China's International Science and Technology Trends and the US–China Relationship

Denis F. Simon

Only if core technologies are in our own hands can we truly hold the initiative in competition and development.
PRC President Xi Jinping's Speech to the Chinese Academy of Sciences/Chinese Academy of Engineering, Beijing, June 2014.

Abstract *The twenty-first century represents a new, dynamic period in world history in terms of the conduct of international science and technology (S&T) affairs. It is a “new era of science diplomacy”. The ability of science diplomacy to thrive has been aided by the onset of globalization. Globalization has enabled the almost unhindered movement of people, products and services, and knowledge across borders. Clearly, China has been a major beneficiary of globalization, utilizing access to the world’s leading corporations, best universities, most dynamic research institutes, and government and non-governmental international organizations and scholarly bodies as a way to support and advance its own modernization efforts. For most of the last 40 years, China has had increasingly unencumbered access to these critical repositories of know-how and information, though Chinese leaders also have felt steadily more and more anxious about the degree to which the openness of the world economy would continue to work in China’s favor. This essay analyzes China’s evolving strategy, policies, and practices regarding its international S&T relations, with special emphasis on the US–China relationship. The essay also highlights China’s strategic posture and footprint in terms of its goal of becoming a player of growing influence in the shaping of international S&T affairs.*

Keywords The twenty-first century represents a new dynamic period in world history in terms of the conduct of international science and technology (S&T) affairs • “New era of science diplomacy” • Globalization has enabled the almost unhindered movement of people, products and services and knowledge across borders • China has been a major beneficiary of globalization • The degree to which the openness of the world economy would continue to work in China’s favor • China’s evolving strategy, policies, and practices regarding its international S&T relations

D. F. Simon (✉)

Duke’s Fuqua School of Business, Duke University, Durham, USA

© The Author(s) 2021

H. Wang and A. Michie (eds.), *Consensus or Conflict?*, China and Globalization,
https://doi.org/10.1007/978-981-16-5391-9_23

253

1 Introduction

The above statement by Chinese President Xi Jinping could not have been more prophetic as just four short years later, China found itself embroiled in both a deleterious “trade war” and destructive “technology war” with the United States and several of America’s allies.¹

The twenty-first century represents a new, dynamic period in world history in terms of the conduct of international science and technology (S&T) affairs. One might even designate it a “new era of science diplomacy.”² The ability of science diplomacy to thrive has been aided by the onset of globalization. Globalization has enabled the almost unhindered movement of people, products and services, and knowledge across borders. Clearly, China has been a major beneficiary of globalization, utilizing access to the world’s leading corporations, best universities, most dynamic research institutes, and government and non-governmental international organizations and scholarly bodies as a way to support and advance its own modernization efforts.³ For most of the last 40 years, China has had increasingly unencumbered access to these critical repositories of know-how and information, though Chinese leaders also have felt steadily more and more anxious about the degree to which the openness of the world economy would continue to work in China’s favor.⁴

This essay analyzes China’s evolving strategy, policies, and practices regarding its international S&T relations, with special emphasis on the US–China relationship. The essay highlights China’s strategic posture and footprint in terms of its goal of becoming a player of growing influence in the shaping of the contemporary international S&T system. Finally, the essay concludes with a discussion of the changing landscape of the international S&T system, with a focus on the ways in which the US–China relationship might alter the evolving structure and operation of the system in the coming years.

2 China’s Evolving Global S&T Footprint

With the founding of the People’s Republic of China (PRC) in 1949, the Communist Party of China (CPC) formulated and implemented a bilateral S&T cooperation agreement with the former Soviet Union—a relatively short-lived arrangement that was followed by the policy of self-reliance (*zili gengsheng*) in response to Moscow’s termination of technology assistance in 1960. The relationship between Moscow and Beijing had been highly asymmetrical as China was very dependent on the former USSR for massive inflows of industrial equipment and managerial know-how to jump-start the Chinese economy after the end of the civil war with

¹Buckley (2014).

²Ruffini (2017).

³Samuelson (2018).

⁴Zukus (2017).

the Kuomintang in 1949. Beginning in the late 1970s, China's leadership shifted its focus to rapid economic and S&T development under the so-called "four modernizations" program. In terms of China's international S&T relations, guidelines were adopted to lay the foundation for expanded global engagement and a more proactive international participation, including significant growth in the level of international S&T cooperation. By the end of the twentieth century, China had achieved full-scale implementation of an international S&T cooperation system focused on acquiring foreign technology and fostering cooperative arrangements with leading international scientific institutions.

With the reform and opening up policy inspired by Deng Xiaoping, and general abandonment of the policy of self-reliance, China joined numerous international and regional S&T organizations, and promoted foreign plant, equipment, and technology imports. During the first two decades of the twenty-first century, the government has pushed for more mutually beneficial international S&T cooperation, developing more well-articulated programs designed to achieve greater symmetry of results and more well-defined mutual benefit. Currently, China is playing an increasingly active role in international organizations—encompassing major global science and engineering programs, while at the same time strengthening technical assistance to developing countries.⁵ Since 2012, China has sought to plan and promote innovation with what it now characterizes as a global vision, embodied in various key national policies.⁶ China's so-called "vaccine diplomacy", as a response to the COVID-19 global pandemic, is a good example of how Chinese leaders hope to use science and technology as an instrument of foreign policy.⁷

At present, China is in the process of transforming itself from primarily a technology importer to a technology importer and exporter, as it pursues a strategy of promoting indigenous innovation as well as global engagement.⁸ It is no longer simply a technology learner but also is a knowledge provider, especially within new promising efforts such as the Belt and Road Initiative (BRI). Overall, central to its efforts to move from imitator and copy-cat to an innovation-driven nation are a series of policies and initiatives associated with becoming a more central player in international S&T affairs.⁹ By mid-2020, China had established S&T cooperation partnerships with 161 countries and regions and executed 114 inter-governmental agreements on S&T cooperation. In addition, the PRC has joined over 200 inter-governmental international S&T cooperation and research organizations. It has appointed over 150 S&T diplomats for its 70+ overseas offices in 47 countries. And, as of the beginning of 2018, over 400 Chinese scientists were holding office

⁵Cheng (2008).

⁶For example, the "Opinions of the CPC Central Committee and State Council on Deepening S&T Reform and Speeding Up the Building of a National Innovation System," the 13th Five Year Science and Technology Plan, the Innovation-Driven Development Strategy, and the Belt and Road Initiative on building international S&T cooperation networks.

⁷Wang (2020).

⁸Central Committee and State Council, "Outline of the National Strategy of Innovation-Driven Development," Beijing: May 20, 2016.

⁹Xie et al. (2014).

in international S&T-related NGOs, including approximately 30 as chairman and 50 as vice-chairman. Among the world's 48 major cross-border big science programs and projects, four have been initiated by China and 17 have China's official participation; China also serves as an observer in three programs. This all demonstrates that China's presence in the structure and organization of global S&T governance is becoming more meaningful and steadily expanding.

3 The Administrative Structure of China's International S&T Policies

The S&T governance structure for China's international S&T engagement is comprised of a number of key state agencies and organizations. Three organizations have emerged as the most important in organizing and managing China's international S&T relations: the Ministry of Science and Technology (MOST), the Chinese Academy of Sciences (CAS), and the China Association for Science and Technology (CAST).¹⁰

3.1 Ministry of Science and Technology (MOST)

The Ministry of Science and Technology is the predominant entity that plans and implements China's overseas S&T activities, providing the overarching framework for international S&T cooperation and exchanges at different levels and by increasingly diverse actors. Since its mission is to foster economic growth and technological advancements, MOST coordinates basic research, frontier technology research, and the development of key and advanced technologies.

In March 2018, the State Administration for Foreign Experts (SAFEA) was placed under the oversight of MOST. SAFEA, heretofore, has been responsible over several decades for bringing to China a broad range of experienced scientific and technical experts from abroad to assist their Chinese counterparts with various developmental problems and issues. It also has sent large numbers of PRC delegations abroad, especially to the US, Western Europe, and Japan for training in management and an assortment of technical fields.

¹⁰Others include the Foreign Affairs Leading Group of the CPC, and the Inter-Ministerial Coordination Mechanism, which includes the Ministry of Agriculture (MOA), Ministry of Education (MOE), the international cooperation departments of local governments, the China Association for International Science and Technology Cooperation, and enterprises. MOST also commands some 20 affiliated agencies, including the Institute of Scientific and Technical Information of China, the High-Tech Research and Development Center, the Intellectual Property Rights Center, the Supervision Service Center for Science and Technology Funds, and the National Science and Technology Venture Capital Development Center.

As part of the same change, the China National Natural Science Foundation (NNSFC) also was moved under the direct oversight of MOST. The NNSFC oversees support for much of the research in basic science that occurs within China. Its creation was modeled after the US National Science Foundation; the onset of serious peer review in the submission and awarding of grants helped improve the reliability and credibility of the funding system. The NNSFC has developed extensive links with the top scientists around the world and has included members of the international S&T community in the periodic reviews of its operational performance.

3.2 *Chinese Academy of Sciences (CAS)*

The Chinese Academy of Sciences, directed by President Hou Jianguo, is structured as a comprehensive, integrated R&D network. It is the nation's high-end think tank, a merit-based learned society as well as a system of higher education and has long functioned as the linchpin of China's national and global S&T ambitions.

Since its inception, the CAS has made significant progress in fostering international S&T cooperation relationships.¹¹ It has succeeded in developing extensive and diverse partnerships with research institutes and scientists across the globe, and is well-positioned to play a central role in shaping China's S&T diplomacy from a substantive point of view.¹² To take some key examples, CAS has accomplished the following:

- set up 20 collaborative groups with the German Max Planck Society for the Advancement of Science in areas including astronomy, life sciences, and materials science;
- implemented several talent programs (such as the CAS Fellowship for Senior and Young International Scientists), attracting over 1,000 foreign scientists and engineers to conduct R&D activities at its institutes;
- initiated a BRI action plan in 2016 calling for international S&T cooperation, training, and cultivating more than 1,800 S&T management and high-tech personnel for relevant countries;
- plans to become the spearhead and central hub for an Asia-Pacific, Eurasia, and Asia-Africa collaborative innovation network system.¹³

Among its major overseas initiatives are (a) the South America Center of Astronomy, (b) the Sino-Africa Joint Research Center, (c) the China-Sri Lanka Joint Center for Education and Research, and (d) the CAS Innovation Cooperation Center in Bangkok.

¹¹Bai (2017a).

¹²Poo and Wang (2014).

¹³Bai (2017b).

3.3 *China Association for Science and Technology (CAST)*

Founded in 1958, the China Association for Science and Technology (CAST) is under the direct jurisdiction of the Secretariat of the CCP's Central Committee. Its role includes promoting S&T exchanges and indigenous innovation, protecting and advancing the interests of science workers, organizing S&T professionals to participate in formulating national S&T policies, and facilitating non-governmental international S&T exchanges and cooperation through developing liaisons with foreign S&T associations and scientists.

4 *China's International S&T Strategy and Policies*

Since Deng Xiaoping's reform and opening up, the Chinese government has been consistent in encouraging Chinese organizations to engage abroad to better leverage international S&T resources as well as formulating a series of policies to guide its S&T engagement with other countries.¹⁴ Today, these policies reflect the growing emphasis on strengthening indigenous innovation, especially in view of the negative impact of the so-called US–China trade/tech war on PRC access to advanced technologies. From China's position, indigenous innovation is necessarily coupled with an outward-looking strategy that calls for S&T partnerships and international collaborations. International S&T relations are thus best understood as constructed to serve China's goal of becoming a global innovation leader, especially in key technologies such as clean energy, artificial intelligence, and life sciences.¹⁵ Not only are scientific and technological advances sought to promote long-term economic development, but they also are viewed as an important component of national wealth and influence, especially as the centrality of technology as a tool of state power in international relations has increased.

Generally speaking, China's state-led efforts to achieve indigenous innovation have not been well received by Western rivals.¹⁶ The 15-Year Medium-to-Long-term Plan for Science and Technology (MLP) launched in 2006, for example, was roundly denounced in a US Chamber of Commerce-sponsored report bearing the title, *China's Drive for Indigenous Innovation: A Web of Industrial Policies* (McGregor 2010).¹⁷ The report accused China of “hunkering behind the ‘techno-nationalism’ moat”, switching “from defense to offense” in light of its economic ascendance as well as its fear of foreign domination.¹⁸ The MLP, according to the report, “is considered by many international technology companies to be a blueprint for technology theft on

¹⁴Bound et al. (2013).

¹⁵Cao and Suttmeier (2017).

¹⁶Atkinson et al. (2017).

¹⁷Ministry of Science and Technology, National Medium- and Long-Term Science and Technology Development Plan (2006–2020),” Beijing, 2006 (in Chinese).

¹⁸McGregor (2010).

a scale the world has never seen before.” The report obviously contains a great deal of hyperbole; nonetheless, the MLP’s policies did provoke a strong reaction from China’s major trade and technology partners that has not dissipated over time.

For China, the emphasis on indigenous innovation, however, is not analogous to self-reliance as was the case in the 1960s. Rather, it always has been seen as a pathway to strengthen China’s leverage in the international technology market.

Budgetary allocations for international S&T cooperation have grown apace with domestic S&T spending, especially at the local level.¹⁹ As suggested above, China’s emphasis on indigenous innovation should not obscure the fact that the government has spared no efforts to deepen and enlarge bilateral and multilateral S&T partnerships. The 13th Five-Year S&T Plan,²⁰ in contrast to its predecessors, designated specific tasks and goals that serve Beijing’s strategy of science diplomacy, transforming itself from passive recipient to active donor. The 14th Five-Year Plan (2021–2025) continues to place similar, if not greater, emphasis on the continued expansion of international S&T engagement.

China’s international S&T cooperation strategy is carefully differentiated according to a categorization of partners into developed, developing, and neighboring countries. The current effort calls for increased openness of China’s national S&T programs, including offering governmental support to overseas experts who are expected to take the lead—or at least participate in—national S&T program strategic research. It also calls for deepening international cooperation on an equal basis with international partners (a claim which has been met with some skepticism). To achieve its goals, China has initiated and organized significant international S&T programs and projects; has become more actively involved in helping to set global S&T agendas; has accelerated the sharing of global large-scale scientific research information; and begun active participation in global S&T governance, including the formulation of international S&T cooperation rules. Chinese scientists have increased their participation in scientific exchange programs, as well as seeking official positions in major international scientific and technological organizations. China’s most recent—and clearly most dramatic—diplomatic move in the science field is the BRI S&T cooperation network, which calls for promoting technology transfer and assisting countries in training young scientists—a clear indication, as noted, that China plans to play a central role in the international S&T landscape as a technology exporter as well as importer.²¹

Despite comments from foreign critics that the PRC appears to be becoming more “techno-nationalistic”, China clearly continues to look outward—out of both conviction and necessity—as it plans its S&T future. Its recent steps toward greater technology self-reliance must be understood in the context of the changing global political situation rather than a purposeful, fundamental Chinese turn inward.

¹⁹OECD, “China Headed to Overtake EU, US in Science & Technology Spending, OECD Says,” Paris, December 11, 2014.

²⁰See in particular the 13th Five-Year Plan Special Program on International S&T Cooperation (Beijing, MOST, 2016)

²¹Zou (2018).

5 China's Bilateral S&T Relations with the United States

Over the last four decades, S&T cooperation has been one of the foundational elements in the Sino–US relationship. While some modest renewal of S&T exchanges occurred in the aftermath of “ping-pong” diplomacy and the now infamous Nixon visit to China in the early 1970s, the 1979–89 period featured the formal inception of China–US S&T cooperation. The 1979 agreement on science and technology has functioned as the overall framework under which the two governments have promoted S&T cooperation in various forms and through a large number of channels.

Bilateral S&T cooperation experienced rapid growth during the early years as it was new and exciting; the two parties invested significantly to support joint programs. Nevertheless, it is important to bear in mind that the two sides also had quite different objectives. The US intended to counter the former USSR by developing rapport and trust with China, and the US technical community was interested in the distinctive natural and social phenomena in China. The Chinese side, however, assumed that engagement with the international science and technology system, especially with the US, would be a useful vehicle for promoting economic construction and catching up with the world's leading powers (Suttmeier 2014).

From 1990 to 1999, bilateral S&T relations witnessed some apparent decline, followed by resumption of activity. Due to the events in Tiananmen Square on June 4, 1989, many programs were curtailed, including China–US space cooperation. Gradual resumption of bilateral S&T cooperation began in 1994. With China's accession to the World Trade Organization in 2001, the possibilities for a new growth spurt began to appear.²²

From 2000 to 2015, China–US relations were characterized by comprehensive and rapid development. President Hu Jintao remarked in 2012 that S&T cooperation had become an important driving force for Sino–US relations, and a critical component of people-to-people exchange. This cooperation fell into six main areas: energy and physics, health and life science, ecology and environmental science, agriculture and food science, science education, and meteorology. It is worth noting that, beginning in 2006, the agenda for bilateral S&T cooperation took on a heightened awareness of the urgent need to explore interdisciplinary research themes, frontier science, and international hot issues such as global warming, new and clean energy, carbon capture, and aggregation. In other words, the rising salience of these global issues altered the context for both sides to think about how S&T cooperation might proceed. A series of new initiatives were taken that were based on high-level political commitments. The Strategic Economic Dialogue (SED) that came into place in 2006 and later the Strategic and Economic Dialogue (S&ED) produced an enormous expansion of activities and functions. The latter launched the Ten-Year Framework on Energy and Environment Cooperation in 2008, designating clean water, clean air, clean vehicles, and energy efficiency as key areas with high priority for cooperation. By 2011, China had risen to become the top collaborating partner of the US,

²²Richard Suttmeier and Denis Simon, “Conflict and Cooperation in the Development of US-China Relations in Science and Technology,” in Mayer et al. (2014).

outpacing the UK, Japan, and Germany—nations that have been long-time partners of the US in science.²³ By the end of the decade, in jointly authored scientific papers, Chinese scientists claimed the first authorship much more frequently than their US counterparts.²⁴

One of the key elements of these new dialogues was the initiation of the China–US Innovation Dialogue, which actually began in 2008 as part of a discussion about how the Chinese side could improve the performance of its own innovation system. The Innovation Dialogue had great potential when it started because it might have served as a useful vehicle for exchanging meaningful information about the evolving requirements for successful innovation in the twenty-first century. An Experts Group represented by top-level Chinese and American scholars from both countries served as a vehicle for ensuring the right issues were placed on the agenda and that the discussions were focused on the key topics of relevance to both sides. Unfortunately, the Innovation Dialogue ended up being neither a real dialogue nor about innovation. On the US side, growing disenchantment with China in the US Congress led to constraints being placed on the White House Office of Science and Technology (OSTP) about the expansion of S&T cooperation; funding was tightly controlled. Moreover, the innovation agenda was hijacked by the US Trade Representative Office (USTR) and made to focus on extracting concessions from the Chinese side on pressing trade matters. The bulk of discussions ended up concentrating on dismantling Chinese policies regarding the promotion of indigenous innovation. On the Chinese side, the prize still remained in sight, though their side also was often distracted from the core innovation-related issues that they expected to drive the Innovation Dialogue.

Starting at the tail end of the Obama Administration, more and more questions were raised about China's willingness to play by WTO rules and to adhere to related commitments about IPR protection, etc. Under the former Trump administration, however, the anti-China rhetoric built up great momentum; a number of major steps were taken to alter the essential dynamics of the overall China–US S&T relationship. Certain things have become clear as the two countries have attempted to find a way around their ongoing trade war—which essentially has been centered on technology issues. Because of tensions over trade, technology transfer, the South China Sea, and human rights (e.g., Hong Kong and Xinjiang), the prevailing political environment will barely support the status quo, let alone an expanded S&T relationship. In fact, the newest iteration of the bilateral S&T agreement did not experience a smooth renewal process during the last set of negotiations; the final decision to renew the agreement was done under the shadow of darkness and given a very low profile from both governments. The decision by the Trump Administration in March 2018 to invoke special legislation under the US Section 301 laws concerning trade and investment with China brought on the beginning of “a trade war” with China over programs such as Made in China 2025 as well as technology theft and other related

²³Suttmeier (2014).

²⁴Wagner et al. (2015).

IPR issues positioned at the center of American concerns.²⁵ It also became the focal point of critical comments by Christopher Wray, the Director of the Federal Bureau of Investigation, in early 2018 when he warned American higher education institutions about the vulnerability of their institutions to “non-traditional” collectors of critical scientific and technical information coming from China. The onset of the COVID-19 virus in Wuhan in early 2020 and its transition into a major global pandemic further exacerbated the tensions between the Trump administration and the Chinese leadership under President Xi Jinping. Finger-pointing, accusations about blame and lack of transparency, and even racism have traveled across the Pacific in both directions, thus further damaging the possibilities for rekindling the kind of relationship that existed in the past. To say that there continues to be a fundamental lack of trust between both sides would be a serious understatement.

6 Key Outstanding Issues and Challenges

In spite of the overall progress China has made in institutionalizing its international S&T cooperation structure and expanding its cross-border S&T relationships, numerous challenges remain. IPR protection has been, and will continue to be, a serious concern for foreign S&T partners—in both public and private sectors. As China is increasingly viewed as a steadily growing serious competitor, relations have become more difficult across a broad spectrum of issue areas.²⁶ For example, given China’s plans for massive investments in the development of artificial intelligence, will Western countries be willing to collaborate with China and perhaps put their technology at risk? China’s increasingly prominent position across the global innovation landscape has made it increasingly difficult for China still to play the role of the learner in its cooperation with developed countries. Clearly, China is in the process of re-defining its role—one where it desires more of a co-equal partnership in terms of cooperation and contribution. This will require China to afford far greater IP protection for foreign partnerships. President Xi Jinping’s heightened attention on IPR issues reflects this reality as well as the fact that with Chinese innovation on the rise, China now has more skin in the game insofar it has its own IPR to protect.²⁷

China’s role in international S&T cooperation is evolving from learner to partner and rule maker. We expect to see increasing proactive participation by China in global S&T governance, as Chinese scientists hold a growing number of positions at major international S&T organizations, and more Chinese-initiated “big science” projects and advanced research facilities that attract scientists from all over the world.

²⁵USTR, “Special 301 Report on Intellectual Property Rights.” Office of the United States Trade Representative, Washington, DC, 2017.

²⁶Friedberg (2020).

²⁷For a somewhat different conclusion, see Baark (2014), who argues that China does not yet possess the excellence that positions its scientific research institutions as world-leading, even if research in key organizations may be able to support leading and original research achievements.

Under the specific reforms that were part of the recently completed 13th Five-Year STI Plan and Strategy of Innovation-Driven Development, China has put forth a strategic vision for future international S&T cooperation that includes very ambitious goals and innovative mechanisms.²⁸ If reforms are successfully implemented, they should increase the openness of China's S&T programs, resulting in the growing demand for international cooperation. Through comprehensive reforms, some of the internal issues that have thus far hindered S&T cooperation, such as restrictions on travel abroad and the use of funds, might be resolved.

Nonetheless, the Chinese government needs a clearer definition of its key role—one that improves the quality of its services to China's major innovation actors. It already is reinforcing its international S&T cooperation strategy through such efforts as promoting innovation dialogues, expanding cultural and educational exchanges, upgrading the scale of communications, and involving an expanded number of stakeholders such as universities, research institutes, and private enterprises. The government also is setting up special funds and programs, with different purposes and characteristics, to promote international S&T cooperation. More resources are being channeled and leveraged from central and local governments, as well as the growing private sector. In the long run, China needs to develop a more coherent strategic plan and policy umbrella that will better guide its international cooperation activities and design more innovative mechanisms to better meet the country's changing needs. The 14th Five-Year Plan promises to launch additional reforms that will foster more mutually beneficial international S&T cooperation; these reforms will provide more incentives to potential and existing foreign partners that ideally will overcome present anxieties and uncertainties that too often have constrained the growth of new activities.

The bottom line looking ahead is a simple one—there is no major international S&T-related issue whose meaningful solution will not require close cooperation and collaboration with China.²⁹ Climate change, clean energy, global pandemics, water, and other such issues are central to China's future and mission-critical for the world if the human race is to avoid major disasters like the COVID-19 pandemic in the coming years. China's decision in 2017 to step up on global climate change despite the US decision (under former President Trump) to withdraw from the Paris Accord signed during the Obama Administration marks an important turning point in China's role in the international S&T system. The decision by the Biden Administration to renew the US participation in the Paris Accord certainly will provide China with added incentives to stay the course in terms of its stated commitments. That said, China's willingness to take on a leadership role on this issue portends an expanded Chinese presence across multiple similar issue areas. Chinese behavior is starting to re-shape the global S&T and innovation landscape. How countries such as the US,

²⁸Ministry of Science and Technology, "The 13th Five-year National Plan for Science, Technology and Innovation of the People's Republic of China," Beijing: August, 2016.

²⁹Manmadov (2020).

the UK and Japan as well as the EU will deal with this new Chinese posture remains one of the key challenges facing the international S&T system.³⁰

Overall, however, there remain two outstanding issues for Beijing. The first revolves around the immediate impact of the COVID-19 pandemic on the Chinese economic trajectory. In May 2020, it was announced that the national budget for science would be cut by 9.1%; this stands in contrast to the 13% increase that occurred in 2019.³¹ The gap is to be filled by local governments, so that the net result still will be a 3% increase in public R&D expenditures. MOST Minister Wang Zhigang specifically noted that international cooperation would still be a major high priority. In the 14th Five-Year Plan, R&D spending will increase around 7% or more annually, accompanied by a hefty increase in spending on basic research.

The second issue deals with the impact of the COVID-19 experience on the prevailing structure and operation of the global supply chain and the evolving Chinese role in the global value chain. Lots of rumors have emerged about how the US and other multinational firms will begin a significant retreat back home as their degree of dependence on China and Chinese suppliers have come to be viewed as a high-risk factor. While initial indications from many multinationals are that there is a great deal of hyperbole surrounding many of the initial media reports, the fact remains that there are likely to be some pronounced shifts over the coming 2–3 years that could alter China's plans to become a high value-added manufacturer and new source of design and innovation in the near future. Xi Jinping's pronouncements in summer-2020 about China's need to pursue a so-called "dual circulation" strategy that gives greater attention to the Chinese domestic economy highlights the fact that China is already preparing for potential discontinuities, including the increased difficulties that it will have gaining access to advanced foreign know-how.³² This is particularly true with respect to semiconductors and integrated circuits as well as the equipment and software needed to design and manufacture advanced chips.

Looking ahead, given that the country aims to deepen engagement in global S&T innovation governance, we likely will see more Chinese efforts in agenda-setting for global innovation systems and more emphasis on rule-setting for key international S&T projects focusing on key global challenges including food security, energy security, environmental protection, climate change, public health, etc. It remains unclear, however, whether the international S&T community will welcome an enhanced Chinese presence without a series of concomitant gestures from Beijing with respect to prevailing norms and values in areas such as Internet freedom, cyber security, IPR protection, and research ethics. The verdict is not out yet on just how bumpy the road ahead will be for China's international S&T relations if present concerns are not addressed head-on by Beijing.

³⁰Wagner (2020).

³¹Chen (2020).

³²Lelyveld (2020).

7 Where Are US–China S&T Relations Headed?

Given the huge stakes involved and before any further costly missteps occur, there is much to be gained from the Biden Administration along with the US Congress stepping back to take a new, fresh look at the role and value of the S&T relationship with China. The framework that supported the bilateral S&T relationship requires a re-think and re-adjustment. Both sides need to reach a new accommodation based on the new evolving realities. The shift from asymmetry to greater parity in many key S&T fields indicates that the hierarchical relationship of the past must give way to a more balanced relationship where the concept of mutual benefit has more tangible meaning. In essence, a new road map is needed to define the rules of the road for the next 40 years, one that considers the growing synergies as well as the growing differences and changing priorities between the two countries.

Why take this important step back instead of just following on with the approach adopted by the former Trump Administration? As noted, the basic dynamics of the Sino–US bilateral S&T relationship have shifted, particularly because of a narrowing of the technological gap between the US and China. In addition, S&T cooperation along with scholarly exchanges no longer sit on the safe margins of the relationship between Beijing and Washington; they are now center stage as the competition between the two countries heats up. Everyone recognizes that we live in a world of high-speed technological change and rapidly accelerating innovation. For the first time in four decades, China's progress in science and technology provides an opportunity for there to be real reciprocity and mutual benefit going in both directions—from the US to China (as in the past) and now from China to the US. In addition, as noted earlier in this essay, many critical global problems, including climate change, clean energy, and global pandemics, are tied to S&T whose meaningful solutions will depend on the close US–China collaboration. The need for cross-border collaboration and cooperation is not just something nice to pursue; it has become a growing necessity. A renewal of the bilateral S&T relationship in an environment of greater transparency and better defined “rules of the road” could help to re-build confidence and restore trust in the political sphere. In turn, constructive engagement regarding S&T cooperation could prove to be one of the key missing ingredients that will take the two countries away from the current problem-plagued situation into the future in a smoother, less tension-filled manner.

References

- Atkinson RD, Cory N, Ezell SJ (2017) Stopping China's mercantilism: a doctrine of constructive, alliance-backed confrontation, information technology and innovation foundation (ITIF)
- Bai C (2017a) International S&T Cooperation Network will be established by 2030. National Natural Science Foundation of China
- Bai C (2017b) ORI network of International S&T Cooperation to be established by 2030, Beijing, Xinhua

- Baark E (2014). Is China Becoming a Science and Technology Superpower, and So What? Discussion paper presented at conference entitled 'The Evolving Role of Science and Technology in China's International Relations,' 3–4 April 2014, Arizona State University, Tempe, AZ.
- Bound K, Saunders T, Wilsdon J, Adams J (2013) China's absorptive state: research, innovation, and the prospects for China-UK collaboration. NESTA, London
- Buckley C (2014) Xi urges greater innovation in core technologies. NY Times
- Cao C, Suttmeier RP (2017) Challenges of S&T system reform in China. *Science* 335:1019–1021
- Chen S (2020) Two sessions: China cuts science budget by 9 per cent but national R&D still tipped to grow. South China Morning Post
- Cheng R (2008) China's international science and technology cooperation strategy and policy evolution in 30 years (in Chinese). *China S&T Forum* 7(26):7–11
- Friedberg A (2020) An answer to aggression: how to push back against Beijing. *Foreign Affairs* 150–164
- Lelyveld M (2020) China unveils new strategy for economic growth—analysis. *Eurasia Rev*
- Manmadov S (2020) China is tapping into its intellectual potential. GCTN, Beijing
- Mayer M et al (2014) The global politics of science and technology. Springer International Publishing, Berlin
- McGregor J (2010) China's drive for indigenous innovation: a web of industrial policies. US Chamber of Commerce Global Regulatory Cooperation Project, Washington DC
- Poo M-M, Wang L (2014) On CAS Pioneer initiative—an interview with CAS President Chunli Bai. *Natl Sci Rev* 1:618–622
- Ruffini P-B (2017) Science and diplomacy: a new dimension in international relations. Springer International Publishing, Paris
- Samuelson RJ (2018) China's breathtaking transformation into a scientific superpower. *Washington Post*
- Suttmeier RP (2014) Co-inventing the future? Science diplomacy and the evolution of Sino-US relations in science and technology. Discussion paper presented at conference entitled "The Evolving Role of Science and Technology in China's International Relations", 3–4 April 2014, Arizona State University, Tempe, AZ
- Wagner CS, Bornmann L, Leydesdorff L (2015) Recent developments in China-US cooperation in science. *Minerva* 53(3):199–214
- Wagner C (2020) The Trump administration is curtailing visas for Chinese scientists. That may backfire. *Washington Post*
- Wang Z (2020) Provide strong support for the global fight against the pandemic with pragmatic and efficient scientific and technological cooperation. *Qizuzhi (Truth)*
- Xie Yu, Zhang C, Lai Q (2014) China's rise as a major contributor to science and technology. *Proc Natl Acad Sci* 111(26):9437–9442
- Zou L (2018) The political economy of China's Belt and Road initiative. World Scientific Publishing, Singapore
- Zukus J (2017) Globalization with Chinese characteristics: a new international standard. *The Diplomat*

Denis F. Simon is Senior Adviser to the President for China Affairs at Duke University and Professor of China Business and Technology at Duke's Fuqua School of Business. He has more than four decades of experience researching business, competition, innovation and technology strategy in China and was awarded the Chinese Government's prestigious 'Friendship Award' medal in 2006. He previously served as Executive Vice Chancellor at Duke Kunshan University in China, General Manager of Andersen Consulting in Beijing and the Founding President of Monitor Group China. He has published several books: *Corporate Strategies Towards the Pacific Rim*, *Techno-Security in an Age of Globalization* (1996) and *China's Emerging Technological Edge: Assessing the Role of High-End Talent* (2009). Dr. Simon received his Ph.D. and MA degrees from UC Berkeley. He speaks and reads Mandarin Chinese.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits any noncommercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if you modified the licensed material. You do not have permission under this license to share adapted material derived from this chapter or parts of it.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.