

Science Diplomacy

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ABSTRACT: In the age of global warming, pandemics and political East-West tensions, the time for science diplomacy has come. Science diplomacy originated during the Cold War era when institutions, such as the International Institute for Applied Systems Analysis (IIASA), built institutional foundations to connect scientists via empirical and rational facts in order to solve global issues of concern aside from potential political realities and country stance differences. Today's most pressing international challenges in climate change, pandemic prevention and resilient finance despite rising East-West tensions call for a renewed spirit to discuss global problems without political biases and historic international customary practice.

KEYWORDS: Climate change, Cultural diplomacy, Global common goods, Global warming, Negotiation, Negotiation Leadership, Pandemic, Prevention, Public policy, Resilience finance, Science diplomacy

Introduction

Today's global challenges in climate change, pandemic outbreaks but also humanitarian crises due to political conflicts demand for urgent action of the global community. Time windows close on humankind's ability to revert global warming. Highly-transmittable pandemics can bring healthcare capacities to their limits. Humanitarian suffering in the eye of territory invasions and newly-emerging frictions between East and West have reached unprecedented urgency for attention to finding common-ground driven solutions fast and efficiently.

In the coming together of all nations to solve global issues of concern, such as global warming, pandemic prevention and humanitarian crises, global governance institutions have done excellent work and proved successful leadership in the past decades. Another form of more informal strategies to discuss global crises leaving aside political frameworks and customary law practices, is to connect and build a bridge of mutual understandings of global community members via scientific facts.

As early as in the 1930s and at its height during the old Cold War, researchers came together and aligned in order to discuss matters-of-facts and rational findings leaving aside any political agenda and historical denominations. This practice became known as Science Diplomacy. At the forefront of Science Diplomacy stood the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria, which – to-this-day – informs public leaders based on science-driven interdisciplinary findings and interculturality-derived insights.

Science Diplomacy builds on “scientific collaborations...to address common and shared problems” (The Vienna Statement on Science Diplomacy 2022). Science diplomats advocate for “free and open exchange of scientific ideas and information” (The Vienna Statement on Science Diplomacy 2022). Building on the integrity of research and societal responsibility focus of science, science diplomacy fosters “freedom of cooperation” (The Vienna Statement on Science Diplomacy 2022).

The following paper acknowledges today's global challenges in climate change, pandemic prevention but also humanitarian crises that demand for urgent action of the global community. With problems being too-big-to-fail requiring global collaboration and fast action, the challenges of our lifetimes appear to only be surmountable if tackled by a rational scientific collaborative approach. The time for Science Diplomacy has therefore come.

In the method of Science Diplomacy, however, clear guidelines and *modi operandi* are still missing to this day. A scientific investigation of the concept of Science Diplomacy and how scientific diplomatic countries are benefiting from a science diplomacy approach, is not studied by macroeconomic models yet. This paper first introduces the concept of Science Diplomacy, drawing from the history of the International Institute for Applied Systems Analysis, to then capture the most pressing contemporary issues of concern of our times. Lastly, a macroeconomic framework will be introduced to study Science Diplomacy as a global panacea to the most urging problems of our lifetime.

Science Diplomacy

Science diplomacy uses scientific collaborations among nations to address common problems and build constructive international partnerships for their solutions (The Vienna Statement on Science Diplomacy 2022). As a rather informal and unpaid diplomatic service, scientists are thereby engaging in technical, research-based academic discourse and scientific exchange with the goal of collaborating based on facts to understand and alleviate global concerns.

Originating since the 1930s in concept but practiced vividly during the Cold War, science diplomacy benefitted from the political and financial independence of scientists, who often could exchange information freer from governmental oversight and media scrutiny control than conventional diplomats. Science diplomats were mainly researchers trained to focus on facts and scientific goals rather than promoting national country interests or advocating for stakeholder demands.

Topics of scientific cross-border interests became subject to informal meetings to discuss the emergence of potential global challenges and world community needs. Oftentimes, scientists were the only elite group who was allowed to travel freely under restrictive regimes, granting them a global network in the governance and development of science. Historic examples of scientific collaboration despite political adversities include explorations and scientific measurement of distance and time as well as grand accomplishments in technology and energy creation. Potential advancements during Cold War that were driven by science diplomacy were the closing of the Ozone Layer, successful development of nuclear energy, space exploration and technology transfers.

Science diplomacy appears to be practiced by scientists to advice and inform as well as support policy objectives with international impetus and/or global governance focus. Science diplomacy also benefits from attracting a range of scientists who are willing to collaborate and practice heterodox – in terms of unconventional methodology – scientific ethics. Science diplomats' scientific cooperation thereby forms a network of scientific exchange around the world, governmental leaders may turn for maintaining communication channels in times of political tensions when conventional diplomacy is deadlocked (Gluckman, Quirion, Sachs & van Jaarsveld 2022). Science diplomacy is therefore a research collaboration-based informal network of allies that transcends nationalism (Gluckman et al. 2022).

Science Diplomacy is considered as a new diplomacy form different from traditional diplomatic ties and a subform of international relations or soft diplomacy (Constantinou & Sharp 2016; Barston 2014; Bjola & Kornprobst 2018; Nye 1990; Sharp 2016; Szkarlat 2020). At the core of science diplomacy rests scientific cooperation and compromise for higher goals of global stability, sustainable development and common security.

Science diplomacy also allows for pooling of diversified viewpoints and a larger range of funding than conventional national scientific endeavors. The international sharing of organizational capacities and historically-grown expertise is bundled with a clear focus on empirically-driven results aside from national-politically-tainted red tape. As a rather unconventional approach to tackle global challenges and mainly focused on often hard-to-

understand or inaccessible scientific jargon, science diplomacy collaboration can also benefit from less media scrutiny and market interference.

Historically, science diplomacy was practiced successfully at the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria from the end of the 1960s on throughout the Cold War (Gluckman et al. 2022). On the back then neutral country ground Austria, scientists from East and West could discuss and exchange research-based knowledge and *en passant* build bridges and lasting ties between two blocs that were officially politically distanced (Gluckman et al. 2022). Scientists focused on common issues of concern and advancing global progress towards a better future for all and thereby incepted concepts like sustainable development, nuclear disarmament and space exploration (Gluckman et al. 2022).

Global governance institutions, like the World Bank, International Monetary Fund and United Nations, are building on science diplomacy to this day. Not only in the elevated number of academic-hired Bretton Woods institutions officials. But also in formal ties and open collaborations with universities and scientific organizations, such as National Academy of Sciences.

Around the world, science diplomacy appears to come to action and push global progress to fruition. Successful examples are the Conferences of the Parties (COP) Intergovernmental Panels on Climate Change (IPCC) reports, which are usually led by scientific investigators and rolled out with the help of global governance institutions, foremost the United Nations. The Sustainable Development Goals of the United Nations but also the Unequal World Conferences of the United Nations have become hallmarks of science diplomacy delivering tangible research output and credible results aside from political agendas.

Most recent notable advancements were the push towards science diplomacy as a soft power during the US President Barack Obama administration. Notable institutional support is – to this day – provided by national Academies of Sciences around the world. The American Association for the Advancement of Science (AAAS) in Washington D.C. houses a Center for Science Diplomacy to bring together “scientists, policy analysts, and policy-makers” to “share information and explore collaborative opportunities” (Center for Science Diplomacy of the American Association for the Advancement of Science). The European Union also advocates for science diplomacy in EU-funded projects and international programs, such as the European Master in Law & Economics.

Leaders in science, politics but also the industry have acknowledged the power and influence of science diplomacy beyond traditional governmental efforts and conventional international development. Global challenges that are too-large-to-fail and can only be surmounted by concerted intellectual effort besides from political agendas call for science diplomacy solutions. Global challenges related to climate change, global health and national stability lay at the intersection of science and international relations.

Climate change

The climate change crisis has gained unprecedented urgency in the most recent decade. Most recent estimations project the world to be on the brink of five disastrous climate tipping points, including melting ice sheets, coral reef die-off, permafrost thaw, glacier loss, monsoon shifts and rainforest diebacks (Armstrong McKay, Staal, Abrams, Winkelmann, Sakschewski, Loriani, Fetzer, Cornell, Rockström & Lenton 2022). Scientific account gives the world community a decade to act on climate change before irreversible lock-ins and substantial tipping points will be reached. The world could end up in an environmentally-hostile state and it will never be possible to bring back stable environmental climate conditions if no concerted action is taken to reduce human-made greenhouse gas emissions.

Overall, climate change has already led to and will continuously lead to irreversible tipping points and lock-ins that will degrade the common welfare (Kellett, Weller, Faulwasser, Grüne & Semmler 2019). The extraction and use of non-renewable fossil fuels is attributed as one of the main causes of human-made global warming and a highly volatile market endeavor. Global warming can be slowed by limiting the total cumulative global CO₂ emissions – but only if this occurs on an international scale and in a globally-concerted action plan.

Historically, the advanced countries have gained welfare and rising living standards by the use of fossil fuel energy and intensive CO₂ emissions, while the developing countries have not and appear nowadays as the most burdened with the climate disasters. In the aftermath of the 2020 United Nations Conference of the Parties (COP26) meeting on Climate Change, it has been argued that the advanced countries have an obligation and responsibility to finance the adaptation to global warming of the low-income countries through direct transfers and credit guarantees (Sachs 2021).

Future economic growth depends on climate change (Hansen 2014). Climate change risks are manifold and comprise of physical risks in weather extremes, wildfires, landslides, flooding, heatwaves, hurricanes, storms and typhoons, smog and many other forms of environmental damage. Climate-related finance costs are also imbued in transition risks in stranded assets as for causing volatility in financial systems.

Macroeconomically, costs arise as a result of damages that are exacerbated by extreme temperature and severe weather events (Banerjee 2014). The measurement of the widespread effects of temperature changes includes catastrophes but also response lags and slow feedback in the wake of environmentally-changing conditions (Bonnen, Klasen & Semmler 2014; Hansen & Sato 2016).

In the treatment of risk, economic and non-economic climate risks have to be considered – such as, for example, tipping points and irreversible lock-ins that could cause Greenland ice shields and the Arctic Sea ice to disappear or collapse as well as ocean circulations that cause hurricanes and typhoons (Brock, Engström & Xepapadeas 2014; Keller & Nicholas 2014). Tipping point effects could increase weather extremes and intensify tropical storms, hurricanes, typhoons and cause weather extremes to occur more frequently. Results could be drastic if considering sea level rises, heat waves and desert formations as well as draught impacts on the ecosystem but also human development. Future vulnerability depends not only on climate change but also on the development path, mitigation, adaptation policies and precautionary measures (Hansen & Sato, 2016).

Overall, climate change is expected to lead to drastic changes in productivity, food supply and labor working conditions. Tipping points and irreversible lock-ins with long-run changes will require improved climate projections to better inform climate risk management on a global scale (Keller & Nicholas 2014). Mitigation efforts of the international community will be needed that target to avert the global effects of climate change. Adaptation efforts around the world must be concerted to cope with local effects of climate change, such as regional disasters.

In the effort to curb harmful CO₂ emissions, problems have arisen historically. The New York Times most recently discussed the disparate impact of climate policies and climate protection attention disparities (Flavelle 2021a, b). Geographically-determined economic prospects in light of climate change reveal vast inequalities in the distribution of future climate-induced economic gain or loss prospects. While ethical imperatives lead to the claim for redistribution of some of the gains of global warming into territories that are losing out from climate change; political realities may hinder efforts to avert climate change. Free rider problems exist, whereby countries that do not take action may benefit from the other countries efforts. Political historical facts may also deter countries from action on climate change, as

was shown during the Copenhagen Intergovernmental Panel on Climate Change Conferences of the Parties (COP).

Novel policy efforts are now focused on redistribution via taxation and bonds strategies (Semmler, Braga, Lichtenberger & Toure 2021; Puaschunder forthcoming). While a current World Bank Report presents a global overview on the current state of climate taxation and climate bonds usage around the globe, it calls for macroeconomic models to inform on the implementation strategy of climate bonds and tax use as a climate gains redistribution and global warming loss burden sharing (Semmler et al. 2021). Current climate change mitigation and adaptation financing efforts are calling for innovative green investment strategies around the globe.

An emerging literature and awareness on the economic gains and losses of a warming globe being distributed unequally between countries is the basis of redistribution schemes. In the aftermath of the COP26 annual climate meeting of the United Nations, Jeffrey Sachs (2021) put forward an idea of funds for climate change mitigation and adaptation that should be raised by climate tax-funded grants provided by some countries as transfer payments, while other countries should be recipients of green bonds granted to low-income countries. A refinement in prioritizing which countries should be grantors and which recipients based on macroeconomically-informed criteria will need a scientifically-informed concerted action of all nations of the world.

Alternative market-driven solutions appear in the Cap-and-Trade scheme but also in Socially Responsible Investing (SRI) and market solutions to curb harmful CO₂ emissions that can only be effective if implemented on a world-wide scale in a relatively fast pace. Ethics of inclusion in the environmental domain as a novel climate taxation-and-bonds strategy to redistribute climate change gains can only raise widespread momentum for a transitioning to a zero-carbon global economy if carried by a global community.

Global pandemic prevention

The new Coronavirus crisis (COVID-19) that started in December 2019 opened eyes for the human impact of deadly pandemics. The novel coronavirus SARS-CoV-2 that first emerged in 2019 accounts for the most unexpected globally-widespread external shock to modern humankind. In January 2020, the World Health Organization declared a state of emergency with international relevance over COVID-19, and in March 2020 a global pandemic. COVID-19 changed behavioral patterns around the world dramatically and will have a lasting impact on society (Baldwin & Weder di Mauro 2020).

As of the end of 2022, over 600 million recorded infections have caused almost 7 million documented deaths in more than 220 countries and territories around the globe (Worldometer Coronavirus Cases 2022). According to estimates, the actual number of infections is a multiple of around 4 up to 13 of the reported and recorded case numbers (Aizenman, Carlsen & Talbot 2021; Mandavilli 2021; McPhillips 2021).

Over the course of the spread of the novel Coronavirus, people around the world have become aware that taking preventive measures can limit the spread of the deadly and debilitating virus – including social distancing and social contact tracking, collective and individual hygiene, preventive healthcare and foresighted nutrition as well as vaccination and medication (Britt 2020; Harrison 2021; Puaschunder 2021; Rubin 2020; Sachs, Horton, Bagenal, Amor, Karadag Caman & Lafortun 2020; WebMD 2020). Prevention and holistic medicine play an important role whether the disease turns out to follow a trajectory of severe or only a mild symptom.

The further the COVID-19 healthcare crisis deepened, the more it became apparent that in some previously-infected individuals the virus lingers to the point of debilitation and often changes health conditions long term. From 10% upwards to more than 50% of those

previously-infected with COVID develop long-term symptoms of the disease, which are often diffuse, come in waves and – to this day – are not well understood (Hart 2021; Searing 2021).

The large-scale dimension of COVID-19 infections around the world is underscored by an estimated 10-50% of those previously infected with COVID-19 facing some kind of longer-term or long-term health impact and/or chronic debilitation that is currently not well-understood by the medical profession (Hart 2021; Searing 2021). Given the worldwide spread of the virus and that the demographic likelihood to become a COVID Long Hauler peaks in the 30-50 years of age bracket, we can predict a large-scale, long-term and global impetus of COVID long-haul induced change.

From the history of humankind and the knowledge about previous diseases but also the currently-blatantly noticeable effect of COVID-19 on almost all features of life, global attention has risen to finding a common ground on future worldwide healthcare pandemic prevention. With reference to historical precedents of the past, global concerted efforts to detect deadly diseases early on and report and exchange information on contagion strategies are currently being called for.

The widespread and long-term impacts of COVID and its legacy may flourish international science diplomacy in a healthcare and common disease prevention direction that will likely transform the law, economics and governance of our world and modern society lastingly.

Resilience finance

The worldwide web of finance and economics has risen steadily in the previous decades. Globalization became a hallmark for international development. Global finance and international trade were seen as ultimate powers to lift the entire world population onto a more developed level.

Yet with the advent of global interconnections between finance and economics driven by digitalization and data transfer around the globe, also lurking contagion risks became apparent. Shadows of the invisible hand were vividly outlined in the 2008-09 world financial recession financial spill-overs, food insecurity emerging out of commodity prices' international interdependence and global health safety risks in spreading diseases in an increasingly mobile general population (Centeno et al. 2013).

The downsides of global dependencies on international capital and world trade are also apparent in the case of political divestiture. Thereby, socially responsible investors use their market power to attribute global governance goals. By foreign direct investment flows, SRI relocates capital with the greater goal of advancing international political development (Schueth 2003; Starr 2008).

Political divestiture features capital withdrawal from politically incorrect markets – for example, such as the foreign investment drain from South Africa during the Apartheid regime and the current capital flight from Sudan as for the humanitarian crisis in Darfur or the search for clean energy and market reaction to Russia's accession attempts.

In the contemporary revived East-West tensions, the time has come to acknowledge the disparate impacts of foreign capital drain. Politically-laden arguments for economic sanctions may also be coupled with scientifically-led methods development to estimate the international costs of nationalism and political divestiture.

Disparate impact analyses of science diplomats without national interests may find creative redistribution means to alleviate patterns of inequality due to negative externalities of sanctions. New science diplomacy methods may detect unnoticed and less discussed inequalities in the 21st century in order to lead leadership guided by scientific facts to address ethics of inclusion to adjust for relative disparities in the hope for equal opportunities and resilient finance for all.

Future research

Climate change imposes massive environmental challenges and unforeseeable human living condition degradation potential. With rising unpredictable risks and a complex ecosystem challenge as never before being imposed on humankind, the call for science-informed united action against climate change has reached unprecedented momentum.

The novel Coronavirus SARS-CoV-2 imposes the most unexpected external economic shock to modern humankind. The currently-ongoing COVID-19 crisis has challenged healthcare around the world. The hope for global solutions in international healthcare pandemic outbreak monitoring and crisis risk management is rising and demand for concerted action growing.

The contemporary East-West tensions have pushed continents towards scarcity in energy and commodities. An unforeseeable end and historically-tainted, politically-laden negotiations prepare the stage for advocating for a science-based solution to stabilize economies and support those innocent groups within society that are affected the most. A scientific disparate impact analysis of Law & Economics may inform how to stabilize economies on a global scale and ensure resilience finance options to become available for vulnerable populations.

In all the mentioned contemporary tragedies of our lifetimes, science diplomacy appears as a beacon of light and ray of hope to connect the world in a united wish to overcome challenges successfully and grow stronger on externally-adverse shocks. Advocating for science diplomacy also enlightens science as a profession, which is often criticized for being a competitive field with a hostile collegial climate and negative socio-psychological externalities. Science diplomats would be trained to be socially-versed and diplomatically-fit. Science diplomacy could also help scientists find meaning and additional value in their doing beyond impact factors and could touch the laypeople's everyday life with quality results.

Science diplomacy could also address the call for heterodox scientific methods granting interdisciplinary and international exchange a prominent role in science. Lastly, in the most recent call for heterodox scientific ethics, science diplomacy could serve in genuine support of creative thinking to develop innovative ideas in a protected environment, inspiring others to move traditions forward respectfully, thoughtfully and meaningfully and to allow for breaking hierarchical dynamics in mutual exchange of insights while meeting in collective appreciation for the differences.

As for future research endeavors, to this day, the question remains whether scientist diplomats or diplomat scientists are more effective than conventional modes of governmental and governance diplomacy and international relations. Until today, we have no clear economic model that investigates which science diplomacy ingredients are favorable and how science diplomacy is related to macroeconomic stability variables.

References

- Aizenman, Nurith, Audrey Carlsen & Ruth Talbot. 2021. "Coronavirus by the numbers: Why the pandemic is 10 times worse than you think." *NPR*, February 6, 2021. Retrieved at <https://www.npr.org/sections/health-shots/2021/02/06/964527835/why-the-pandemic-is-10-times-worse-than-you-think>.
- Baldwin, Richard & Beatrice Weder di Mauro. 2001. "Economics in the time of COVID-19." Retrieved at <https://cepr.org/sites/default/files/news/COVID-19.pdf>.
- Banerjee, Lopamudra. 2014. "Climate thresholds, weather extremes, and catastrophic losses." In Lucas Bernard & Willi Semmler (Eds.), *The Oxford Handbook of the Macroeconomics of Global Warming*, pp. 567-587. Oxford: Oxford University Press.
- Barston, Ronald Peter. 2014. *Modern Diplomacy*. Routledge: Oxon.
- Bjola, Corneliu & Markus Kornprobst. 2018. *Understanding International Diplomacy: Theory, Practice and Ethics*. Routledge: Oxon,

- Bonen, Anthony, Stephan Klasen & Willi Semmler. 2014. "Economic damages from climate change: A review of modeling approaches." *Schwartz Center for Economic Policy Analysis* working paper 2014-3, 2014. Retrieved at <https://ideas.repec.org/p/epa/cepawp/2014-3.html>.
- Britt, Robert Roy. 2020. "Long-lasting COVID Symptoms: Early research helps quantify coronavirus long-hauler' experiences." *Elemental*, August 14, 2020. Retrieved at <https://elemental.medium.com/new-survey-identifies-98-long-lasting-covid-symptoms-87935b258a3e>.
- Brock, William, Gustav Engström & Anastasios Xepapadeas. 2014. "Energy balance climate models, damage reservoirs, and the time profile of climate change policy." In Lucas Bernard & Willi Semmler (Eds.), *The Oxford Handbook of the Macroeconomics of Global Warming*, pp. 19-52. Oxford: Oxford University Press.
- Centeno, Miguel Angel, Angela N. Creager, Adam Elga, Edward Felton, Stanley N. Katz, William A. Massey & Jacob N. Shapiro. 2013. *Global systemic risk: Proposal for a research community*. Princeton University, NJ: Princeton Institute for International and Regional Studies working paper.
- Center for Science Diplomacy of the American Association for the Advancement of Science, Retrieved at <https://www.aaas.org/programs/center-science-diplomacy>.
- Costas, M. Constantinou & Paul Sharp. 2016. *Theoretical perspectives in diplomacy*. *SAGE Handbook of Diplomacy*. London: Sage.
- Flavelle, Christopher. 2021a. "Billions for climate protection fuel new debate: Who deserves it most." *The New York Times*, December 3, 2021. Retrieved at <https://www.nytimes.com/2021/12/03/climate/climate-change-infrastructure-bill.html>.
- Flavelle, Christopher. 2021b. "The climate bill includes billions in funding: Will it be spent fairly?" *The New York Times*, December 8, 2021. Retrieved at <https://www.nytimes.com/2021/12/03/climate/climate-change-infrastructure-bill.html>.
- Gluckman, Peter, Rémi Quirion, Jeffrey Sachs & Albert S. van Jaarsveld. 2022. "Scientific diplomacy keeps reason alight in dark times: *Nature* 604: 7906, 425.
- Hansen, James E. 2021. "Environment and development challenges: The imperative of a carbon fee and dividend." In Lucas Bernard & Willi Semmler (Eds.), *The Oxford Handbook of the Macroeconomics of Global Warming*, pp. 639-646. Oxford: Oxford University Press.
- Hansen, James E & Makiko Sato. 2016. "Regional climate change and national responsibilities." *Environmental Research Letters* 11: 9-17.
- Harrison, Arielle. 2021. "70% of COVID long haulers have impaired organs up to 4 months after infection, study finds." *KuTv*, April 27, 2021. Retrieved at <https://kutv.com/news/local/70-of-long-haulers-have-impaired-organs-up-to-4-months-after-covid-19-infection>.
- Hart, Robert. 2021. "Long Covid has over 200 symptoms and leaves 1 In 5 unable to work, study finds." *Forbes*, July 15, 2021. Retrieved at <https://www.forbes.com/sites/roberthart/2021/07/15/long-covid-has-over-200-symptoms-and-leaves-1-in-5-unable-to-work-study-finds/?sh=7f71338e5eb2>.
- Keller, Klaus & Robert Nicholas. 2014. "Improving climate projections to better inform climate risk management." In L. Bernard & W. Semmler (Eds.), *The Oxford Handbook of the Macroeconomics of Global Warming*, pp. 9-18, 2014. Oxford: Oxford University Press.
- Kellett, Christopher M., Steven R. Weller, Timm Faulwasser, Lars Grüne & Willi Semmler. 2019. "Feedback, dynamics, and optimal control in climate economics." *Annual Reviews in Control* 47: 7-20.
- Mandavilli, Apoorva. 2021. "Coronavirus infections much higher than reported cases in parts of U.S., study shows." *The New York Times*, July 21, 2021, <https://www.nytimes.com/2020/07/21/health/coronavirus-infections-us.html>.
- McPhillips, Deidra. 2021. "Study estimates US COVID-19 infections may be 4 times higher than reported." *CNN*, January 5, 2021. Retrieved at https://www.cnn.com/world/live-news/coronavirus-pandemic-vaccine-updates-01-05-21/h_833be27384fd892bf390e72fe3f34b1e.
- Nye, Joseph S. 1990. *Bound to lead: The changing nature of American power*. New York: Basic Books.
- Puaschunder, Julia M. 2021. "Alleviating COVID-19 inequality." *ConScienS Conference Proceedings*, pp. 185-190.
- Puaschunder, Julia M. forthcoming. "Funding Climate Justice: Green Bonds and Diversified Interest Rates." In: S. Boubaker & L.T. Han, *Handbook of Environmental and Green Finance: Towards a Sustainable Future*, World Scientific.
- Rubin, Rita. 2020. "As their numbers grow, COVID-19 'Long Haulers' stump experts." *Journal of the American Medical Association* 14: 1381-1383.
- Sachs, Jeffrey D. 2021. "Fixing climate finance." *Social Europe: Politics, Economy and Employment & Labor*, November 17, 2021.
- Sachs, Jeffrey D., Horton, R., Bagenal, J., Amor, Y.B., Karadag Caman, O. & Lafortun, G. 2020. "The Lancet COVID-19 Commission." *The Lancet* 396: 454-455.
- Schuth, S. 2003. "Socially responsible investing in the United States." *Journal of Business Ethics* 43: 189-194.

- Searing, L. 2021. “50 percent of people who survive covid-19 face lingering symptoms, study finds.” *The Washington Post*, November 15, 2021. Retrieved at https://www.washingtonpost.com/health/long-covid-50-percent-lingering-symptoms/2021/11/12/e6655236-4313-11ec-9ea7-3eb2406a2e24_story.html.
- Semmler, Willi, Joao A. Braga, Andreas Lichtenberger, Marieme Toure & Erin Hayde. 2021. “Fiscal policies for a low-carbon economy.” Washington, D.C.: *World Bank Report*, Retrieved at <https://documents1.worldbank.org/curated/en/998821623308445356/pdf/Fiscal-Policies-for-a-Low-Carbon-Economy.pdf>.
- Sharp, Paul. 2016. *Domestic public diplomacy, domestic diplomacy, and domestic foreign policy: The transformation of foreign policy*. Oxford University Press.
- Starr, M. 2008. “Socially responsible investment and pro-social change.” *Journal of Economic Issues* 42(1): 51-73.
- Szkarłat, Monika. 2020. “Science diplomacy of Poland.” *Humanities and Social Sciences Communications* 7(1): 1-10.
- The Vienna Statement on Science Diplomacy, International Institute for Applied Systems Analysis (IIASA), Retrieved at <https://iiasa.ac.at/network-with-us/vienna-statement-on-science-diplomacy>.
- WebMD. 2020. How scientists predict how many people will get COVID-19. WebMD, April 1, 2020. Retrieved at <https://www.webmd.com/lung/news/20200401/how-scientists-predict-how-many-people-will-get-covid-19#1>.
- Worldometers.info. 2022. *Coronavirus Cases*. Available at <https://www.worldometers.info/coronavirus/>.