Society and American Association for the Advancement of Science 2010. This publication, which can be considered an official start for a new discipline, has enlarged the scope of the science diplomacy concept by pointing out the interactions between the world of science and that of diplomacy. The document helped to pave the way toward a better understanding of the role of nonstate actors, such as scientific epistemic communities, in engaging in, and even initiating, science diplomacy actions. Another debate has developed on the place that should be given to the pursuit of national interests in the driving of science diplomacy. Gluckman, et al. 2017 underlines that science diplomacy is about advancing both direct and indirect national interests and provides a taxonomy that articulates national

interests and the global interest. Since 2012, the Center for Science Diplomacy's quarterly publication *Science & Diplomacy* has been an up-to-date resource for articles devoted to the various practices of science diplomacy. A special issue of the open-access journal *Global Policy* (Kaltofen, et al. 2018) is devoted entirely to science diplomacy and analyzes science diplomacy from the perspective of international relations theory. Questions of power and knowledge are central to many of the articles of the issue. The continuous evolution of the concept of science diplomacy is reflected in the Madrid Declaration on Science Diplomacy, written by science diplomacy scholars and practitioners in the frame of S4D4C (Using Science for/in Diplomacy for Addressing Global Challenges), a Horizon 2020-funded project. A general overview of science diplomacy is proposed in the *SAGE Handbook of Diplomacy*, with a chapter, Copeland 2016, that develops conceptual, historical, and policy perspectives. An edited volume, Davis and Patman 2015, examines the ways in which politics, science, and diplomacy have become intertwined and also accesses the wider significance of this trend in the 21st century. Building on the wealth of examples drawn from history and contemporary international relations, Ruffini 2017 proposes an overall approach to science diplomacy and addresses the diversity of questions it raises conceptually. Krasnyak identifies a "national style" in science diplomacy and argues that acknowledging historical peculiarities in which national style in science and diplomacy was formed helps to understand and foresee a state's science diplomacy aspirations.

**Copeland, Daryl. "Science Diplomacy." In *The SAGE Handbook of Diplomacy*. Edited by Costas M. Constantinou, Pauline Kerr, and Paul Sharp, 628–641. London: SAGE, 2016.**

This chapter provides a conceptual and practical overview of science diplomacy with the focus on its capacity to address global issues. The author also emphasizes that, in comparison with less developed countries, rich and scientifically developed countries are at a significant advantage to use science diplomacy within a wider spectrum of activity to promote national interests.

**Davis, Lloyd S., and Robert G. Patman, eds. *Science Diplomacy: New Day or False Dawn?* World Scientific, 2015.**

This book acknowledges the emergence of science diplomacy in the international arena and discusses how far it represents a major break from the past. It explores its significance in considering a number of topics and case studies. It provides a critical assessment of science diplomacy by not only emphasizing its successes in initiating and managing large-scale international science projects but also pointing to the limitations of science diplomacy in addressing global challenges because of the attachment of states to their sovereignty.

**Gluckman, Peter D., Vaughan C. Turekian, Robin W. Grimes, and Teruo Kishi. "Science Diplomacy: A Pragmatic Perspective from the Inside." *Science & Diplomacy* 6.4 (2017): 1–13.**

The authors propose an alternative conceptual framing to the Royal Society-AAAS "traditional" taxonomy. The authors distinguish three new categories for science diplomacy: actions designed to directly advance a country's national needs; actions designed to address cross-border interests; and actions designed primarily to meet global needs and challenges. They show the utility of this new framing for foreign ministries and other agencies with international responsibilities.

**Kaltofen, Carolin, and Michele Acuto. "Rebalancing the Encounter between Science Diplomacy and International Relations Theory." *Global Policy* 9.S3 (2018): 15–22.**

Noting the scarcity of scholarly work on science diplomacy, this article deals with science diplomacy from the point of view of international relations theory. The authors provide new insights into the debate on the interactions between the sphere of science and that of diplomacy. They argue for a practice-based approach, grounded in the empirical analysis of micro-level interactions between both spheres.

**Kaltofen, Carolyn, Michele Acuto, and Jason Blackstock, eds. *Special Issue: Science Diplomacy. Global Policy 9.3 (2018)*.**

This special issue adds to the literature with fourteen articles by scholars and practitioners of science diplomacy. It brings together theoretical and practical perspectives of science diplomacy. Various case studies aim to point out a science diplomacy mechanism as a possible solution to address global challenges. In introducing this special issue, Kaltofen and Acuto identify science diplomacy as a “boundary problem” about which the views of practitioners and scholars cross-fertilize the ongoing debate.

**Krasnyak, Olga. *National Styles in Science, Diplomacy, and Science Diplomacy*. Leiden, The Netherlands: Brill, 2018.**

The monograph seeks to understand different “national styles” in science and diplomacy. The author argues that recognizing elements of national style in science diplomacy helps to identify a state’s geopolitical motivations, its diplomatic and strategic behavior toward other states, and its capacity to negotiate collaborative governance. She emphasizes that a state’s national style in science diplomacy also bears on its ability to address long-term global challenges.

**Madrid Declaration on Science Diplomacy. Madrid: S4D4C, 2019.**

The declaration provides a broad insight into science diplomacy practices at the intersection of science, technology, and foreign policy. The declaration proclaims a common vision for science diplomacy, outlines its benefits, sets out concrete principles to fostering science diplomacy worldwide, and emphasizes tackling global challenges on a systematic scale. The declaration has been signed on an individual basis by a number of specialists in science diplomacy as well as by practitioners and scholars.

**Royal Society and American Association for the Advancement of Science. *New Frontiers in Science Diplomacy*. London: Royal Society and American Association for the Advancement of Science, 2010.**

This influential report is at the origin of the wide dissemination of the expression *science diplomacy*. Its conceptual contribution is to consider science diplomacy as a set of interactive practices between scientific and diplomatic actors: science contributes to diplomacy (science for diplomacy, science in diplomacy) and diplomacy contributes to science (diplomacy for science). This taxonomy is often referred to as “traditional.”

**Ruffini, Pierre-Bruno. *Science and Diplomacy: A New Dimension of International Relations*. Berlin: Springer, 2017.**

The book raises a number of questions about the relationship between science and diplomacy, illustrates how the essence of both are contrasting: the universality, internationality, and neutrality of science, on one hand, and the particularities, bias, and national interests-based foreign policy on the other. It asserts that a state’s science diplomacy is implemented through the combined effect of three drivers: attraction, cooperation, and influence.

**Rungius, Charlotte, Tim Flink, and Alexander Degelsegger-Márquez. *State-of-the-Art Report: Summarizing Literature on Science Diplomacy Cases and Concepts. Deliverable 2.2*. Vienna: S4D4C, 2018.**

This report explores science diplomacy from an analytical point of view and proposes two orientations. It aims to reconstruct the concept by addressing science diplomacy as a discourse and discussing its semantic content and by considering science diplomacy as an empirical social phenomenon. The report provides a literature overview.

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## Science Diplomacy and National Interests

The practice of diplomacy is traditionally considered as an attribute of sovereign states. Although challenged by the growing involvement of nonstate actors in the diplomatic game, this state-centric perspective still holds. As part of a country's diplomacy, science diplomacy helps to promote and advance a state's foreign policy objectives, and it is utilized by the most advanced countries to exercise in power and influence. This encompasses the use of scientific knowledge in informing policymaking and diplomacy and the exploitation of scientific and technological advantages to secure power over other states. In the contemporary world, advanced countries do not overlook implementing competitive science diplomacy strategies. Numerous contributions reveal the variety of national strategies of science diplomacy. Chalecki 2008 argues that scientific advice was crucial in informing American diplomacy in three historical cases, and concludes that a close engagement among scientists, policymakers, and diplomats advanced American national interests. Krige 2006 evaluates the idea of how science and technology were instrumentalized and embedded into American foreign policy for the projection of American power in postwar continental Europe. Smith 2014 analyzes the approach taken by US science diplomacy in promoting American national interests in Indonesia. Flink and Schreiterer 2010 takes into account six major industrial states that use science diplomacy to gain political influence, promote their own interests, and obtain access to promising markets and the scientific and technological developments of other countries. Several additional writings describe national strategies in science diplomacy, including Lane 2013 on France, Schlegel 2014 on Switzerland, and Yakushiji 2009 on Japan. Articles in the journal *Science & Diplomacy* document national approaches of science diplomacy for other countries: Canada, New Zealand (Gluckman, et al. 2012), South Africa, and Spain. Science diplomacy's approach through the state interests raises the question of the possible instrumentalization of science and scientists for the benefit of foreign policy objectives, a topic that is addressed only marginally in the literature. Another debate concerns the possible tensions between national and global interests; indeed, more scholarship is needed on this subject. Finally, the central reference to the national interest is challenged when actions portrayed as science diplomacy are conducted by nonstate public entities, such as the European Union. A similar question arises for territories beyond any one country's jurisdiction, as the Arctic and the Antarctic where governance is clearly influenced by the interests of scientific communities over those of states. These last two debates will be addressed in more detail in a later section.

**Chalecki, Elizabeth L. "Knowledge in Sheep's Clothing: How Science Informs American Diplomacy." *Diplomacy & Statecraft* 19.1 (2008): 1–19.**

The article examines three historical cases of US science-driven foreign policy (the German-American pork war, the International Geophysical Year, and the Montreal Protocol) when American diplomacy benefited from taking advice from epistemic scientific communities and successfully implemented scientific advice into foreign policymaking.

**Flink, Tim, and Ulrich Schreiterer. "Science Diplomacy at the Intersection of S&T Policies and Foreign Affairs: Toward a Typology of National Approaches." *Science and Public Policy* 37.9 (2010): 665–677.**

An outstanding characterization of the science diplomacy engagement of six major international players and competitors—France, Germany, Japan, Switzerland, the United Kingdom, and the United States—through their approaches in pursuing national interests and in pushing business opportunities while engaging in science diplomacy. The article stands out from the dominant discourse by clearly explaining the possible tensions between cooperation and competition in the practice of science diplomacy.

**Gluckman, Peter D., Stephen L. Goldson, and Alan S. Beedle. "How a Small Country Can Use Science Diplomacy: A View from New Zealand." *Science & Diplomacy* 1.2 (2012): 1–7.**

Science diplomacy is a tool used to advance foreign policy goals of small developed countries. New Zealand acknowledges that a small developed nation can play a disproportionately valuable role in international scientific affairs, provided it carefully chooses its tools for promoting international scientific cooperation or addressing global challenges. The article shows that the science diplomacy of New Zealand is focused primarily on issue areas of nuclear policy and greenhouse gases.

**Krige, John. *American Hegemony and the Postwar Reconstruction of Science in Europe*. Cambridge, MA: MIT Press, 2006.**

The book provides a detailed analysis of American foreign policy with respect to science and technology. More specifically, the author shows how the United States sought to use its scientific leadership to achieve political goals on the European continent in the period after World War II. American scientific and technological powers were utilized to strengthen US-European ties in science and as part of efforts to contain communism. A few empirical cases support the main argument.

**Lane, Philippe. *French Scientific and Cultural Diplomacy*. Liverpool, UK: Liverpool University Press, 2013.**

The book, written by a scholar and former cultural attaché, emphasizes the importance of the diplomacy of influence. Lane utilizes the example of France and shows that French diplomacy of influence is based on the close link maintained between the country's advanced scientific development and ambitious foreign policy. Science diplomacy is predicated on an ability to exercise French influence through the spheres of education and culture.

**Lyons, Elizabeth E., William Colglazier, Caroline S. Wagner, et al. "How Collaborating in International Science Helps America." *Science & Diplomacy* 5.2 (2016): 1–14.**

This article's title perfectly summarizes how critical it is for the United States to advance its national interests. It provides a comprehensive framework describing the benefits that cooperation in science, technology, and innovation brings to America in seven sectors: science, economy, health, diplomacy and development, national security, education, and society. Considering the decentralized organization of science in the United States, the framework can serve as a starting point for subnational actors to identify the benefits of international cooperation at their operational scales.

**Schlegel, Flavia. "Swiss Science Diplomacy: Harnessing the Inventiveness and Excellence of the Private and Public Sectors." *Science & Diplomacy* 3.1 (2014): 1–11.**

As a small and advanced country that needs to compete with other countries of similar or larger caliber, Switzerland has to find the most effective ways to promote its foreign policy agenda. The Swissnex science diplomacy network with established hubs in the United States, China, India, and Brazil aims to promote cooperation in science, technology, and innovation, although avoiding formal political activities in keeping with the necessity of maintaining Switzerland's policy of neutrality.

**Smith, Frank L., III. "Advancing Science Diplomacy: Indonesia and the US Naval Medical Research Unit." *Social Studies of Science* 44.6 (2014): 825–847.**

The US Naval Medical Research Unit 2 (NAMRU-2) in Indonesia is perceived as a tool of statecraft to advance American interests in Indonesia. The author, one among few who critically examine science diplomacy, argues that strategic communication and science and technology exchange might lead to both positive and negative consequences while utilizing science diplomacy in foreign affairs.

**Yakushiji, Taizo. "The Potential of Science and Technology Diplomacy." *Asia-Pacific Review* 16.1 (2009): 1–7.**

Yakushiji notes that science and technology diplomacy must be incorporated into Japan's government policy and that it is Japan that first set out this concept. Therefore, the author suggests, Japan's diplomatic policy in science and technology should be promoted in different countries. Doing so will advance Japanese soft power and will help the country to secure its position as an international leader in this field.

## Addressing Global Challenges in the Era of Science Diplomacy

Addressing global challenges is part of the very essence of science diplomacy. Not every aspect of each global problem has yet been recognized internationally, but it is clearly understood that that only by joint efforts of both scientifically advanced countries and emerging scientific powers will it be possible to address global issues in utilizing science diplomacy as the mechanism to do so. During the Cold War amid the competition between the two superpowers, a predetermined shared responsibility for global issues enabled great and lesser powers to agree on joint efforts for global governance initiatives. A number of international treaties and agreements, including the Antarctic Treaty and the Non-Proliferation Treaty, were signed and maintained under collective supervision. In the contemporary world the toolbox available to science diplomacy is extended beyond bilateral relations (see, for instance, Pigman 2004, which evaluates the change in US-Russia relations in aerospace diplomacy) and often includes multilateral relations and negotiations to address global challenges on a systematic scale (Benedick 1998 treats international efforts to protect the ozone layer), challenges that include climate change and international inequality, health and food security, the risk of great power conflict and nuclear threats, among others. While some advances in science have helped in creating these problems, others are available to help to find solutions. Science diplomacy structural mechanisms and collective efforts of state and nonstate actors are in place to address the global challenges that humanity faces. It is traditionally in the interest of nation-states to pursue their own national interests without the obligation to think of the global good. However, a common view that science is universal, inclusive, and interdisciplinary—all of which greatly contribute to decision-making on a global scale—serves as a solid platform to initiate international knowledge-based discussions and to push a science diplomacy agenda. Copeland 2017 identifies a group of interrelated obstacles in the way of a science diplomacy agenda and explains that these impediments stem from the complexity of and instability in world politics. Van Langenhove and Boers 2018 conceptualizes science diplomacy as a tool for international cooperation and building trust between states. More specifically, Patman and Davis 2017 evaluates the potential of science diplomacy to address environmental issues. Ruffini 2018 does so for climate change and Elbe and Buckland-Merrett 2017 for health. Legrand and Stone 2018 focuses on the trans-governmental angle of science diplomacy. Payette 2012 looks at the International Space Station as an example of effective multilateral scientific and diplomatic collaboration.

**Benedick, Richard Elliot, ed. *Ozone Diplomacy: New Directions in Safeguarding the Planet*. Cambridge, MA: Harvard University Press, 1998.**

In light of a number of manmade environmental disasters, the author analyzes the series of international agreements aiming to protect the ozone layer. The author, the chief US negotiator of the ozone agreements, focuses on the Montreal Protocol and agreements addressing ozone depletion. He details the challenges faced during the behind-the-scenes diplomatic negotiations and highlights the possibilities for further action as well as warning of further difficulties.

**Copeland, Daryl. *It Won't Come Easy: Seven Obstacles to a Science Diplomacy Renaissance*. Ottawa, ON: Canadian Global Affairs Institute, 2017.**

In pursuing the diplomacy of cooperation to address global challenges on the systematic level, science diplomacy itself is, at times, marginalized and obscured, and it faces a number of obstacles. Copeland identifies these obstacles and promotes the belief that knowledge-based and technologically enabled science diplomacy is crucial in addressing global issues.

**Elbe, Stefan, and Gemma Buckland-Merrett. "Data, Disease and Diplomacy: GISAID's Innovative Contribution to Global Health." *Global Challenges* 1.1 (2017): 33–46.**

The spread of lethal infectious diseases is one of the global challenges the world faces. To combat the threat, national governments must collaborate in information sharing, action coordination, and conflict resolution. The article takes into account the Global Initiative on Sharing All Influenza Data (GISAID) and urges that fostering the initiative has major implications for global health in reducing the risk of spreading diseases.

**Legrand, Timothy, and Diane Stone. "Science Diplomacy and Transnational Governance Impact." *British Politics* 13.3 (2018): 392–408.**

The potential of science diplomacy from the perspective of trans-governmental diplomacy is examined in this article. The authors provide well-argued reasons in acknowledging the numerous intergovernmental organizations and informal international associations that make use of scientific evidence in formulating their missions and setting up agendas and of the potential that science diplomacy hold in policymaking, politics, and the administration.

**Patman, Robert G., and Lloyd S. Davis. "Science Diplomacy in the Indo-Pacific Region: A Mixed but Promising Experience." *Politics & Policy* 45.5 (2017): 862–878.**

The authors investigate evolving relations between science and diplomacy in the Indo-Pacific region specifically with respect to environmental issues such as global warming and the protection of the Ross Sea in Antarctica. The authors argue that the full potential of science diplomacy is yet to be realized and fully implemented.

**Payette, Julie. "Research and Diplomacy 350 Kilometers above the Earth: Lessons from the International Space Station." *Science & Diplomacy* 1.4 (2012): 1–8.**

The author's perspective here is to note that the International Space Station is the consequence of a foreign policy decision and serves as a tool of effective international communication and collaboration. This tool must be projected onto global challenges that require multilateral solutions.

**Pigman, Geoffrey Allen. "The New Aerospace Diplomacy: Reconstructing Post-Cold War US-Russian Economic Relations." *Diplomacy & Statecraft* 15.4 (2004): 683–723.**

The article argues that US-Russia aerospace diplomacy, i.e. science diplomacy, carried out in the 1990s was a relative success benefiting US aerospace firms, yet preserving the cultural and scientific prestige of Russian leadership in space science. High-level bilateral diplomacy helped to promote the transition from defense-based to commercial cooperation between the two countries.

**Ruffini, Pierre-Bruno. "The Intergovernmental Panel on Climate Change and the Science-Diplomacy Nexus." *Global Policy* 9.S3 (2018): 73–77.**

The article argues that the model of the science-diplomacy nexus and its "hybridization" interactive process could serve as a framework to address climate change at the multilateral level. However, such a model cannot entirely ensure its effectiveness due to existing limitations and constraints posed by international treaties, and the tendency of nation-states to follow their own national interests, thus explaining why scientific consensus on climate change does not translate into a diplomatic consensus over an appropriate course of action.

**van Langenhove, Luk, and Elke Boers. *Science Diplomacy in Search of a Purpose in the Populist Era. EL-CSID Policy Brief 2018/4. Brussels: Institute for European Studies, 2018.***

Science diplomacy can serve to encourage scientists to cooperate internationally in the interests of sustaining peace, solving or mitigating international conflicts, and addressing global challenges. However, this policy brief points out possible weakness and threats if science diplomacy is understood or interpreted poorly. The authors provide policy recommendations for a more effective use of science diplomacy in foreign affairs.

## International Scientific Cooperation and International Affairs

This section highlights some of the major contributions that, without using the label of “science diplomacy,” offer insightful analyses of the interrelationships between science and technology and foreign policies and international affairs. These contributions make it possible to relativize the novelty of today’s interrogations on science diplomacy, and allow for linking it to an already identified epistemological field. The literature devoted to understanding the role of science and technology in international relations and international relations (IR) theory also sheds light on the theoretical debate on the concept of science diplomacy, the field of science and technology linked to international relations. Krige and Barth 2006 and Oreskes and Krige 2014 provide overviews on international affairs and science and technology studies and emphasize the role played by scientists in the Cold War. Skolnikoff 1993 analyzes the evolution in international affairs driven by scientific and technological progress. Weiss 2005 goes further and identifies the diversity of mutual impacts of science and technology and international affairs. Rosenau and Singh 2002 focuses specifically on informational technology and its convertibility into power and governance—basic foundations for science diplomacy’s agenda. Mayer, et al. 2014 provides an overview on the variety of established approaches in the field of science and technology in international relations and establishes techno-politics as a new conceptual approach in treating the relationship between science and technology and international politics in its own right. Wagner 2002 argues that when working internationally, scientists can build relationships across political borders in developing trust and allying with non-traditional partners while pushing a foreign policy agenda. Balakrishnan 2017 argues that scientists, diplomats, and policymakers should join forces in jointly responding to global challenges.

**Balakrishnan, Bhaskar. *Technology and International Relations: Challenges for the 21st Century*. New Delhi: Vij Books India, 2017.**

From a diplomat’s perspective, the book documents the impact of technologies on international relations in many science- and technology-related sectors, such as nuclear proliferation, climate change, and the oceans and outer space. It underlines areas where more efforts in joining forces by scientists, diplomats, and foreign policymakers are required.

**Krige, John, and Kai Henrik Barth. “Introduction: Science, Technology, and International Affairs.” *Osiris* 21.1 (2006): 1–21.**

This article gives an overview for science diplomacy scholars who wish to examine the history of science and technology and policy-related studies. The article summarizes the concepts and major themes of science and technology used as an instrument of state power over the last fifty years. Empirical cases of four major sites—the nuclear, the postcolonial, patronage, and globalization—illustrate the evolution of international affairs in historical and contemporary perspective.

**Mayer, Maximilian, Mariana Carpes, and Ruth Knoblich, eds. *The Global Politics of Science and Technology*. 2 vols. New York: Springer, 2014.**

Volume 1, *Concepts from International Relations and Other Disciplines*, presents established theoretical approaches of science and technology in IR. Volume 2, *Perspectives, Cases and Methods*, conceptualizes the relationship of science and technology in IR in a novel way. It presents two forms of techno-politics: international techno-politics and co-productionist techno-politics. Techno-politics occupies a conceptual space between the conventional two views on science and technology in IR: techno-determinism and constructivism.

**Oreskes, Naomi, and John Krige, eds. *Science and Technology in the Global Cold War*. Cambridge, MA: MIT Press, 2014.**

An overview of the history of science and technology in the Cold War with a focus on scientists and engineers and the role they played in the competition between the two great powers. The volume emphasizes how scientists negotiated their position and adjusted their relations with their respective governments and how their work was intrinsically tied to the political agendas pursued



by their countries, including in the international arena.

**Rosenau, James N., and J. P. Singh, eds. *Information Technologies and Global Politics: The Changing Scope of Power and Governance*. Albany: State University of New York Press, 2002.**

This edited volume is devoted to examining the impact of informational technologies on global politics through the lens of the changing scope of power and governance. A concluding essay written by James N. Rosenau will be of an interest for science diplomacy researchers. The essay unfolds an idea of the convertibility of information into knowledge and then into power. Thus, information and technology can be assessed as an instrument of power to pursue a state's national interests.

**Skolnikoff, Eugene B. *The Elusive Transformation: Science, Technology, and the Evolution of International Politics*. Princeton, NJ: Princeton University Press, 1993.**

This book is an early ground-setting volume in providing a comprehensive analysis of the relationship between international affairs and science and technology. The author identifies the nature and the driving forces of scientific and technological progress and analyzes the impact of this progress on international affairs in the spheres of national security, politics and economy, and global challenges. While providing conclusions and generalizations, Skolnikoff notes that the structure of the international system is constantly evolving.

**Wagner, Caroline S. "The Elusive Partnership: Science and Foreign Policy." *Science and Public Policy* 29.6 (2002): 409–417.**

Built on Skolnikoff 1993 in analyzing the intersection between science and technology and international affairs while highlighting the partnership that exists between two distinct communities, namely, the community of science and the community of foreign policy, Wagner advocates that these communities need to work in a tight partnership so as to deepen international scientific collaboration and advance foreign policy.

**Weiss, Charles. "Science, Technology and International Relations." *Technology in Society* 27.3 (2005): 295–313.**

In this article, Weiss claims that throughout recent history, science and technology have exerted a fundamental and pervasive influence on international affairs. In turn, the author argues that science and technology are heavily influenced by international relations. The author affirms that those mutual influences have implications for policy formation, diplomacy, intelligence gathering, propaganda, and crisis management. The author proposes creating a framework and a system of classification of the mutual influences of science, technology, and international relations.

**Weiss, Charles. "How Do Science and Technology Affect International Affairs?" *Minerva* 53.4 (2015): 411–430.**

The author identifies six patterns of interaction in which international affairs are influenced by a state's advanced technological capabilities. Pattern number 5, which can be related to science diplomacy, identifies science and technology as a foreign policy instrument to maintain bilateral relations and contribute to international order. The author uses "science diplomacy" terminology and notes historical examples of when scientific communication, competition, and cooperation were used as instruments of foreign policy.

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## Science and Technology Collaboration and Competition in the Cold War

The way in which scientific advancements and world politics affect each other has drawn the interest of historians and of many scholars in international relations and science and technology. Keeping in mind that care must be taken when applying retrospectively the term *science diplomacy*, historical practices of utilizing scientific knowledge for diplomatic purposes to achieve foreign policy goals can be recognized specifically in the Cold War period. Even though competition was the overriding condition, collaboration between the two superpowers became essential due to the full acknowledgment of the deadly consequences of the nuclear revolution and in light of the arms and the space race. Thus, despite the highly competitive environment of the Cold War, science diplomacy mechanisms enabled scientific and technical exchanges that benefited the United States and the USSR and had positive long-lasting effects for the rest of the world. Several works investigate various aspects of science diplomacy. Zubok and Pleshakov 1996 unfolds the specifics of “atomic diplomacy.” Ezel and Ezel 2010 and Krasnyak 2018 study the Apollo-Soyuz Test Project (ASTP) as a successful example of collaboration between the two countries during the period of *détente*. Several years of preparations and the symmetrical scientific exchanges involved allowed the project to succeed, and the ASTP became the prototype of the International Space Station. Diplomacy surrounding vaccines was another joint project between the Americans and the Soviets. Manela 2010 provides an extensive overview and a detailed analysis of joint efforts to advance disease control and smallpox global eradication. Hotez 2017 examines the vaccine science diplomacy that resulted in smallpox eradication and polio elimination in Third World countries. Schweitzer 1989 suggests a techno-diplomacy mechanism that would enable the effective cooperation between the two superpowers to eliminate any possibility of nuclear or conventional war. On the other hand, the competitive environment of the Cold War put science diplomacy in the front line to serve foreign policy goals. Wolfe 2018 examines the role of people-to-people scientific and technical exchanges during the Cold War. These exchanges were essential not only in promoting collaboration and identifying the peaceful intentions of both countries, but also in serving the purposes of psychological warfare because scientists could not be completely separated from politics and the competition between the great powers. An example of direct communication between scientists—Track II diplomacy—can be accessed in exploring the history of the Pugwash Conferences on Science and World Affairs (see online) to which a portion of Wolfe 2018 is devoted.

**Ezel, Edward Clinton, and Linda Newman Ezel. *The Partnership: A History of the Apollo-Soyuz Test Project*. Mineola, NY: Dover, 2010.**

Originally published in 1978. Written by professional historians, the book retells the history of NASA's programs and is based on an analysis of a large number of official documents and various documentary resources as well as interviews conducted with scientists, engineers, and astronauts. The narrative of the book and materials enrich the history of the Apollo-Soyuz Test Project, a historic venture in manned spaceflight.

**Hotez, Peter J. “Russian–United States Vaccine Science Diplomacy: Preserving the Legacy.” *PLoS Neglected Tropical Diseases* 11.5 (2017): e0005320.**

The article argues that successful collaborative effort by the United States and the USSR during the Cold War in promoting use of vaccines in Third World countries should serve a guide in improving bilateral relations and fostering scientific collaboration between the two countries today.

**Krasnyak, Olga. “The Apollo-Soyuz Test Project: Construction of an Ideal Type of Science Diplomacy.” *The Hague Journal of Diplomacy* 13.4 (2018): 410–431.**

Reinforcing bilateral relations with each other, both adversarial powers undertook at least a decade-long project of space science diplomacy. Drawing on the narrative of the Apollo-Soyuz Test Project, the author analyzes, contrasts, and compares it with the Weberian ideal type designed to understand the significance, meaning, and sometimes the causes and consequences of this collaboration.

**Manela, Erez. “A Pox on Your Narrative: Writing Disease Control into Cold War History.” *Diplomatic History* 34.2 (2010):**

**299–323.**

An important narrative of the first US-USSR joint efforts in smallpox eradication. The superpower collaboration is examined through diplomatic relations with regard to the Third World. The article provides a deeper understanding of the role of international organizations and networks in such collaboration and, overall, in the history of Cold War development in their wider political, ideological, and cultural contexts.

**Needell, Allan A. *Science, Cold War and the American State: Lloyd V. Berkner and the Balance of Professional Ideals*. Amsterdam: Harwood Academic, 2000.**

One of the key insights of Needell's book is that science during the Cold War bolstered scientific research and simultaneously advanced foreign policy. Scientific advancement coexisted with multiple goals of American foreign policy, served as a source of scientific and technical intelligence, and was used in political warfare.

**Schweitzer, Glenn E. *Techno-diplomacy: US-Soviet Confrontations in Science and Technology*. New York: Plenum, 1989.**

Written just before the collapse of the Soviet Union, the book promotes the idea of extensive cooperation between the two superpowers. Acknowledging the weakness of the Soviet economy but the strength of its military and nuclear arsenal, the author suggests that cooperation should be based on science and technology. To achieve this objective, Schweitzer proposes a techno-diplomatic approach, which would allow the two superpowers to move away from confrontation while eliminating the risk of war.

**Suttmeier, Richard P. "From Cold War Science Diplomacy to Partnering in a Networked World: 30 years of Sino-US Relations in Science and Technology." *Journal of Science and Technology Policy in China* 1.1 (2010): 18–28.**

The article provides an overview of Sino-American cooperation in science and technology since the 1970s. This cooperation aimed to counter the USSR and included partnership in the areas of agriculture, energy, medicine and public health, industry, and other fields. The author argues that Sino-US relations should be considered as science diplomacy because both scientific and political values were at play.

**Wolfe, Audra J. *Freedom's Laboratory: The Cold War Struggle for the Soul of Science*. Baltimore: Johns Hopkins University Press, 2018.**

Drawing on a large number of archival documents of the Cold War, the author provides a detailed narrative and analysis of the role of scientists in assessing and promoting scientific freedom. The author argues that American scientists, integrally involved in the American public and cultural diplomacy campaign, could not be entirely free from political beliefs and state propaganda.

**Zubok, Vladislav, and Constantine Pleshakov. *Inside the Kremlin's Cold War: From Stalin to Khrushchev*. Cambridge, MA: Harvard University Press, 1996.**

Based on declassified documents from Russian archives, the book assesses "atomic diplomacy" in US-Soviet relations. According to the authors, triggered by news of the atomic bomb dropped on Hiroshima and concerned about maintaining its place in the post-1945 world architecture, the Soviet Union embarked on its own massive program of developing a nuclear industry. At the same time, Soviet diplomatic efforts were directed at negotiating with the United States on nuclear issues. These efforts were unsuccessful during the Stalinist era because the United States adopted a doctrine of containment toward the Soviet Union.

## Manifestations of Science Diplomacy in the Contemporary World

Science diplomacy is currently a global trend manifested with respect to both specific parts of the world, such as the polar regions and the European Union (EU), and to specific challenges, such as climate change, that can be resolved only on a global basis. These particular approaches might not reflect the definition of science diplomacy as centered on the nation-state, yet they make up the research agenda and are reflected in practical implementations of the community of scholars and practitioners of science diplomacy. Pincus and Ali 2015 suggests a planetary vision of diplomacy of polar regions putting it into the framework of global development. Berkman, et al. 2011 is devoted to the particular geopolitical order prevailing in Antarctica and governed by the Antarctic Treaty whose origin, administration, and development are intimately associated with the conduct of science. Goodsite, et al. 2015 looks at science diplomacy mechanisms with their linkage to the Arctic in post-Cold War geopolitics and international law, and acknowledges the turn toward multipolarity. Buchanan 2016 warns that Russia's assertive foreign policy might shake cooperation among the five Arctic powers. However, Burke 2019 explores the continuation of cooperation among the club of Arctic states despite political turmoil. The EU affirms its interest in science diplomacy to which it has devised strategy and dedicated a set of tools. The EU implements science diplomacy as a part of its diplomatic practices to promote and secure its global interests. The European research policy is a major asset of its international influence through science: Horizon 2020 is the world's largest transnational program for research and innovation and is open to participation by countries outside the EU (see online). Several research programs are specifically implemented to foster the potential of science diplomacy for EU policies. An important debate centers on use of science diplomacy at the level of the member states and that of the EU. Van Langenhove 2017 assesses the competence of the EU, identifies science diplomacy strategic tools, and provides a few empirical examples. Proud 2018 goes into details in evaluating the Horizon 2020 project and cautions that promoting EU diplomatic, scientific, and political interests might fail to more fully activate science diplomacy within the science community. Lopes de San Roman and Schunz 2018 argues that science diplomacy is embedded in the core of EU external activities. Ruffin and Schreiterer 2018 and Penca 2018 attempt to clarify science diplomacy as it appears in EU official documents.

**Berkman, Paul Arthur, Michael A. Lang, David W. H. Walton, and Oran Young, eds. *Science Diplomacy: Antarctica, Science and Governance of International Spaces*. Washington, DC: Smithsonian Institution Scholarly Press, 2011.**

This edited volume brings together scholars and practitioners in exploring the Antarctic Treaty System and its relevance to global governance. The book is centered on science-policy interactions and includes numerous review and summary articles on diplomacy, international law, and governance of the Antarctic. It concludes with lesson in science diplomacy for future governance of the Antarctic and other international areas outside the jurisdiction of national sovereignties.

**Buchanan, Elizabeth. "Arctic Thaw: Arctic Cooperation and Russian Rapprochement." *Foreign Affairs* 95.1 (2016).**

The article explores Russia's strategy toward the Arctic. Buchanan argues that despite Russia's assertive foreign policy, its Arctic strategy is a rational and pragmatic one, and Russia will continue to cooperate with the West to sustain common goals in the region. Available online by subscription.

**Burke, Danita Catherine. *Diplomacy and the Arctic Council*. Montreal: McGill-Queen's University Press, 2019.**

This book argues that despite political hurdles on the international stage, the Arctic Council club members seek to successfully collaborate with each other. Identifying Russia's controversial image and presumably assertive foreign policy, the author concludes that these issues did not impact Russia's role in Arctic cooperation, which proceeds without interruption.

**Goodsite, Michael Evan, Rasmus Gjedssø Bertelsen, Sandra Cassotta Pertoldi-Bianchi, Jingzheng Ren, Lize-Marie van der Watt, and Halldor Johannsson. "The Role of Science Diplomacy: A Historical Development and International Legal**

**Framework of Arctic Research Stations under Conditions of Climate Change, Post–Cold War Geopolitics and Globalization/Power Transition.” *Journal of Environmental Studies and Sciences* 6.4 (2015): 645–661.**

The article looks at the specifics and the functionality of research stations in the Arctic. The authors emphasize that apart from purely scientific purposes, Arctic research stations have played a diplomatic role as intermediaries between countries of the Arctic Council and other countries. The role of science diplomacy is assessed through environmental concerns, geopolitics, and international law.

**Lopes de San Roman, Alea, and Simon Schunz. “Understanding European Union Science Diplomacy.” *Journal of Common Market Studies* 56.2 (2018): 247–266.**

The article looks at the ways in which the EU expands the scope of its external activities in the area of science diplomacy. The authors argue that the EU is in the process of reinforcing its influence in two dimensions, one of normative power (NPE) and one of market power (MPE), to promote existing EU norms, practices, policies, and regulations globally.

**Penca, Jerneja. “The Rhetoric of ‘Science Diplomacy’: Innovation for the EU’s Scientific Cooperation?.” *EL-CSID Working Paper 16*. Brussels: Institute for European Studies, 2018.**

Science diplomacy faces a problem in understanding its concepts and separating it from the rhetoric. The author examines the EU’s foreign policy documents and other relevant sources in order to identify both the meanings and the purposes of the EU science diplomacy.

**Pincus, Rebecca H., and Saleem H. Ali, eds. *Diplomacy on Ice: Energy and the Environment in the Arctic and Antarctic*. New Haven, CT: Yale University Press 2015.**

The edited volume provides an account of international law and diplomacy in the polar regions. The authors emphasize that dramatic planetary changes happening in the Arctic and Antarctic pose new challenges and opportunities for humanity and require adaptive governance mechanisms. Science diplomacy is not directly evaluated in this volume but the notion of science diplomacy and its mechanisms and implementations can undoubtedly be perceived.

**Proud, Virginia. “The Hunt for Science Diplomacy: Practice and Perceptions in the Horizon 2020 Scientific Community.” *EL-CSID Working Paper 18*. Brussels: Institute for European Studies, 2018.**

This paper argues that in achieving the EU’s diplomatic objectives, the potential of the scientific community is not overlooked. A deeper engagement with the scientific community is beneficial for the societal and scientific impact of projects. However, the author cautions that using the scientific community as a diplomatic tool puts at a risk the credibility of science and of scientists as unbiased experts.

**Rüffin, Nicolas, and Ulrich Schreiterer. “Case Study Science and Technology Agreements in the Toolbox of Science Diplomacy: Effective Instruments or Insignificant Add-ons?.” *EL-CSID Working Paper 6*. Brussels: Institute for European Studies, 2018.**

The study is devoted to a quantitative analysis of science and technology agreements that were signed by the EU and six countries (France, Germany, Switzerland, the United Kingdom, the United States, and Denmark). The authors evaluate the role science and technology agreements might play in the science diplomacy toolbox.

**van Langenhove, Luk. "Tools for an EU Science Diplomacy." Luxembourg: Publications Office of the European Union, 2017.**

This is one of the core publications by Luk van Langenhove on EU science diplomacy. The report distinguishes strategies, operations, and support tools in various—explicit and implicit—science diplomacy practices. These tools often result from deliberate governmental policies and aim to promote and support science diplomacy in connection with foreign affairs policies. The report provides science diplomacy empirical cases of Germany, Spain, France, Switzerland, the United Kingdom, the United States, and Japan.

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## Scientists, Diplomats, and Science Diplomacy

The Royal Society-AAAS seminal report of 2010 states, in noting with a touch humor: “scientists and diplomats are not obvious bedfellows.” Stemming from their culture, interests, and missions, scientists and diplomats belong to very different worlds. Yet, science diplomacy in its practices can exist only because individuals from each of these two worlds come together to engage in dialogue in efforts to understand each other and put their skills collaboratively to achieve specific goals. Particular categories of actors emerge, those of “science diplomats” and other professionals working at the intersection of science and foreign policy. They are individuals with academic and research backgrounds who employ their expertise and serve in advisory functions with foreign policy decisionmakers (chief scientists at the ministry of foreign affairs) or in diplomatic functions in cooperating with embassies (science attachés). Works on the background and activities of science attachés include Berg 2010 and Degelsegger-Márquez, et al. 2019; and on the interrelations and forms of dialogue between scientists and diplomats in Leshner 2014, Fähnrich 2017, and Moomaw 2018. Other contributions come from acting or past science advisers to governments—actors who have proved influential in the debate on science diplomacy. Gluckman 2016 and Turekian and Kishi 2017 analyze the role of science and technology advisers to ministries of foreign affairs, and they advocate for better consideration of scientific method and evidence in policy formation. The interplay of politicians and scientific experts in the political relations among states is discussed in Bouneau and Burigana 2018. With its focus on scientists and diplomats, the literature often omits to mention and acknowledge an expanding community of science diplomacy researchers and academics who contribute significantly to the knowledge of science diplomacy.

**Berg, Lutz-Peter. "Science Diplomacy Networks." *Politorbis* 49.2 (2010): 69–74.**

The author identifies science diplomacy networks. The networks consist largely of recruited professionals—experts and career diplomats—whose official capacity and activities aim to facilitate mutual awareness of research activities, support international scientific exchanges, and promote constructive bilateral relations when those are strained or limited.

**Bouneau, Christine, and David Burigana, eds. *Experts and Expertise in Science and Technology in Europe since the 1960s: Organized Civil Society, Democracy and Political Decision*. Brussels: PIE-Peter Lang, 2018.**

Contributors analyze the interplay of politicians and experts in the political relations among states since the 1960s, based on a guideline question: do the politicians actually take decisions or rather do the experts do it in their place? It argues that expertise provides the basis for mediation among the states, and that degree to which the spheres of decision making and expertise are able to interact is a key factor for the international accountability of a country.

**Degelsegger-Márquez, Alexander, Tim Flink, and Charlotte Rungius. *What It Takes to Do Science Diplomacy: Practices, Identities, Needs and Challenges of Science Diplomacy Practitioners; Baseline Analysis and Needs Assessment. Deliverable 2.3*. Vienna: S4D4C, 2019.**

Based on quantitative data—an open online survey, desk research, and interviews—this report brings the results and analytical

insights into the community of professionals who work at the interface of science and foreign affairs. The results are used to identify the needs and further the development of EU science diplomacy initiatives and implementations.

**Fährnich, Birte. "Science Diplomacy: Investigating the Perspective of Scholars on Politics—Science Collaboration in International Affairs." *Public Understanding of Science* 26.6 (2017): 688–703.**

The article focuses on collaboration of scholars and government officials in science diplomacy. The case study of Germany shows that scholars, using their political outreach and connections, can extend opportunities to reach international targets for further international scientific cooperation. However, the author concludes that scientists have to adapt to the logic of politics and to political rules in subordinating initial scientific objectives in the interest of long-term science diplomacy programs in Germany.

**Gluckman, Peter. "Science Advice to Governments: An Emerging Dimension of Science Diplomacy." *Science & Diplomacy* 5.2 (2016).**

The central question that is posed in this article is how science can most effectively assist public policy. The author affirms that science advice to governments is the answer. The author provides a taxonomy of science advice and makes note of the creation of the International Network for Government Science Advice (INGSA), an organization that aims at enhancing the role of science in public policy at all levels of governance from local to global.

**Leshner, Alan. "The Partnership of Scientists and Diplomats." *Science & Diplomacy* 3.4 (2014).**

Leshner, then AAAS CEO, takes a look at the involvement of the science community in international diplomacy and policies. The author argues that intertwining the communities of scientists and diplomats is vital and inevitable in the increasingly globalized world.

**Moomaw, William R. "Scientist Diplomats or Diplomat Scientists: Who Makes Science Diplomacy Effective?" *Global Policy* 9.S3 (2018): 78–80.**

The article identifies cooperative outcomes in science diplomacy when scientists and diplomats work together. The author illustrates using two examples of stratospheric ozone depletions and climate change issues that joint efforts made by scientists and diplomats can lead to successful outcomes. He suggests optimistically that such results can be replicated.

**Turekian, Vaughan, and Teruo Kishi. "Science and Technology Advising in Today's Foreign Policy." *Science & Diplomacy* 6.1 (2017).**

Drawing on the experiences of the United States and Japan, two countries that have established positions of science and technology adviser to the minister of foreign affairs, the authors underline that science advice in foreign policy should do more than bring professional knowledge: it should convince policymakers to apply the scientific method in addressing foreign policy challenges.

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