From Cold War science diplomacy to partnering in a networked world

30 years of Sino-US relations in science and technology

Richard P. Suttmeier
University of Oregon, Eugene, Oregon, USA

Abstract

Purpose – The purpose of this paper is to review the history, current activities, and prospects of Sino-US cooperation in science and technology (S&T). It seeks to understand the role of S&T in Sino-US relations, how the relationship has affected Chinese scientific development and, more generally, to better understand the ways S&T affect – and are affected by – the foreign policies of nation states.

Design/methodology/approach – Employing an institutional perspective, the paper is based on interviews in China and the USA and reviews of government documents and press reports.

Findings – Owing to the impacts of the Cultural Revolution on Chinese S&T, the relationship is highly asymmetrical when it began in the late 1970s. As Chinese capabilities have improved, aided measurably by the relationship with the USA, the two sides are now in a position to cooperate more fully across a wide range of areas of interest to both sides. Channels for cooperation have been developed through the two governments, through Chinese and US corporations and through academic institutions in the two countries. Together, these allow for collaborative activities in basic science, commercial research and development, and in S&T in support of public goods.

Originality/value – The Sino-US relationship in S&T has become more important to the two countries as they face an array of daunting challenges of energy, public health, basic research, and new industrial technologies. Yet, the relationship has not been extensively studied in spite of its growing importance. This paper attempts to help overcome this neglect. A better understanding of the relationship will contribute to improved understandings of Sino-US relations more generally, and to the ways in which S&T fit into the foreign relations of major powers.

Keywords International relations, China, United States of America, International cooperation

Paper type Research paper

Background

January 31, 2009 marked the 30th anniversary of the signing of the Agreement Between the Governments of the People's Republic of China and the United States of America on Cooperation in Science and Technology (hereafter, the Agreement). The signing marked the formalization of reestablished ties in science and technology (S&T) between the two countries which began following the signing of the Shanghai Communique in 1972.

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While sometimes dismissed as "scientific tourism" by the American side, the exchanges of scientific delegations which began after 1972 played a critical role in shaping what was to become a far more complex relationship. For the American technical community, these exchanges provided opportunities to bring Chinese talent back into world science, get access to distinctive natural and social phenomena and data, and learn of pockets of Chinese research excellence. But more generally, they led to an appreciation of the great costs to Chinese science and higher education imposed by the Cultural Revolution years. For the Chinese technical community, the opportunity to travel to the US facilities was not only a liberating chance to reestablish contact with international science, but also provided a new perspective on just how far behind China had fallen after years of radical politics.

For the two governments, the S&T relationship was an opportunity to build closer political ties – in spite of a highly asymmetrical nature of scientific development in the two countries – to counter Soviet influence. Six months prior to the January 1979 formal establishment of diplomatic ties, and on the heels of Zbigniew Brzezinski's important visit to China in May, 1978, which helped lay the political foundation for normalization, President Carter's Science Adviser, Dr Frank Press, led a major delegation of representatives from the US technical agencies to China to explore the expansion of relations in S&T. This was then followed by the signing of agreements in the fall of 1978 for cooperation and exchange in agriculture, space, energy, earth sciences, and hydropower, and the important Agreement on the Exchange of Students and Scholars, which opened the way for the one million plus Chinese who subsequently came to the USA for training and advanced degrees. For the USA, the S&T relationship was one more strand in the "web of relationships" it hoped to build with China, one that addressed both many of China's developmental concerns and US long-term interests in global issues. For the Chinese, the relationship offered invaluable access to intellectual resources needed to rebuild the research and higher education systems. Scientific, technological, and political factors were thus mixed together in what was an interesting new initiative in Cold War science diplomacy, and one that facilitated the reestablishment of diplomatic relations between the two countries.

Few would have imagined what the Agreement would have wrought 30 years later. The web of relationships that has been created in S&T is now characterized by multiple institutional strands, with multiple stakeholders having multiple objectives. Although the reforms and investments China has made in research institutes and universities over the past-30 years have not entirely erased the asymmetries of the past, they have certainly made China an especially important partner in research and innovation for many constituencies in the USA. In a number of fields of research and on a number of pressing global problems, the S&T partnership between the USA and China will play a critical role in determining the twenty-first century future. Revolutions in science-based technologies hold the potential for significant enhancements in national wealth and power in both countries, while shared interests in the management of such collective good and bad as climate change, pollution, water and energy availability, food supplies, and a broad range of issues involving risk and safety, are forcing increased attention to knowledge-based approaches to these challenges. The scope of the relationship can be seen in three realms – government programs, industrial cooperation, and academic science[1]. The existence of these different channels represents significant institutional resources for the kinds of strategic partnering on twenty-first century scientific and technological development and global problems alluded to above. Since these challenges have basic research, commercial, and public goods components they require a repertoire of organizational approaches, many of which now exist.

Government programs

The government-to-government relationship, conducted under the Agreement and some 26 subordinate agency-to-agency protocols (themselves having more than 60 annexes), covers a broad range of activities from basic research to technical assistance, in domains ranging from agriculture to transportation. The implementation of the Agreement is the responsibility of the Joint Commission on S&T Cooperation (JCM), which meets every two years and is co-chaired by the Chinese Minister of Science and Technology and by the President's Science Adviser. The S&T Executive Secretaries, led by the Director of the Office of Science and Technology Cooperation of the Department of State and by the Director of the International Cooperation Bureau of the Ministry of Science and Technology, meet during the years when the JCM does not meet. A sense of the government-to-government relationship can be seen in some of the more prominent areas of cooperation[2].

Agriculture

Agricultural agreements between the USDA and the Ministries of Agriculture and Science and Technology (MOST) call for the establishment of several working groups. A US-China High-Level Biotechnology Working Group (BWG) provides a forum for the two sides to exchange views on regulatory and biosafety issues associated with agricultural biotechnology, and involves not only the Chinese Ministry of Agriculture on the Chinese side but also the Administration of Quality Supervision and Inspection and Quarantine (AQSIQ), the Ministry of Commerce, and the Ministry of Public Health. The BWG also includes a Technical Working Group on the environmental and food safety implications of agricultural biotechnology which, in addition to the agencies above, also include representation from the Shanghai Academy of Agricultural Sciences, The Chinese Academy of Agricultural Sciences, The China Center for Disease Prevention and Control, The Chinese Academy of Sciences, Fudan University, and various provincial departments of agriculture. A variety of other activities in the area of food safety have occurred, including discussions of food safety regulatory systems with the National Development and Reform Commission (NDRC).

Other agriculture related activities include cooperation on ethanol and biofuels development, forestry management, soil and water conservation (including cooperation with The Chinese Ministry of Water Resources and the Chinese Academy of Sciences), plant and animal health, control of invasive species, agricultural economics and statistics, nutrition issues, and cooperation on research and management of individual plant and animal species. USDA also cooperates with The Chinese Academy of Agricultural Sciences in the establishment and operation of a Sino-US Biological Control Lab in Beijing. Under its Scientific Cooperation and Exchange Program, USDA has supported the exchange of some 1,500 US and Chinese scientists since the program was initiated in 1978.

Energy

The US Department of Energy (DOE) has also been engaged with China since 1978 but its involvement has intensified considerably in the face of global energy and climate change questions. A Protocol for Cooperation in the Field of Fossil Energy Technology Development and Utilization between DOE and MOST includes five annexes for cooperation: power systems (with China Power Investment Corporation); clean fuels (with NDRC); oil and gas (with China Petroleum and Chemical Industries Association); energy and environmental control technologies (with MOST); and climate science (with the Chinese

Academy of Sciences and the China Meteorological Administration). Activities under these annexes involve training, research and development (R&D) and demonstrations and capacity building in areas of high-global salience, and are becoming increasingly central to Sino-US relations as a result of the Strategic Economic Dialogue (SED) and the new Ten Year Framework for Energy and Environment Cooperation[3].

As China pushes ahead with measures intended to ameliorate the environmental effects of burning coal and as the US struggles to develop a sound strategy for its own reliance on coal, opportunities for cooperation in clean coal technologies are especially notable. China is requiring that new coal burning plants be equipped with supercritical or ultra supercritical generation technology, and has redoubled its efforts to develop commercial scale facilities cold gasification and for CO_2 capture and storage. The Ministry of Science and Technology, with the Huaneng Group, set aside funds for participation in the DOE sponsored FutureGen project, which had been canceled by the Bush administration but now seems to be again funded by the new Economic Recovery Act. Meanwhile, China is pushing ahead with its own clean coal demonstration projects and with its increasing wealth, it has the wherewithal to build large facilities, which are of considerable interest to the USA.

Activities under the Protocol for Cooperation in the Fields of Energy Efficiency and Renewable Energy Technology Development and Utilization have also become especially salient. Again under the protocol, there are a series of annexes – for rural energy development, wind energy, energy efficiency, renewable energy business development, development of electric drive and fuel cell vehicle technologies, and renewable energy policy and planning. With the increasing attention being given to energy efficiency in China and to renewable energy technologies, the technology sharing, technical assistance, training, and business development provided for under this protocol help link the two countries in highly important areas of technology and policy.

DOE is also involved with China in areas of basic research, most notably through agreements for cooperation in high-energy physics and nuclear fusion. The high-energy physics agreement was first signed in January, 1979 and has provided for close cooperation between high-energy physics communities in the two countries, especially in support of the establishment – and recent upgrading of – the Beijing Electron Positron Collider, an important facility which allows for world-class research in China. The largest current collaboration under this agreement is the construction of facilities for studying neutrino oscillations at the site of the Daya Bay nuclear power plant complex, scheduled for completion in 2011. The USA is contributing half of the cost of the detectors, while the Chinese side is paying for the construction and civil engineering. DOE has also assisted in the design and construction of other major facilities including the new Shanghai Synchrotron Radiation Facility.

The Protocol on Cooperation in the Fields of Nuclear Physics and Controlled Magnetic Fusion Research was originally signed in 1983. Activities under the protocol have focused mainly on fusion and have involved training, cooperative research, and design assistance to China in the construction of its new EAST tokamak facility at the Institute of Plasma Physics of the Chinese Academy of Sciences in Hefei. This facility, which was tested and achieved its first plasma in September, 2006, has led to the increase of cooperative, mutually beneficial bilateral activities. With China joining International Thermonuclear Experimental Reactor, opportunities for bilateral cooperation on multilateral issues have also increased. In both the high-energy physics and nuclear fusion cases, we see that China's increasing ability and willingness to pay for large complex and expensive facilities is one of the reasons why it has become an increasingly attractive partner for international cooperation[4].

Finally, in 1998, an agreement between DOE and NDRC on the peaceful uses of nuclear technologies was signed with the China Atomic Energy Authority being the implementing agency on the Chinese side. The agreement calls for cooperation in such areas as nuclear technology, export controls, materials protection, control and accountability, safeguards, emergency management, and high-level radioactive waste management. The DOE activities in the nuclear safety area augment activities under an agreement between the Nuclear Regulatory Commission and the Chinese National Nuclear Safety Administration (NNSA) which goes back to 1981 when NRC entered into an agreement with the State Science and Technology Commission (now the Ministry of Science and Technology). The NRC-NNSA agreement has taken on new life with China's decision to build Westinghouse AP1000 power plants. Meanwhile, Chinese innovations in reactor design, especially its "pebble bed" reactor, are of considerable interest to the US side.

The growing importance of cooperation in energy R&D was further emphasized during Secretary Steven Chu's visit to Beijing in July, 2009, and the announcement that the two governments would establish a joint clean energy R&D center focusing on energy efficiency, clean coal (including carbon capture and storage) and clean vehicles, with an initial investment of US$15 million.

Medicine and public health

Cooperation in the areas of medicine and public health also goes back to 1979 with the signing of the Protocol for Cooperation in Science and Technology of Medicine and Public Health, which provided for cooperation in public health, biomedical research, health care, and health policy. But, the health area has expanded and become quite active in recent years in light of the AIDS epidemic, and in the wake of the SARS outbreak. In 2002, HHS and the Ministry of Health signed a memorandum of understanding for cooperation in fighting AIDS through prevention activities, treatment, and research. As part from the US Emergency Plan for AIDS Relief, activities include research on vaccines, the development of testing kits for rapid diagnosis, surveillance, and innovative treatments.

A second MOU, for collaboration on emerging and reemerging infectious diseases was signed by the two parties in 2005. It provides for a higher profile HHS presence in China with staffing from the Centers for Disease Prevention and Control (CDC), and supports Chinese capacity building through laboratory development, surveillance, enhanced epidemiology, and the establishment of China's own CDC.

The National Institutes of Health (NIH) are also actively involved with China. Chinese researchers have been consistently the most numerous visiting scientists at NIH laboratories (in 2007, there were 630). NIH employs one scientist in Beijing who coordinates with the Chinese CDC, the Chinese Academy of Medical Sciences, and the Chinese Academy of Sciences in facilitating research on a variety of diseases, and plays an important role in the implementation of the agreement on emerging and reemerging infectious diseases; some US$4 million has been spent by NIH on influenza research in China. In addition, NIH has also had its own long-standing MOU with the Chinese Academy of Sciences for cooperation in basic biomedical research. The MOU was first signed in 1983 and was amended in 2005. Among other things, it calls for jointly funded research training in the USA, and continuing support for researchers once they return to China. It is also intended to encourage CAS scientists to collaborate more actively with Ministry of Health entities to raise the level of research capacity in the fields of medicine and public health.

Basic science

US NSF activities with China derive from two protocols. The Basic Sciences protocol is with the Chinese Academy of Sciences, the Chinese Academy of Social Sciences, The Ministry of Education, and the National Natural Science Foundation of China (NSFC). A second protocol involving the US Geological Service as well as the NSF on the US side, and the NSFC, the China Earthquake Administration (formerly the State Seismological Bureau), and the Ministry of Construction on the Chinese side. Under these protocols, NSF has supported a broad range of collaborative research in basic science, engineering, and the social sciences, which amounted to more than $16 million of spending during 2006-2007. NSF has cooperated with China on projects dealing with disaster prediction and mitigation and structural engineering and the mitigation of hazards. Beyond the work under the protocols, however, there are a variety of other activities. In recent years, NSF has emphasized the importance of educational programs in its relations with China and has supported summer research opportunities for American graduate students in China. China also figures prominently in the NSF Partnership for International Research and Education (PIRE) program, which provides for multi-year institutional support for international collaboration involving students and faculty, often on multilateral projects.

China participates as an associate member in the NSF Integrated Ocean Drilling Program, and this past year NSF and NSFC laid the foundations for a multidisciplinary project on climate change. The relationship between NSF and NSFC is especially cordial; as noted above, NSF inspired the establishment of NSFC and has provided ongoing counsel in the management and operation of a basic research-oriented funding agency. In 2004, the two agencies cooperated in convening a forum on basic science for the next 15 years in conjunction with the preparation of China's Medium to Long-term Plan (MLP) for scientific and technological development. NSF also sponsors a variety of high level workshops and symposia in areas of cutting edge work of interest to the two countries, such as recent workshops on nano-scale standards and computer science. As a measure of China's growing importance to NSF, NSF established a representative office in Beijing in 2005[5].

Atmospheric and marine science

The US National Oceanic and Atmospheric Administration conducts activities with China under two protocols, one on atmospheric S&T with the Chinese Meteorological Administration (CMA), and one on marine and fisheries S&T with the State Oceanic Administration of China. A number of working groups have been established under each protocol. In the atmospheric science area, NOAA has played an important role in helping to modernize CMA through training, instrumentation, and software. Meanwhile, China itself has significantly increased its capabilities with the acquisition of more advanced radars, satellites, high-performance computers, and increasingly sophisticated basic science. Areas of cooperation include numerical weather prediction, atmospheric chemistry, and the relationship between monsoons and climate. Under the marine sciences protocol, there is also work on the role of oceans in climate change, and working groups on oceanographic data and information, living marine resources, integrated coastal management, and polar sciences.

Given its size, location, and topography, China figures prominently in earth observation activities of interest to NOAA, and NOAA's leadership in the science and technologies of earth observations makes it of considerable interest to China. China and the USA are both important members of the World Meteorological Organization, and extend their bilateral cooperation into multilateral settings. China and the USA also work together in the Global Earth Observation System of Systems.

The cases, above, are intended to give a flavor to what has become a fairly extensive government-to-government S&T relationship. Clearly, there are a number of other interesting areas that could be examined including, for instance, active programs in metrology at the US National Institute of Standards and Technology, and expanding programs in environmental protection, growing out of the energy and environment initiatives of the SED, involving the US Environmental Protection Agency (EPA), and a new initiative between MOST and EPA on environmental technologies. The list could go on.

Industry

Cooperation through industrial channels began in the early 1980s with the transfer of technology. The initial forms of transfer involved licensing and equipment purchases, but as China's foreign investment regime came to be liberalized during the course of the 1980s, technology transfer increasingly became part of foreign investment projects. By the 1990s, China had developed increasingly sophisticated foreign investment regulations intended to extract as much technology as possible from foreign investors under its so-called "market for technology" strategy. Although US firms were not alone in transferring technology to China, in terms of scale and value of investments, levels of technology, and styles of corporate management, US companies arguably have been the major source of foreign technology for China since the early 1980s, in spite of US export control policies.

China's accession to WTO has required that its foreign investment regime be liberalized, thus undercutting to some extent the policy tools used in the "market for technology" approach. It is in this context, of course, that China has redoubled its support for its own industrial R&D and made the development of its own technical standards and intellectual property central objectives of its MLP. Interestingly, however, as China began to adjust its own industrial and technology policies in anticipation of WTO membership, foreign companies began to show an interest in performing R&D in China, thus facilitating new forms of knowledge transfer.

Interest in investing in R&D in China began slowly in the early 1990s, mainly with the initiation of contracts for research and technical services from Chinese universities and research institutes. Gradually, however, R&D activities were added to corporate investment strategies, and by the end of the 1990s, a number of companies had established R&D centers in China. By the end of 2007, this number had risen to some 1,160, the majority of which were American firms. It is thought that R&D expenditures by companies accounts for at least 15 percent of China's industrial R&D, and perhaps as much as 305 percent. Although a great deal of this R&D activity goes to support manufacturing and marketing in China, for a number of large firms – IBM, Microsoft, General Electric, etc. – China R&D operations have become critical components of global technology development efforts and have led to important basic and applied breakthroughs.

There is considerable debate about the impacts of these operations. On the Chinese side, government policy has been welcoming of these efforts in the belief that they provide China with critical experience in the management of R&D in the kinds of science-based industries China sees as the future of its industrial economy, and will lead to significant knowledge transfers as employees migrate out of the multinational companies (MNCs) to start their own companies or join Chinese enterprises. Nevertheless, there are also critics who argue that most of the benefits from these R&D centers go to the MNCs, and their global operations. The benefits for China do not compensate for the costs in terms of the loss of some of China's best and brightest to employment in MNCs and in terms of policy privileges granted by the Chinese government, in this view.

Similarly, on the US side, critics argue that China-based R&D centers lead to technological leakage which will come back to haunt American companies, and result in the loss in high-paying professional jobs for American scientists and engineers. Defenders of R&D investments in China argue that US companies are forced to globalize their R&D in order to stay competitive, especially with regard to exploiting pools of science and engineering talent wherever it may be. In both the Chinese and US debates, we again see the playing out of tensions between S&T nationalism in S&T globalism.

Academic and professional contacts

At the core of developments in Sino-US collaboration are the thousands of activities occurring at the scientist-to-scientist level. This, of course, is consistent with the traditional culture of academic science, as researchers seek out colleagues with common interests with whom they can share findings, collaborate, or perhaps, compete. Collaboration among individuals in China and the US, of course, has been powerfully influenced by the ties that have developed as a result of Chinese students doing graduate work at the US universities. Mentor-student relations involve research collaboration, which over time evolves into senior colleague-junior colleague collaboration.

A large number of Chinese students who have come to the USA over the 30 years have stayed and taken professional employment in the US universities, companies, and government laboratories. At the same time, these individuals have often maintained ties with colleagues at institutions in China which has also fostered collaboration. Thus, there is also a strong co-ethnic dimension to Sino-US relations in S&T as well. The effects of both the US graduate school experience and the influence of common ethnicity is evident in co-authoring patterns of China- and US-based researchers. When one examines the international co-authoring of China-based researchers, collaborations with US colleagues clearly outnumber those with other countries. Reportedly, nearly 40 percent of China's science and engineering publications in international journals had US-based co-authors. On the US side, some 8 percent had China-based co-authors. Among China-US co-authored papers, the role of co-ethnicity is quite high. A deepening interdependency in academic science, thus, is developing between the two countries.

Further evidence of this trend is the growth of more institutionalized relations between US universities and Chinese counterparts. US universities have been somewhat slow in establishing formal research relationships with Chinese universities, but this is beginning to change. For example, Texas A&M has initiated its China-US Relations Conferences and the UC Santa Barbara has launched a partnership with the CAS Dalian Institute for Chemical Physics, an internationally recognized center for research on catalysis[6]. The Harvard China Project of the Harvard School of Engineering and Applied Sciences and Harvard University Center for the Environment is connected with key Chinese universities in the field of environmental studies. An ambitious new initiative to build inter-institutional cooperation is the "10 + 10 Alliance" which calls for collaborative research and education between the ten campuses in the University of California system, and ten leading Chinese universities. Co-ethnic influences are also evident in these institutional initiatives, for example in the Peking-Yale Joint Research Center for Plant Molecular Genetics and Agro Biotechnology, a collaboration between the Department of Molecular, Cellular and Developmental Biology at Yale and the College of Life Sciences at Peking University. The center is led by Xing-wang Deng, a Member of the Yale faculty who also holds a Changjiang Scholar appointment at Peking University.

Conclusion – partnering in a networked world

The S&T relationship between China and the USA in 2009 is a very different one from that of 1979. Recently, both sides have the opportunity of building a genuine partnership in ways, which were not true 30 years ago. At the same time, they also face the likelihood of becoming competitors in ways, which were not true before – competitors for talent, for market share in high-technology markets, for leadership in clean energy technologies and control over intellectual property and standards, for technologies relevant to national security, and for prestige. The bilateral relationship, furthermore, is increasingly embedded in a series of multilateral interactions – whether in basic research, commercial R&D, or public sector technologies. These are a reflection of the globalization of research and innovation and the emergence of what might be referred to "post-nationalist science." But, while the trends towards globalism continue, so too do the pulls of S&T in support of national security and national economic well-being. The challenges for the two countries moving forward are to ensure that techno-nationalist forces do not excessively interfere with what is becoming an especially valuable relationship, understood in both bilateral and multilateral terms.

At the outset, the relationship of the late-1970s was described as a new departure in Cold War science diplomacy in which both the scientific and political values were at play. Scientific and political values are no less at play in the relationship today, but the formula for integrating them has clearly changed as the world has changed. Cold War concerns no longer drive the relationship, the distribution of scientific and technological capabilities around the world has changed, and science-based technologies affecting competitiveness and national security are never far from political agendas in ways that were not true 30 years ago. Science diplomacy still involves negotiation and mutual adjustment among nation states; in our case, between an established scientific superpower and a rising one. But, it also involves the development of strategies for managing multiple interactions in a world of internationalized research and innovation networks. While the concept of "Chimerican"[7] science has appeal, it is ultimately misleading precisely because of the multiple interactions both China and the USA have with other countries in the networks.

In these networks, the USA can still be thought of as a "supernode," whose S&T assets attract collaborators from around the world. But, while this status in the networks continues, it also faces challenges from other nodes of activity – "emerging supernodes" if you will – whose status is being enhanced by virtue of successful collaboration with other active nodes and by successfully exploiting network externalities. China clearly qualifies as an emerging supernode which has not only build up its domestic S&T assets by its own ambitious policy and investment decisions, but has also shrewdly devised strategies for international cooperation to exploit network effects. Within the networks, though, its bilateral relationship with USA remains by far the most important.

For the USA, the bilateral relationship with China 30 years ago was of little significance for the well-being of its own S&T. This is no longer the case; and trends suggest that cooperation with China will become increasingly important for the health of the US science enterprise and for maintaining its network position. While understood by many in the business, academic, and government technical communities, this insight has not been widely recognized by the political community in the USA, but this is beginning to change.

About 30 years of cooperative relations between the two countries leave both in good positions to exploit these S&T ties to enhance their positions as "supernode" and "rising supernode" in global research and innovation networks. Enhanced cooperation between them will have the effects not only of strengthening the networks, but will also help determine how twenty-first century global problems will be approached and how twenty-first century technological future is to be invented.

Notes

1. Contacts through the National Academy of Sciences, The American Association for the Advancement of Science, and a variety of non-governmental organizations constitute a fourth channel, but in the interest of space, I will not discuss them here.
2. The following information is drawn from US Department of State (2009).
3. The framework provides for intensified cooperation in areas of electric power generation, transportation, clean water, clean air, and wetland preservation. The recently completed fifth SED-added energy efficiency to the framework and enlists the US Trade and Development Agency and the US Export-Import Bank to support private sector activities in addressing "deficiencies in energy efficiency Chinese enterprises" and to assist in the implementation of the clean water program. TDA funding will also be used to support training programs for government officials at the national and provincial levels in pollution reduction and energy efficiency (US Treasury Department Office of Public Affairs, 2008a, b).
4. Although not discussed here, this is true in other fields as well, as seen, for instance, in astronomy with the construction of the Large Sky Area Multi-Object Fibre Spectroscopic Telescope facility.
5. In addition to NSF, other agencies now maintain representatives in Beijing, including DOE, FAA, and units of HHS. These are in addition to seven officers in the Embassy's science counsellor's office.
6. The UCSB-DICP relationship is one of several next-generation projects with China supported by the NSFs PIRE program noted above.
7. A term coined by Niall Ferguson and Moritz Schularick to describe the significance of the China-US financial interdependence for the world economy.

References

US Department of State (2009), *United States-China Science and Technology Cooperation, 2008*, Biennial Report to the US-China Economic and Security Review Commission, Office of Science and Technology Cooperation, Bureau of Oceans and International Environmental and Scientific Affairs, US Department of State, Washington, DC.

US Treasury Department Office of Public Affairs (2008a), US Fact Sheet: Energy and Environment Accomplishment, December 4.

US Treasury Department Office of Public Affairs (2008b), Joint US – China Fact Sheet: The Fifth US – China Strategic Economic Dialogue, December 5.

Further reading

Jin, B., Rousseau, R., Suttmeier, R.P. and Cao, C. (2007), "The role of ethnic ties in international collaboration: the overseas Chinese phenomenon", in Torres-Salinas, D. and Moed, H.F. (Eds), *Proceedings of the ISSI*, CSIC, Madrid, pp. 427-36, available at: http://china-us.uoregon.edu/papers.php

Neureiter, N.P. and Wang, T.C. (2009), "US-China S&P at 30", *Science*, Vol. 323, p. 687.

Seligsohn, D. (2009), "Can the US and China cooperate on coal?", *The Huffington Post*, January 28.

Suttmeier, R. (2008), "State, self-organization, and identity in the building of Sin-US cooperation in science and technology", *Asian Perspective*, Vol. 32 No. 1.

Web sites

http://china-us.tamu.edu/index.php (accessed February 19, 2010).

http://uoip.ucdavis.edu/documents/10 + 10_overview.pdf (accessed February 19, 2010).

www.pyc.pku.edu.cn/index.html (accessed February 19, 2010).

Corresponding author

Richard P. Suttmeier can be contacted at: petesutt@uoregon.edu