THE ROYAL SOCIETY

AAAS
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

New frontiers in science diplomacy

Updating the concept for the next 15 years

Since the Royal Society and American Association for the Advancement of Science (AAAS) report, *New Frontiers in Science Diplomacy* was published in 2010, the concept of 'science diplomacy' has spread rapidly throughout the international scientific community. High-profile conferences and training programs have centered around the concept, international scientific leaders and high-level diplomats use the term regularly, and countries have adopted national science diplomacy strategies.

Yet this conceptual framework reflects the time it was written, which was the start of the Obama Administration in the US and the transition between the Labour and coalition governments in the UK. Since its publication, the governance of both the UK and the US has become increasingly politically polarized and less stable. Globally, nationalist politics are on the rise. The geopolitical landscape is increasingly volatile, as evidenced by armed conflicts with regional and global consequences including the recent conflict in the Middle East, ongoing civil war in Syria, and Russia's continued invasion of Ukraine. Governmental leaders in science-dominant countries have grown increasingly concerned with research security and the potential vulnerability of an open global science system. With China in particular, nations that once embraced broad scientific collaboration are skewing toward distrust and competition.

The basic principles behind the framework — such as the use of science as a 'soft power' tool to improve international relations — are more important than ever. However, this evolving, complex context calls for the Royal Society and AAAS to update the framework. This discussion paper is concentrated on several key questions, highlighted with examples, to drive the conversation on how to reflect the current landscape and ensure that the Royal Society and AAAS framework remains a highly influential resource for the science diplomacy community in the future.

Questions for discussion

Question 1: What is science diplomacy in the 21st century?

In 2010, AAAS and the Royal Society divided science diplomacy into three conceptual dimensions: the ability of science to inform foreign policy (science in diplomacy), using science to improve relations between countries (science for diplomacy), and the capacity of diplomacy to facilitate scientific cooperation across borders (diplomacy for science).

One of the defining features of today's world is the rise of populism, authoritarianism, and political polarization, often manifesting itself in ways which openly defy sound scientific advice and evidence. In this world, how can world leaders defend science and reason and how can we address the implications of science diplomacy (see question 2), which can be heavily influenced by national interest?

Further information on case studies and examples of science diplomacy in the original framing, including highlighting large-scale research infrastructure projects, the ways science has been used to ease diplomatic tensions, and examples of science diplomacy in addressing global commons and global challenges; as well as addressing the role of science diplomacy in international development, can be found in the appendix.

Question 2: What are the changing implications of science diplomacy?

The original framing of science diplomacy emphasized the unique positive role of scientific collaborations between researchers from countries where there was a history of mistrust, hostility, or conflict — but did not include a detailed focus on potential downsides or unintended consequences of those activities[1]. How does science diplomacy address issues such as safeguarding research security, a rapidly emerging area of focus for the international scientific and diplomatic communities in recent years?

The appendix has more information about the implications of science diplomacy between non-allied nations.

Question 3: What is not science diplomacy?

The term science diplomacy has gained considerable momentum over the past 15 years and is widely used. This is a positive reflection of interest in the concept. However, with this increased popularity, there is a risk of overuse and/or misuse of the term, which demonstrates the need for clarification in the reframing.

The appendix has background information on the risk of overusing the term to define all international scientific collaborations as science diplomacy, as well as the potential misuse of the term in conflating conducting or participating in any scientific activities abroad with science diplomacy.

Further questions

- What does science diplomacy mean to you?
- What are the most productive examples of collaboration between science and diplomacy?
- What should an updated concept of science diplomacy include — and what should it exclude?
- What is the role of coordinated research and action in science diplomacy?
- What aspects of science are most useful to diplomats, and what aspects of diplomacy are most useful to scientists?
- Are concepts such as innovation diplomacy and development diplomacy contained in the concept of science diplomacy, or are they separate concepts?

1 Even though there were such examples, most notoriously the AQ Khan network which exploited weaknesses in global supply chains to help supply nuclear and missile technology to countries like North Korea, Iran, and Libya.

Appendix

This section includes background information for the three questions reviewed in the main document.

Question 1: What is science diplomacy in the 21st century?

Below are some such examples, both past and present, of what might be science diplomacy under the original framing.

Large-scale research infrastructures

Large-scale research infrastructures serve as examples of science diplomacy and often represent two elements of our three dimensions of science diplomacy: diplomacy for science and science for diplomacy. They first represent diplomacy for science as these massive projects require diplomacy to facilitate their creation and operation, as they are international in nature. From this collaboration, one can then see science for diplomacy at work, with the scientific collaboration being conducted by an international team each day ultimately building stronger bonds between the nations involved.

There are several good examples of large-scale research infrastructures, including the European Organization for Nuclear Research (CERN)[2], the Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME)[3], the Square Kilometre Array Observatory (SKAO)[4], and the Atacama Large Millimeter/submillimeter Array (ALMA)[5].

Easing diplomatic tensions

Science has proven itself to be a great instrument of soft power and can often be used in situations where formal diplomatic relationships between two or more countries have been strained or severed. This is another example of science for diplomacy, or scientific cooperation being used to improve relationships between countries.

Mount Paektu is an active volcano that sits on the border between China and the Democratic People's Republic of Korea (DPRK) and is responsible for one of the largest volcanic eruptions in Earth's history. After a period of unrest in the early 2000s, it was deemed important by scientists and local governments alike to study the volcano to ensure the safety of those living around it. This led to a unique and long running collaboration[6] that brought together US and UK researchers together with their DPRK counterparts to better understand the nature of the volcano and its surrounding geology.

Relations between the US and Cuba have been strained since 1959, when Fidel Castro and supporters overthrew a US-backed regime in Havana. Despite this tense relationship between governments, AAAS and the Cuban Academy of Sciences (ACC) foster connections between the US and Cuban scientific communities under a broad and longstanding memorandum of understanding.

Using science to engage across borders is not new. Dr. Joseph Needham, an English scientist and Fellow of the Royal Society known as the "father of chemical embryology" during World War II, served in China as a science counselor for the British Embassy in Chongqing. He was the Director of the Sino-British Science Cooperation Office and is regularly cited as one of the key figures in 20th century Sino-British scientific relations.

Global commons and global challenges

Other areas where we commonly see science diplomacy at work are when dealing with global commons — spaces that span national borders — and addressing global challenges that cross borders and require international attention.

2 The European Organization for Nuclear Research or Conseil Européen pour la Recherche Nucléaire (CERN) was established in the aftermath of World War II, in 1952, and initially brought together 12 member states, despite tense diplomatic relationships, for the purpose of advancing science.

3 Modelled after CERN, SESAME is a synchrotron light located in Jordan, created under the auspices of UNESCO in 2002 and officially opened in 2017. SESAME brought together many Middle Eastern countries for the purpose of science despite fractured diplomatic relationships.

4 The Square Kilometre Array Observatory (SKAO) is an intergovernmental radio telescope project headquartered in the United Kingdom, with two telescopes covering different frequency ranges at radio-quiet sites in South Africa (SKA-Mid) and Australia (SKA-Low).

5 Operating in Chile's Atacama Desert, ALMA is a cooperation between the European Southern Observatory (ESO), the National Radio Astronomy Observatory (NRAO), the National Astronomical Observatory of Japan (NRAO), and the Republic of Chile.

6 Mount Paektu brought the international community together for the sake of science, despite the political challenges of collaborating with the DPRK. Even when the United Nations sanctioned scientific cooperation with the DPRK, the work on Mount Paektu received an exemption.

Examples of global commons include the Antarctic Treaty that was signed in 1959[7], during the height of the Cold War; the Arctic Council, created in 1996, which brings together representatives from Arctic states, indigenous peoples, and other observers to address the shared issues the region faces, primarily environmental; the Artemis Accords[8], which is a multilateral agreement on the uses of space drafted by NASA and the US Department of State, grounded in the United Nations Outer Space Treaty of 1967; and the Human Genome Project, a large-scale internationally collaborative endeavor, under which the pooling of data has led to a number of medical advances.

The climate crisis is arguably the greatest problem humanity has yet faced. However, there are past precedents of international scientific collaboration successfully addressing a critical global challenge. The Montreal Protocol is a global environmental agreement, adopted in 1987, to address the depletion of the ozone layer caused by ozone-depleting substances (ODS) that were once commonly used in refrigerators, air conditioners, and aerosols[9, 10]. The Montreal Protocol was the first treaty to achieve universal ratification and is a superb example of government leaders acting on scientific advice.

The Intergovernmental Panel on Climate Change (IPCC) found that human emissions have already warmed the climate by 1.1°C since 1850–1900 and it expects global average temperature to rise another 1.5°C or more over the next few decades. While scientists have done a good job of diagnosing the issue, and international bodies have taken some action, including the addition of climate action to the 2030 Agenda for Sustainable Development, and the signing of the Paris Agreement in 2015 by 196 Parties at COP21, we are yet to see any concrete success — at least in terms of major action to halt greenhouse gas emissions — coming from this collaboration.

The IPCC did serve as the inspiration for the creation of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which has played a similar role in assessing the extent of the biodiversity crisis. Yet these diagnoses have not led to meaningful action in preventing the problem from getting worse.

As demonstrated by IPCC and IPBES and the hundreds of scientists from around the world they have convened, science diplomacy has been able to accurately diagnose global challenges such as climate change and biodiversity. However, the considerable science diplomacy activities that went into building scientific consensus on the issues has not led to solution implementation at scale. Instead, these have been largely left to the private sector or to scientists operating under the traditional competitive scientific framework, with neither offering the incentive structures likely to drive meaningful action. What might the role of science diplomacy be in combating global challenges more actively, and facilitating the crucial shift from diagnosis to action? How can it facilitate scientific cooperation and interact with the private sector to create stories of success in the future?

In 2010, a deadly pandemic was considered a real possibility. However, it would have been hard to envisage then that when it did occur, scientists around the world would have to fight misinformation, including from democratically elected world leaders, and scientific advisers would become a target of those influenced by such misinformation. How might an updated framework of science diplomacy provide a coordinated defense of scientific evidence and reason against growing conspiratorial and authoritarian worldviews?

7 There were concerns about the land being used for military use, but instead the treaty, originally signed by 12 countries, transformed the land almost exclusively for scientific research, with much collaboration happening between the current 50 countries that adhere to the treaty.

8 The Accords were initially signed in 2020 by eight countries, and its reach has since expanded with 28 countries having signed on as of September 2023.

9 The ozone layer filters harmful ultraviolet radiation that would otherwise reach the Earth's surface, and lead to an increase in skin cancer and cataract diagnoses, as well as an increase in the Earth's temperature.

10 The treaty played a pivotal role in repairing the ozone layer by phasing out ozone-depleting substances (ODS), and has protected humans from the effects of ultraviolet radiation while also preventing an additional 2.5°C temperature increase by the end of the century.

Science diplomacy and international development

The use of science in international development is an important aspect of international collaboration and has a long history[11]. However, in recent years, there has been an increasing level of scrutiny on scientific collaboration between high income and low/middle income countries, and in particular practices which derive from the disparity in wealth and power between the collaborating partners[12]. There are some efforts campaigning for changes to these practices and promoting a more equitable framework for research collaboration[13]. Might these efforts be considered science diplomacy, and where might they fit into a new framework?

Question 2: What are the changing implications of science diplomacy?

There have been reports from the US Federal Bureau of Investigations (FBI) and the US Senate that have highlighted foreign state adversaries seeking to illegitimately acquire US academic research, US researchers agreeing to give Chinese institutions intellectual property rights that overlapped with research conducted at US institutions, and researchers submitting false information when applying for grant funds, among other examples. In the US, this led to the China Initiative[14], which has been discontinued due to overreach, but Australia, Canada and the UK have also devoted increasing attention to addressing the issue, with the latter so far promoting awareness raising and advice through initiatives like the Research Collaboration Advice Team and Trusted Research[15]. And such allegations have not been limited to China. In June 2023, the UK government launched an inquiry into allegations that scientists at British universities helped the Iranian regime develop technologies that could be used to improve its programme to build suicide drones.

A completely open internationally collaborative science system does pose legitimate national security risks, even though some may have exaggerated them. This calls into question whether there are limitations to the original framework and how to address these in order to ensure science diplomacy continues to play an important role in connecting researchers from different nations, especially if those countries have strained or severed diplomatic relations.

The limitations of these frameworks are becoming increasingly apparent with the current geopolitical situation which includes Russia's invasion of Ukraine, and the subsequent cessation of almost all scientific collaboration between Western countries and Russia. It remains to be seen to what extent the Israeli-Palestinian conflict — entering a new and dangerous phase following the October 2023 Hamas attacks — will impact regional initiatives such as SESAME and the Malta conferences[16].

Responding to these challenges presents a great opportunity to reframe science diplomacy — and in some cases has already forced closer ties between scientists and diplomats. Safeguarding research security, for example, has required rapid and novel engagement and trust-building between researchers, governments, and security agencies. Dealing with fast-moving and constantly shifting security threats requires the empowerment of researchers to become confident managers of geopolitical risk. And law enforcement and intelligence agencies have had to trust academics and institutions with relevant classified information.

11 For instance, the Royal Society has been supporting scientific collaboration with partners in Africa since the 1960s.

12 These are often referred to in shorthand as 'helicopter' or 'parachute' science — when researchers from higher-income settings carry out research in resource-poor settings with limited to no involvement of local communities or researchers.

13 When the World Conference on Research Integrity was held in Africa for the first time in May 2022 in Cape Town, researchers from across the continent and around the world dedicated several sessions to addressing these issues, leading to the Cape Town Statement on Fostering Research Integrity through Fairness and Equity, a crucial and influential piece of guidance for the global scientific community.

14 This was an effort by the US Department of Justice under the Trump Administration to prosecute perceived Chinese spies in industry and academia, but since has been discontinued after facing much criticism for what has been described as an overreach.

15 Although there is pressure for more to be done, following recent UK-China tensions over the latter's alleged interference in the UK democratic process.

16 The Malta conferences address the desire to improve the quality of life and political stability in the Middle East by serving to identify opportunities for collaboration to address the scientific and technological challenges of the region.

Finally, the mobilization of the international scientific community to help rebuild Ukrainian science also arguably provides a solid template for a new science diplomacy. National academies from around the world, led by those from Poland and the US, have come together to support Ukrainian researchers to continue their research elsewhere, as part of a ten-point plan for rebuilding Ukraine's science system. While there is surprisingly little literature on the role of science in post-war recovery, there arguably has never been as much focus on its potential role as there is in plans for post-war Ukraine.

Question 3: What is not science diplomacy?

One example of overuse is to define all international scientific collaborations as science diplomacy. This ignores the fact that the scientific enterprise is inherently global and scientific collaborations often involve researchers from different countries. Having two researchers, for instance from Malaysia and Germany, working together on a project does not mean the international collaboration is an example of science diplomacy. What matters is the motivation behind the project. The goal of most international scientific projects is not to affect relationships between countries, and such projects are not usually motivated by the national interests of a particular country. Instead, most scientific collaborations are focused on advancing scientific excellence and achievement and are motivated to do the best science — this often means collaborating with experts who are from or reside in different countries. That makes them good international scientific collaborations, but not necessarily examples of science diplomacy.

Another example of misuse is to conflate conducting or participating in scientific activities, including presentations, attending conferences, and doing research, in another country as science diplomacy. Again, motivations and goals of the work are important distinctions. As mentioned, the scientific enterprise is global and scientists are often called to present their work, to meet with counterparts in other countries, and to conduct research abroad. This does not mean that work is science diplomacy — the crossing of national borders is not sufficient to meet the definition. However, if the scientist is making a genuine contribution to improving international relations — e.g., as a representative of a program such as the US Science Envoys program, which is run by the US State Department, and has a motivation of leveraging the scientific expertise and networks of eminent US scientists and engineers for international cooperation — then it is an example of science diplomacy.

The line between what makes an international scientific activity and science diplomacy is not always a clear one, which along with the popularity of the science diplomacy concept, likely has not helped in the overuse and misuse of the term science diplomacy.

Hence, in the reframing discussion, it may be helpful to return to the original three dimensions to clarify how international scientific collaborations and activities need to be connected to the three pillars of science in diplomacy, diplomacy for science, and science for diplomacy — and have a motivation to affect relationships — to be considered science diplomacy. Essentially, there needs to be a high standard of diplomacy involved in the endeavor, as well as high quality science.