The Promise and Paradox of Science Diplomacy

There is no accepted definition of science diplomacy. As a concept, science diplomacy seeks to navigate two opposing imperatives: addressing common issues and advancing national interests. This tension cannot be resolved. For this reason, science diplomacy will remain a contested and dynamic concept.

By Leo Eigner

Over the past two decades, "science diplomacy" has emerged as a new policy concept interconnecting science and technology (S&T) and international relations (IR). States like the US, the UK, Japan, or Switzerland as well as scientific institutions, like the American Association for the Advancement of Science (AAAS), refer to the concept in policymaking. Meanwhile, advocates and practitioners signed the Madrid Declaration of Science Diplomacy (2019) and the Vienna Statement on Science Diplomacy (2021), while think tanks and higher education institutions (HEI) offer courses on science diplomacy, which has grown into an academic subfield in its own right.

ISS crew members Andrew Morgan (NASA), Alexander Skvortsov (Roscosmos), and Luca Parmitano (European Space Agency) in Russia in June 2019. *Evgenia Novozhenina / Reuters*

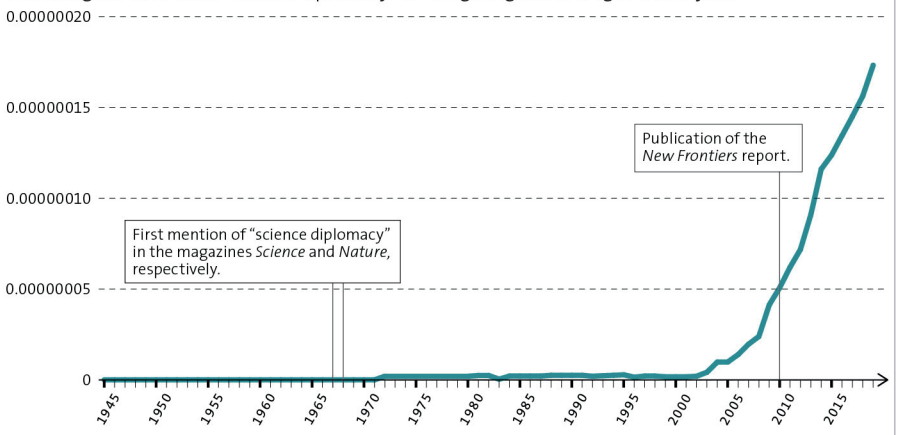
Despite this upsurge of interest, there is still no accepted definition of science diplomacy. Generally speaking, it is an attempt to understand the intersections between science and politics, mainly at the international level. More specifically, science diplomacy refers to a set of practices that leverage, harness, or instrumentalize S&T with the aim of advancing broader political objectives. It encompasses a wide range of activities, such as facilitating international scientific collaboration, integrating science advice mechanisms into policymaking, or strengthening research and development (R&D), and thus assembles a variety of actors, including states, scientific institutions, HEIs, NGOs, companies, and individual scientists. The manifold activities that these actors associate with science diplomacy continuously shapes its meaning, resulting in science diplomacy developing into a catch-all concept.

To some extent, this is unavoidable. As an interface concept, science diplomacy contains a boundary problem, yet this should not be viewed as problematic. Indeed, the term's elasticity gives it its productive tension. This tension, inherent and insoluble, is twofold. First, science is a global endeavor that derives its legitimacy from the production of authoritative knowledge, while politics is locally bound and depends on popular sovereignty. Second, science diplomacy is torn between collaboration and competition. The rationale of science diplomacy thus appears paradoxical: it is implemented to collaboratively address global issues and to competitively advance national interests.

Although coined in the 1960s, "science diplomacy" emerged in the early 21st century among US and UK-based practitioners who promoted science diplomacy as a state-centric, heuristic tool, arguing that it could transform IR. Since science was claimed to be a global, non-ideological endeavor, it could act as a bridge-builder to forge, stabilize, and improve IR, and thus support coalition building and conflict resolution. It could therefore improve bilateral relations and support multilateral efforts addressing common issues, like climate change. Furthermore, international scientific collaboration not only produced beneficial knowledge but also positive, non-scientific externalities, such as cross-cultural understanding and mutual trust.

The Emergence of Science Diplomacy

Percentage of the search "science diplomacy" in Google Ngram averaged over 5 years



Source: Google Books Ngram Viewer

These arguments have largely defined the public discourse on science diplomacy, yet they have also been criticized for being idealistic. Actors routinely use science diplomacy to serve their own interests without promoting trust or facilitating scientific exchanges. In 2021, Switzerland broke off negotiations with the EU on a new framework agreement. In consequence, Switzerland was excluded from Horizon Europe, the EU's flagship research fund worth 95.5 billion EUR. Science diplomacy is as much defined by the global, collaborative spirit of scientific discovery as it is by the local, competitive principle of national interests. Given the disparate nature of science diplomacy, it is perhaps best thought of as an inspired form of rivalry and interdependence.

> The modern practice of science diplomacy emerged out of the Second World War.

The Origins of Science Diplomacy

Science, technology, and international politics have been interlinked since antiquity, yet the modern practice of science diplomacy emerged out of the Second World War. In the spirit of reconciliation, large research infrastructures, like CERN (1954) or the European Southern Observatory (1962), were built to unify scientists and diplomats from multiple backgrounds around a common, peaceful enterprise with long-term commitments. Science diplomacy was also used to stabilize relations in international spaces. The Antarctic Treaty (1959) settled the peaceful use of the polar region by suspending all territorial claims, rejecting resource exploitation, and promoting scientific exploration. It was the first multilateral agreement to govern all aspects of an international space and became the blueprint for non-armament treaties for outer space (1968) and the deep seas (1972).

At a bilateral level, science diplomacy played a more inconspicuous role in easing tensions. To encourage post-war reconciliation and democratization processes, the US unilaterally funded cultural and scientific exchange programs with the Federal Republic of Germany and Japan. In 1961, the US-Japan Joint Committee on Scientific Cooperation – the first of its kind – was created to restore "the broken dialogue" between the two scientific communities. Science diplomacy also originated from the scientists themselves. The most famous example is the Pugwash Movement launched by Bertrand Russell and Albert Einstein in the 1950s and driven by conscientious scientists on both sides of the Iron Curtain to avert the dangers of nuclear weapons.

During the Cold War era of détente, science diplomacy was explicitly used as a foreign policy instrument. Following US President Richard Nixon's historic trip to China in February 1972, the Shanghai Communiqué was signed, establishing S&T as an area of cooperation. At the Moscow Summit a few months later, Nixon and Soviet General Secretary Leonid Brezhnev signed a series of scientific cooperation agreements – a novelty at the time – in addition to arms control treaties. In 1979, the US and China formalized their scientific cooperation with an agreement. These examples are often cited in the history of science diplomacy to illustrate how science can positively impact IR.

Following the collapse of the Soviet Union, science diplomacy acquired new connotations. As science was considered a universal language promoting cross-cultural understanding, science diplomacy was ideal to drive the global convergence towards liberal democracy and a global market economy. In addition, macro-trends, like the rising awareness of global challenges, the impact of new technologies, and the shift from state-centric to multistakeholder diplomacy, linked science diplomacy with the rhetoric and logic of collective action. Science diplomacy, as practiced by the Intergovernmental Panel for Climate Change for example, could balance scientific insights with political considerations in order to solve common issues. At the same time, competition for S&T talent, capital, and prestige intensified in light of rapid globalization and was increasingly reflected in state policies.

The Turning Point

Science diplomacy, as a concept, emerged in the wake of the US-led invasion of Iraq in 2003. In the mid-2000s, polls revealed that while the overall perception of the US had reached a low point, the S&T capacities of the US continued to be universally admired, even in countries with Muslim majorities. Scientists and policy advisors realized the potential of this insight and called for a new era in science diplomacy, arguing that S&T should be central to US

foreign policy. By the late-2000s, "science diplomacy" had gained currency among policymakers, including the S&T advisor to the US Secretary of State, and scientific institutions, like the US National Science Board and the AAAS, which founded the Center for Science Diplomacy in 2008. A year later, US President Barack Obama delivered a speech in Cairo where he announced "a new beginning" in US-Muslim relations in which S&T initiatives, like the science envoy program, would play a key role.

In 2010, the AAAS and the Royal Society in London co-published *New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power*, a report widely considered canonical in the field of science diplomacy. Its enduring influence is largely based on a tripartite definition of science diplomacy: "science in diplomacy" refers to the use of scientific advice to inform foreign policy; "diplomacy for science" refers to the use of diplomacy to facilitate international scientific collaboration; and "science for diplomacy" refers to the use of these collaborations to improve IR. Though convenient, the definition is criticized because science diplomacy activities frequently encompass all three dimensions at once. The report's main contribution was to conceive science diplomacy both as a platform for addressing common issues and as a means of converting the soft power of science into broader political objectives.

"Big science" projects have remained an effective form of science diplomacy.

In parallel, other states were exploring the role of S&T in their foreign policy. In 2008, Japan's top science council issued a policy *Toward the Reinforcement of Science Diplomacy and Technology* that described S&T as a diplomatic resource and soft power instrument. In the 2010s, science diplomacy, both as a term and as a concept, was incorporated into foreign policies, such as in the US in 2012, France in 2013, or the European Commission in 2014, and entered into the public discourse, leading to numerous definitions and models.

Alternative Models

Two alternative models are particularly noteworthy. In 2017, four leading science advisors from Japan, New Zealand, the UK, and the US co-authored an article that conceived science diplomacy as a state activity that directly or indirectly pursues the advancement of national interests. They proposed an alternative framing of science diplomacy as: activities that advance a state's interests through the use of soft power or strengthening national S&T capacities; activities that address cross-border issues by using scientific advice, services, and organizations to managed transboundary ecosystems or emergencies; and activities that tackle global challenges. The model is credited with putting the logic of interstate competition at the heart of science diplomacy.

A second model, developed by political scientists Tim Flink and Ulrich Schreiterer in 2010, distinguishes science diplomacy activities in terms of three distinct goals. The first goal is to secure access to scientific resources, such as talent, knowledge, research facilities, natural resources, and capital, in order to strengthen national S&T capacities, drive innovation, and encourage cross-cultural exchange. The second goal is to promote a country's S&T capacities on the global market to attract scientific resources, commercial investment, and international prestige. The third goal is to convert S&T capacities into soft power to influence public debates and steer political outcomes. The advantage of this model is that it is not state-centric and reveals overarching strategies.

Common Issues

Science diplomacy has been and continues to be applied in situations where common issues need to be collectively addressed to manage risks and share benefits. As a global endeavor, scientific knowledge, processes, and objectives provide a common ground as well as solutions that frees politics from its local context and competitive concerns.

Since the creation of CERN, "big science" projects have remained an effective form of science diplomacy and inspired projects like the Synchrotron-Light for Experimental Science and Applications in the Middle East (2017). The advantage of big science is twofold. First, it directs scientific and political efforts towards a common, mutually beneficial goal that would be too complex and costly to undertake alone. Second, it ensures that the study of a strategically sensitive field has a purely scientific aim and remains under international scrutiny. However, big science can be a source of friction. In response to its exclusion to various international scientific collaborations, Russia threatened to withdraw from the International Space Station (ISS) by 2024 but later announced that it would extend its support until 2028 to the relief of the scientific community.

A second area where science diplomacy plays an important role is in global governance, which seeks to incorporate scientific objectives, collaborations, and management structures into the regulation of international spaces. These include the polar regions (Artic Council), the deep and high seas (UN Convention on the Law of the Sea), outer space (Outer Space Treaty, ISS), and cyberspace (Budapest Convention). The assumption is that science diplomacy can reduce uncertainty among states collaborating in international space by providing an alternative platform and aim that ensures the fair and peaceful use of a global commons. Yet this kind of science diplomacy is being challenged. As Arctic ice melts, opening new trade routes and access to natural resources, polar powers, like China, Russia, and the US, are reassessing the Arctic as a new military and economic zone.

Science diplomacy can also be applied as a collective action mechanism to resolve transboundary issues affecting common goods. The assumption is that, given air pollution or groundwater depletion affect regional actors equally, the incentive to

Science Diplomacy in Switzerland

Switzerland's S&T performance is considered vital to national security, prosperity, and competitiveness. Though it did not refer to it as such, Switzerland has practiced science diplomacy for a long time with the aim of attracting scientific investments. In this sense, the founding of CERN on Swiss-French soil was a major diplomatic achievement. Swissnex and the 2008 Education, Research, and Innovation Dispatch, which identified non-Western target regions for international scientific collaborations, signaled a greater willingness to promote Swiss S&T capacities abroad. By the 2010s, science diplomacy activities were increasingly referred to as such and culminated in explicit policies, such as the foundation of the Geneva Science and Diplomacy Anticipator (GESDA) in 2019 and the appointment of a special representative for science diplomacy in 2021. Science diplomacy now features in various strategies, such as the Maritime Strategy (2023), which suggests that Switzerland is increasingly willing to use its S&T assets.

collaborate is high. In the 1960s, acid rain in Europe was a common concern and led to the 1979 Convention on Long-Range Transboundary Air Pollution that successfully curbed emissions. Similar attempts are not guaranteed success. In the 1990s, efforts to reduce transboundary air pollution in East Asia failed because Chinese scientists refused to accept Japanese and South Korean studies that described China as the main polluter in the region. In short, the political will to find and implement scientific solutions remains a central factor in science diplomacy.

National Interests

The application of science diplomacy to the advancement of national interests differs according to a state's aims and constraints, and thus varies considerably. The common aim of science diplomacy activities is to gain a relative competitive advantage over other states in terms of scientific excellence, technological innovation, and economic output, while at the same time deepening individual and institutional exchange to enhance mutual understanding and trust.

Science diplomacy is a very broad and blurry concept, but this ambiguity is part of its attractiveness.

Fostering as well as limiting international scientific collaborations remain a core feature of science diplomacy. As the exchange of people and ideas leads to better science, states usually encourage these collaborations with financial and diplomatic support through mobility programs, like Erasmus+ or easing visa regulations, and funding mechanisms designed to increase international collaborations. However, state involvement cuts both ways. In 2011, the US Congress barred NASA and lunar researchers from working with China or Chinese companies, citing human rights and national security concerns (see CSS Analysis 323). The non-transference of knowledge and technologies is a key state concern and often ignored in the public discourse on science diplomacy.

Since the post-war period, states have created science diplomacy networks. This strategy encompasses numerous policies, such as posting scientists to top ambassadorial positions, sending science attachés to key embassies, and creating science and innovation centers. Their aims include monitoring S&T developments in foreign countries, promoting national S&T capacities abroad, and facilitating international scientific collaborations. Pioneers of the science and innovation centers include Swissnex and the Science and Innovation Network, both launched in 2000 by Switzerland and the UK respectively, and have inspired similar strategies in Denmark (2006) and Germany (2009). In the 2010s, diplomats began to see emigrated scientists as part of an organic network that could be tapped to strengthen the country's science diplomacy. Though individual scientists have been enlisted into diplomatic work for decades, many scientists opposed the overt politicization of their work.

The Endless Frontier

Science diplomacy contains multiple meanings and activities that are shaped by a nexus of evolving scientific, political, and economic principles that are context and actor specific. As a result, it is a very broad and blurry concept. This ambiguity is part of its attractiveness, as it helps to navigate the inherent tension between addressing common issues and advancing national interests. Recognizing the need to collaborate and the urge to compete helps to relativize both imperatives and to assess what is politically feasible and desirable. In a context of rising geopolitical tensions, it will be important for advocates and practitioners of science diplomacy to engage with the limits of science diplomacy by addressing the consequences of politicizing science and pushback from scientists. At the same time, promoting dialogue, tackling common issues, and fostering exchanges to produce new knowledge in the hope stabilizing IR and encouraging mutual trust will remain a key function of science diplomacy.

Further Reading

Royal Society, "New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power," *RS Policy Document*, 1:10 (2010).

P.D. Gluckman et al, "Science Diplomacy: A Pragmatic Perspective from the Inside," *Science & Diplomacy*, 6:4 (2017).

Tim Flink / 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 (2012), pp. 665–677.

For more on perspectives on Euro-Atlantic Security, see CSS core theme page.

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