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SYNTHESIS PAPER

A Global Network of Science and Technology Advice in Foreign Ministries

Vienna Dialogue Team[#]

16 March 2017

[#] List of Co-Authors and Participants from the *International Dialogue on Science and Technology Advice in Foreign Ministries* ('Vienna Dialogue') in October 2016 at the headquarters of the International Institute for Applied Systems Analysis near Vienna, Austria (see Appendix 1 – Co-Author List in Alphabetical Order).

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Abstract

This paper is a product of the *International Dialogue on Science and Technology Advice in Foreign Ministries* (Vienna Dialogue) in October 2016, involving more than twenty nations and several international organisations. The event was a key step to further develop the Foreign Minister Science and Technology Advisor Network (FMSTAN), growing from an initial group of five nations. The Vienna Dialogue was convened by the Fletcher School of Law and Diplomacy, Tufts University, and the International Institute for Applied Systems Analysis (IIASA) at the Vienna headquarters of IIASA, bringing together diplomats from foreign ministries to consider the value of evidence for informed decision-making by nations with regard to issues, impacts and resources within, across and beyond national boundaries. The evidence comes from the natural and social sciences with engineering and medicine as well as other areas of technology. By building common interests among nations, science is a tool of diplomacy, promoting cooperation and preventing conflict in our world. Science diplomacy was discussed as an international, interdisciplinary and inclusive process to help balance national interests and common interests in view of urgencies today and across generations in our globally-interconnected civilization.

Keywords: decision-making; evidence; external relations; foreign ministries; global; science diplomacy

1. Our Globally-Interconnected Civilization

Our connections across the Earth are intimate more than any point in human history. Yet, we still are in our infancy as a globally-interconnected civilization.

Consider our oldest calendars, recording time annually from around 6000 years ago to the present. In all this time, it was only the last century when humans truly became interconnected across our home planet, not just populations living in different locations on Earth, but actually touching each other across all continents.

First half of the 20th century (after the calendar reset around 2000 years ago) was marked by animosity among all nations with the introduction of "world" wars. These were not regional wars in Europe or Asia or Africa or South America or Australia or North America. These were conflicts that affected our world on a planetary scale (Fig. 1).

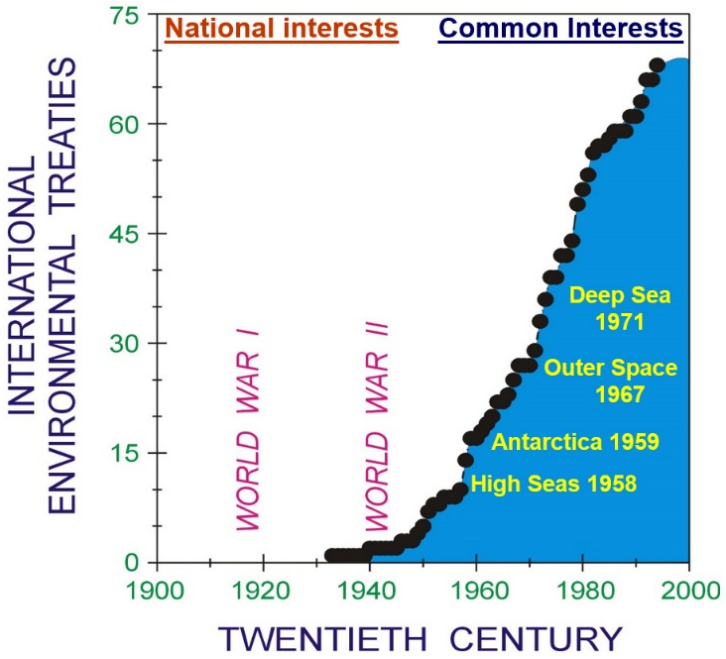

FIGURE 1: Emergence of our globally-interconnected civilization during the 20th century.[1] In stark contrast to the 'world' wars during the first half of the 20th century – more than 95% of the multilateral ecosystem and environmental regimes in force (dots) have been signed after 1950. Institutions to establish 'international spaces' beyond sovereign jurisdictions (yellow) further highlight the development of common interests among all humankind, including regions that shall be used for peaceful purposes only without nuclear weapons.

Humbled by the horrors of a world at war, nations collectively began to think together about transboundary issues, impacts and resources. From this united exercise, a global arena of treaties and conventions was born, creating connections among nations during the second half of the 20th century for the sustainability of our civilization.[2]

[1] Adapted from: Berkman, P.A. 2002. *Science into Policy: Global Lessons from Antarctica*. Academic Press, San Diego.
[2] WCED. 1987. *Our Common Future: From One Earth to One World. Report Transmitted to the General Assembly as an Annex to Resolution A/RES/42/187*. United Nations, World Commission on Environment and Development, Geneva.

Together, the first and second halves of the 20th century reflect periods of national interests and common interests on Earth (Fig. 1). Like the 20th century, there are national interests and common interests across the Earth's surface. National interests exist within the boundaries of nations, which collectively cover nearly thirty percent of the Earth's surface.

Common interests exist across the remaining seventy percent of the Earth, in areas established by humankind as international spaces beyond national jurisdictions, limiting the origins of national conflict (Fig. 1). With hope and inspiration, the second half of the twentieth century is best reflected by Antarctica, which the *1959 Antarctic Treaty* protects for *"peaceful purposes only…. with the interests of science and the progress of all mankind."*

With global perspective, we also can see human population growth in cities around the world. We cannot know exact numbers, but the trend is unambiguous. From the beginning – across all of the millennia – it was only 1800 when we reached the first billion humans alive at the same time on Earth. By 1920, twelve decades later, there were two billion, doubling the human population. By the 1970's there were four billion, doubling again in just five decades. Accelerating, there will be eight billion humans by end of this decade as our global population continues to grow exponentially across the Earth.

With human population growth comes environmental and societal changes that underlie the risks of famine, disease and war.[3] These risks are now operating on a planetary scale. Consider the refugee crises that are stirring nationalistic responses today with population movements at levels unseen since the World War II [4] – when there was two-thirds less people alive on Earth. How should cultures and nations respond to refugee crises, recognizing the tide of human population growth will continue to rise with foreigners increasingly mixed around our world?

Among our globally interconnections, we now live in a digital era that has transformed information transfer on Earth. Leapfrogging traditional producers of information – everyone with a smart device and social media now is a publisher as well as recipient. Barraged from all angles, there is information overload, consuming time with the moment as we race ever faster to keep up with news from around the world, increasingly concerned about cyber-security.[5]

[3] Malthus, T.R. 1798. *An Essay on the Principle of Population as it Affects the Future Improvement of Society.* J. Johnson, London.

[4] UNHCR. 2016. *Global Trends: Forced Displacement in 2015.* United Nations High Commission on Refugees, Geneva.

[5] Scheiner, B. 2000. *Secrets and Lies: Digital Security in a Networked World.* Wiley, New York.

Our digital era also is new with its dimensions of artificial intelligence[6], robotics[7] and genomics[8] to name a few innovations that highlight human imagination with science fiction becoming reality. Yet, we are still in our infancy as a global community, perhaps best reflected by the polarized debate decrying 'climate change,' which itself is a redundant phrase since climates (by definition) are inherently dynamic on every planet in our solar system. Nonetheless, the fact that we are talking about climate reflects a maturity in our capacity as a civilization to understand the integrated responses of oceans and atmosphere with geology and biology over time on Earth.

Aligned with our global population growth, the Earth system has been influenced increasingly by humans from the dawn of agriculture through the industrial era into the future.[9] How nations individually and collectively respond to warming or cooling of the Earth's surface will remain a work in progress.

On a planetary scale – as a globally-interconnected civilization – the challenge we face today and will forever face, as long as there are nations, is to balance national interests and common interests across the Earth. We also have to be practical, recognizing that nations will always first and foremost look after their national interests.

The fundamental intersection between national and international interests exists within foreign ministries, charged with promoting cooperation and preventing conflict among nations. Decision-making within foreign ministries requires evidence collected, integrated and interpreted in view of political, economic and cultural instabilities each nation must avoid for its own security.

Urgencies exist across security time scales to address the risks of instabilities that are the concern of each and every nation. In a global context – unlike any time in human history – today urgencies also exist across sustainability time scales, involving present and future generations (Fig. 2), recognizing that children being born will be alive in the 22nd century.

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[6] Poole, D.K. and Mackworth, A.K. *Artificial Intelligence: Foundations of Computational Agents*. Cambridge University Press, Cambridge.

[7] Asimov, I. 1995. *The Complete Robot.* Doubleday, New York.

[8] Watson, J.D. 1968. *The Double Helix: A Personal Account of the Discovery of the Structure of DNA.* IN: Gann, A. and Witkowski, J. (eds.) 2012. *The Annotated and Illustrated Double Helix*. Simon and Schuster, New York.

[9] Schwägerl, C. 2014. *The Anthropocene: The Human Era and How It Shapes Our Planet.* Synergetic Press, Santa Fe.

FIGURE 2: In our globally-interconnected civilization today, urgencies exist simultaneously across security time scales (mitigating risks of political, economic and cultural instabilities) and sustainability time scales (balancing societal, economic and environmental elements across generations) that must be addressed by nations individually and collectively.

In our globally-interconnected civilization – where urgencies of the present and future meet today (Fig. 2) – science and technology (S&T) advice in foreign ministries is part of the solution to address the issues, impacts and resources within, across and beyond the boundaries of nations.[10] In foreign ministries, the 'evidence brokers' are the science and technology advisors to foreign ministers.

Recognizing the fundamental importance of S&T advice for our globally-interconnected civilization,[11] the Fletcher School of Law and Diplomacy at Tufts University and the International Institute for Applied Systems Analysis (IIASA) co-convened the *International Dialogue on Science and Technology Advice in Foreign Ministries*[12] in October 2016 near Vienna, Austria, at the headquarters of IIASA. The '*Vienna Dialogue*' engaged diplomats from more than twenty nations, including the five members of the nascent *Foreign Minister Science and Technology Advisor Network* (FMSTAN) as well as other representatives of foreign ministries and from international organisations (represented by the co-authors of this paper inclusively). Emanating from the *Vienna Dialogue,* the goal of this paper is to share lessons and perspectives with a view toward enhancing S&T advice in foreign ministries.

2. Science Diplomacy in Foreign Ministries for the 21st Century

Topics discussed during the *Vienna Dialogue* are shown in Table 1, introducing the position of S&T Advisor to the Foreign Minister as an option for nations to consider. The larger goal of the *Vienna Dialogue* was to nurture science diplomacy in foreign ministries, enhancing the capacity of our world to balance national interests and common interests.

[10] National Research Council. 2015. *Diplomacy for the 21st Century: Embedding a Culture of Science and Technology Throughout the Department of State.* National Academy Press, Washington, D.C.
[11] Brooks, H. 1994. The relation between science and technology. *Research Policy* 23:477-486.
[12] http://www.iiasa.ac.at/web/home/about/events/161018-science-diplomacy.html

TABLE 1: Agenda Topics for the *International Dialogue on Science and Technology Advice in Foreign Ministries* ('Vienna Dialogue') at the International Institute for Applied Systems Analysis near Vienna, Austria, on 18-19 October 2016
Opportunities and Challenges of Science Advice to Foreign Ministries
The Role of Science in Foreign Policies
Trade
Science in Embassies
Science Diplomacy in International Spaces
Mechanisms for Delivering Science Advice in Foreign Ministries
Providing Science Advice During a Crisis
From Science Advice to Science Diplomacy
Science and Technology Supporting the Sustainable Development Goals
Benefits of Science and Technology Advice in Foreign Ministries
A Global Network of Science and Technology Advisors in Foreign Ministries

Decision-making by individuals, governments and our world requires evidence about change to understand the context of the challenges and opportunities to address. Across time and space, change is revealed by the natural and social sciences with technology and innovation further assisting to frame the appropriate solutions.

Questions addressed by the natural sciences underpin evidence for disaster risk reduction as well as responses to 'extreme events,' from regional hurricanes that occur seasonally to localized earthquakes, volcanic eruptions and tsunami that reoccur over decades and centuries. With the advent of human-launched satellites[13] in 1957, we also have synoptic capacity to observe, record and transmit information on a planetary scale, underscoring our technological advances to address global opportunities and challenges across present and future generations.

Questions addressed by the social sciences underpin evidence for our sustainability,[14] balancing economic, environmental and societal elements in view of the urgencies today and across generations to come (Fig. 2). The socio-economic evidence underlies all manner of decisions, from trade and financial systems to infrastructure investments.

[13] Berkman, P.A. 2011. President Eisenhower, the Antarctic Treaty and Origin of International Spaces. IN: Berkman, P.A., Lang, M.A., Walton, D.W.H. and Young, O.R. (eds.). *Science Diplomacy: Antarctica, Science and the Governance of International Spaces*. Smithsonian Institution Scholarly Press, Washington, DC. pp.17-28.

[14] National Research Council. 1999. *Our Common Journey: A Transition Toward Sustainability*. National Academy Press, Washington, DC.

In the international arena, nations receive and exchange evidence through many channels with the ministries of foreign affairs at the center of statecraft. For diplomacy among nations in our digital age – the evidence is unprecedented with the volume, variety and velocity of the deluge that is now known as 'Big Data'.[15] Sorting out the signal from the noise of the evidence that nations must address individually and collectively with urgency in our globally-interconnected civilization (Fig. 2), now is a matter of science diplomacy.

As a quantitative process to formulate and answer questions, science diplomacy reveals options that contribute to informed decision-making. The options (without advocacy) – which can be used or ignored explicitly – are distinct from recommendations advocated by individuals or institutions with agendas.

In a general sense, options are integrated through a decision-support process (Fig. 3), responding to constantly changing circumstances within, across and beyond the boundaries of nations. This iterative process involves stakeholder perspectives; evidence that is holistic (international, interdisciplinary and inclusive); and governance records.

FIGURE 3: Iterative decision-support process involving international, interdisciplinary and inclusive (holistic) evidence from the natural and social sciences that is integrated with governance records (policies, regulations and laws of governments) in view of stakeholder perspectives to reveal options (without advocacy) that contribute to informed decision-making for the foreign affairs of nations.

[15] Mayer-Schönberger, V. and Kenneth Cukier, K. 2014. *Big Data: A Revolution That Will Transform How We Live, Work, and Think.* John Murray, London.

Building on the decision-support generalization (Fig. 3), science diplomacy itself can be defined as an international, interdisciplinary and inclusive process involving evidence to balance national interests and common interests for the benefit of all on Earth. This definition has been evolving since over the past decade,[16-17] resonating with increasing application on a global scale.

Among the early events in the synthesis of science diplomacy is the June 2009 meeting on *New Frontiers in Science Diplomacy* that was hosted by The Royal Society in partnership with the American Association for the Advancement of Science (AAAS), involving government ministers, scientists, diplomats, policymakers, business leaders and journalists from twenty countries. This conference revealed a taxonomy for science diplomacy with three major aspects:[18]

1. *Diplomacy for science* (facilitating international science collaboration);

2. *Science for diplomacy* (helping to improve understanding between countries, especially where regular diplomacy may be strained); and

3. *Science in diplomacy* (informing foreign policy objectives with science and technology advice).

That same year, the *Antarctic Treaty Summit*[19] in Washington, D.C. brought together high-level decision makers, along with global thought leaders from 27 nations to celebrate lessons learned for humankind from the first half century of the *Antarctic Treaty.* These global lessons are memorialized in a joint Congressional Resolution that was adopted with unanimous consent in the United States House of Representatives and United States Senate during the *Antarctic Treaty Summit* – on the December 1st signature day of the *Antarctic Treaty* fifty years before.[20]

Global elements of science diplomacy emerged from the *Antarctic Treaty Summit*[21] and are distilled in Table 2. These global elements, which reveal the value of science across our civilization, are open for elaboration and practical application in the spirit of inclusion.

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[16] Lord, K.M. and Turekian, V.C. 2007. Time for a New Era of Science Diplomacy. *Science 315:769-770.*

[17] Turekian, V.C., Macindoe, S., Copeland, D., Davis, L.S., Patman, R.G. and Pozza, M. 2015. The Emergence of Science Diplomacy. IN: Davis, L.S. and Patman, R.G. (eds.). *Science Diplomacy New Day or False Dawn?* World Scientific, London. Pp. 3-24.

[18] The Royal Society. 2010. *Science Diplomacy: Navigating the Changing Balance of Power.* London. 32 p.

[19] http://atsummit50.aq

[20] *House Concurrent Resolution 51* and *Senate Resolution 365* (Recognizing the 50th Anniversary of the Signing of the Antarctic Treaty) adopted during the 1st Session of the 111th Congress of the United States in 2009.

[21] Berkman, P.A., Lang, M.A., Walton, D.W.H. and Young, O.R. (eds.). Science Diplomacy: Antarctica, Science and the Governance of International Spaces. Smithsonian Institution Scholarly Press, Washington, DC. 337 p.

TABLE 2: Global Elements of Science Diplomacy
Essential gauge of changes over time and space (providing perspective for informed decision-making)
*Instrument for Earth system monitoring and assessmen*t (revealing insights for sustainable development)
Early warning system (relating to security and welfare among nations)
Source of invention and commercial enterprise (enabling business and societal transformations globally)
Determinant of public policy agendas (underscoring the allocation of government resources and assets)
Element of international institutions (facilitating cooperation, coordination and consistency among nations)
One of the "subsidiary means for the determination of rules of law" (International Court of Justice)
Source of continuity in our civilization (built on an evolving foundation of prior knowledge)
Tool of diplomacy (fostering inclusive dialogues among allies and adversaries alike)

Lessons of science diplomacy operate all over the world at local to global scales. A regional application is reflected by the Murmansk speech of Soviet President Mikhail Gorbachev in 1987, when he borrowed from the *Scientific Committee on Antarctic Research* to introduce the concept of an "Arctic Research Council."

In 1996, the *Arctic Council* emerged, establishing sustainable development as a common Arctic issue among the eight Arctic states and six indigenous peoples organizations. Throughout, this high-level forum for the Arctic has been nourished by evidence from its permanent working groups of social and natural scientists, stimulating Foreign Ministers to explicitly affirm "peace" in their biannual declarations since 2009.[22]

The eight Arctic states then signed two binding agreements in 2011 and 2013, dealing with search-and-rescue and marine-pollution-response, respectively. Next to be signed is the binding *Agreement on Enhancing Arctic Scientific Cooperation* during the upcoming Arctic Council Ministerial Meeting – chaired by the United States in Fairbanks, Alaska, in May 2017. Contrary to media hype, the high north is a region of low tension, precisely because states have been cooperating around science.

All of the global elements of science diplomacy (Table 2) are represented in the trilogy of global agreements approved by humankind in 2015:

[22] http://arcticcouncil.knohow.co

- *Sendai Framework for Disaster Risk Reduction 2015–2030*[23] from March 2015 adopted by participants from 187 nations, directly involving 25 Heads-of-State in the negotiations;
- *Transforming Our World: The 2030 Agenda for Sustainable Development*[24] from September 2015 with its seventeen *Sustainable Development Goals* (Fig. 4) agreed upon by 193 nations, directly involving more than 150 Heads-of-State; and

- *Paris Agreement*[25] from December 2015 ratified by 117 nations among the 197 parties to the *United Nations Framework Convention on Climate Change*, entering into force on 4 November 2016 with more than 150 Heads-of-State directly involved.

In an holistic manner, the Sustainable Development Goals (Fig. 4) are characterized as a *"knowledge platform… a plan of action for people, planet and prosperity."* While they were crafted in a political environment with urgencies of the moment – these goals offer humankind a timeless gift that is purposeful today and will continue to be so into the distant future.

FIGURE 4: The 17 *Sustainable Development Goals* established by the United Nations in 2015.[26]

In our globally-interconnected civilization – the evidence required for the welfare and security of nations (Fig. 4) is international, interdisciplinary and inclusive (the 3 I's). Among these holistic features, the biggest challenge is inclusion, which is open ended, if for no other reason than the evidence for informed decision-making must look across generations (Fig. 2). The

[23] http://www.unisdr.org/we/coordinate/sendai-framework
[24] https://sustainabledevelopment.un.org/post2015/transformingourworld
[25] http://unfccc.int/paris_agreement/items/9444.php
[26] http://www.un.org/sustainabledevelopment/sustainable-development-goals/

decisions involve all of the science-diplomacy elements (Table 2) to achieve economic prosperity, environmental protection and societal well-being. On a global scale – the seventeen Sustainable Development Goals (Fig. 4) help to frame the holistic capacity within and between nations, shaping the future of our globally-interconnected civilization.

3. Science and Technology (S&T) Advice Networks in Foreign Affairs

Recognizing the need to build *"knowledge platforms"* within and between nations, the *International Network of Government Science Advice* (INGSA) was established in 2014 to consider the *"use of scientific evidence in informing policy at all levels of government."*[27] INGSA operates under the aegis of the *International Council for Science* (ICSU), which is a non-governmental organization with a global membership of national scientific bodies and international scientific unions, involving 142 nations currently.[28]

ICSU is now merging with the International Social Science Council to more fully mobilize the knowledge and resources of the international science community for the benefit of society, complemented by the S&T organs of the United Nations as well as networks of science academies around the world (Table 3).

TABLE 3: International Networks of Science Academies

Global Academy Networks		Regional Academy Networks	
Name	**Characteristics**	**Name**	**Characteristics**
The World Academy of Sciences (TWAS)	Global network of scientists among developing nations (launched 1983)	European Academies' Science Advisory Council (EASAC)	National science academies of the EU Member States (launched 2001)
InterAcademy Panel (IAP)	Global network of science academies (launched 1993)	Inter-American Network of Academies of Sciences (IANAS)	Among the countries of the Americas (launched 2004)
InterAcademy Medical Panel (IAMP)	Global network of medical and scientific academies (launched 2000)	Network of African Science Academies (NASAC)	Academies of sciences in Africa (launched 2001)
InterAcademy Council (IAC)	Global network of national scientific academies and corresponding organizations (launched 2000)	Association of Academies and Societies of Sciences in Asia (AASSA)	Academies of sciences in Asia (launched 2012)
Global Young Academy	Global network of young scientists (launched 2010)		
InterAcademy Partnership (IAP)	Global academy network of networks (launched 2016), bringing together the IAP (IAP for Science), IAMP (IAP		

[27] http://ingsa.org
[28] http://icsu.org

	for Health) and IAC (IAP for Research)

Moreover, mechanisms to create government bridges with the national academies are being initiated independent of institutional or political interests, such as the Scientific Advisory Mechanism through the European Commission's Directorate General for Research and Innovation.[29] In addition, there is increasing investment in S&T networks for trade and economic development, as reflected by the *Partnership for Skills in Applied Sciences, Engineering and Technology* (PASET) in Sub-Saharan Africa.[30] A typology of S&T connection mechanisms, enabling scientists across various career stages and disciplines to build relationships with policymakers, has been compiled by the American Association for the Advancement of Science.[31]

At the international level, national governments interact in terms of their foreign affairs. S&T advisors involved with foreign affairs exist at the highest levels of national governments with their heads-of-state and foreign ministers (Table 4). Recognizing the 'silo' nature of governments, there also can be external S&T advisors in health, trade, defense and other ministries with more focused foreign remits. While Table 4 identifies nations with individual S&T advisors, other countries have opted for a different institutional arrangements for S&T advice, including government services, advisory boards and agencies.

TABLE 4: Science and Technology (S&T) Advisors Involved with Foreign Affairs at the Highest Levels of National Governments

Level of S&T Advisors and Starting Year of the Position Among Nations			
Heads-of-State	**Starting Year**	**Foreign Minister[1]**	**Starting Year**
United States	1941	United States	2000
United Kingdom	1964	United Kingdom	2009
Australia	1989	New Zealand	2010
India	1999	Japan	2015
Cuba	2004	Senegal	2016
New Zealand	2009	Oman	2017
Malaysia	2010	Poland	2017
Ireland	2012	[1] The *Foreign Minister Science and Technology Advisor Network* (FMSTAN) emerged in 2016.	
Canada	2016		

[29] https://ec.europa.eu/research/sam;
[30] http://www.worldbank.org/en/programs/paset
[31] AAAS Center for Science Diplomacy. 2017. *Landscape Analysis of Mechanisms Around the World Engaging Scientists and Engineers in Policy.* American Association for the Advancement to Science. Washington, D.C.

The appearance of S&T Advisors to Foreign Ministers is very recent,[32] originating in 2000 (Table 4). Emergence of the *Foreign Minister Science and Technology Advisor Network* (FMSTAN) is even more recent, starting effectively in February 2016 with a meeting convened by the U.S. Science and Technology Advisor to the Secretary of State at the National Academy of Sciences in Washington, D.C. This initial meeting involved the four S&T advisors to foreign ministers from Japan, New Zealand, United Kingdom and United States along with diplomats from twelve other nations: Chile, Ghana, Kazakhstan, Kenya, Malaysia, Oman, Panama, Poland, Senegal, South Africa, Ukraine, and Vietnam.

A few months later, Senegal became the next member of FMSTAN. In 2017, Oman and Poland have joined FMSTAN to date. This nascent global network is focusing initially on four areas to articulate the benefits of investing in internal S&T advisory capacity within foreign ministries to more fully complement external capacity:

1) Raising awareness about the importance of enduring S&T advisory capacity in foreign ministries;
2) Sharing best practices and lessons learned in building S&T advisory capacity;

3) Strengthening S&T advisory capacity in foreign ministries; and

4) Coordinating respective S&T diplomacy activities.

S&T advisors to foreign ministers are not necessarily experts on all scientific matters, but they understand science and know where to find the most appropriate expert on any given topic. They have the skills to explain evidence required for informed decision-making about foreign affairs, serving as evidence brokers in our increasingly transboundary world with constantly emerging complexities. Characteristics of S&T advisors generally and with specific focus on foreign affairs were revealed by the *Vienna Dialogue* (Table 5), considering their roles as evidence brokers to reveal options (Fig. 2) that contribute to informed decision-making by nations across the international landscape.

TABLE 5: Characteristics of S&T Advisors to Foreign Ministers

S&T Capacity	Diplomatic Capacity	Personal Capacity
• Knowledge broker vs. advocate	• Communication ability	• Emotional intelligence
• Interdisciplinary skills	• Publically astute	• Create trust
• Look far afield	• Fearless policy advice	• Good listener and teacher

[32] National Research Council. 1999. *The Pervasive Role of Science, Technology, and Health in Foreign Policy: Imperatives for the Department of State.* National Academy Press, Washington, D.C.

• Agility to different resources • Systems thinker • International insights	• Understand cultures for advice • Diplomatic and S&T skills • Institutional access	• Personal touch to be helpful • Ethics • Make others look good

Among the nearly 200 nations in our world, seven Foreign Ministers now have S&T Advisors. The *Vienna Dialogue* (Table 1) is a tribute to Dr. Vaughan Turekian (United States), Sir Peter Gluckman (New Zealand), Prof. Robin Grimes (United Kingdom), Dr. Teruo Kishi (Japan) and Prof. Aminata Sall Diallo (Senegal). These S&T Advisors to Foreign Ministers and their predecessors are the pioneers of a global network (Table 3), establishing a new level of diplomacy across foreign ministries[33-34] at the intersection of national interests and common interests on a global scale (Fig. 5).

FIGURE 5: Global interests of our civilization – which is now interconnected arcoss the Earth (Fig. 1) – require balance between national interests and common interests with urgencies across security and sustainability time scales (Fig. 2).

[33] National Research Council. 2015. *Diplomacy for the 21st Century: Embedding a Culture of Science and Technology Throughout the Department of State.* National Academy Press, Washington, D.C. 190 p.

[34] Turekian, V. and Kishi, T. 2017. Science and Technology Advising in Today's Foreign Policy," *Science & Diplomacy*, Vol. 6, No. 1. (http://www.sciencediplomacy.org/perspective/2017/science-and-technology-advising-in-todays-foreign-policy).

Before such balance can be achieved, the first step is build common interess among nations, which is an important result of science diplomacy, promoting cooperation and preventing conflict. Such balance and stability in our world involves evidence from the natural and social sciences along with integration of stakeholder perspectives and governance records that contribute to informed decision-making (Fig. 3) for the benefit of nations individually and collectively.

The S&T acceleration through the industrial[35] and digital[36] revolutions coincides closely with human-population growth, probably because necessity is the mother of invention. On our common journey, S&T connections now operate with urgency across security and sustainability time scales (Fig. 2), creating international challenges and opportunities that influence the foreign affairs of nations on a global scale (Fig. 5).

Science, technology and innovation introduce new challenges as well as new solutions that transform our world, probably since humans began walking the Earth. Today and forever after – for the security and sustainability of nations individually and collectively (Figs. 1-5) – S&T advice in foreign ministries and the global development of the *Foreign Minister Science and Technology Advisor Network* (Table 3) is a source of holistic capacity and hope for our globally-interconnected civilization.

> *Science knows no country because knowledge belongs to humanity, and is the torch which illuminates the world.*
>
> Louis Pasteur

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[35] Toynbee, A. 1957. *The Industrial Revolution*. Beacon Press, Boston.

[36] Isaacson, W. 2015. *The Innovators: How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution.* Simon and Schuster, New York.

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