PART V

(Political economic) geographies of science
A series of recent statistical reports have called attention to the rapid rise of China’s research and development expenditures and the likelihood that Chinese spending on R&D, in purchasing power parity (PPP) terms, will surpass that of the United States in the not-too-distant future (National Science Board, 2016; Van Noorden, 2016; R&D Magazine, 2016). As these quantitative indicators show, there have been significant changes in the Chinese research and innovation systems over the past two decades. Of particular note is the dominant role played by the industrial enterprises sector in the overall national R&D spending account – now more than 70 percent of the total – a major change from the legacy system in which spending by government was the dominant source of funding (Cao, 2015). This shift reflects the influence of state policy intended to make the industrial enterprises sector the core of the national innovation system.

Other signs of progress include increasing numbers of papers published in international journals, increasing numbers of patents, a large and expanding community of scientists and engineers, and the successful completion of demanding research and engineering projects in such fields as space, ocean engineering, supercomputing, transportation, materials science, etc. These indicators all point to considerable success in implementing science, technology and innovation (STI) policies for transforming Chinese science and catching up with international scientific and technological frontiers.

What these success indicators fail to show, though, is that China’s policies and institutions for research and innovation have also undergone enormous changes over the past 35 years, changes which help explain the successes alluded to above. But they also fail to indicate that these systems continue to face serious problems, and thus remain targets of further reform. Indeed, the quantitative indicators at times mask these problems. Thus, the “transformation of Chinese science” must be understood as part of a multi-decade process of progress, encounters with serious problems, and reform, the success of which is still elusive.

The initial challenges of transformation

The origins of the “transformation” can be traced back to the late 1970s and the end of the Maoist era in China. We should recall that, during the 1950s and early 1960s, China built up a substantial research system under Soviet influence and with Soviet assistance. These efforts enabled China successfully to develop nuclear weapons and the ability to launch satellites (the
so-called liangdan yixing or “two bombs, one satellite” achievements). But, in spite of success in the strategic weapons areas, the disruptions caused by the Cultural Revolution (1966–1976) caused serious setbacks in China’s research and innovation capabilities.

These setbacks led to a rethinking of China’s approach to science and technology during the 1970s, rethinking that was also influenced by China’s increasing exposure at the time to the research and innovation systems of the United States and other OECD countries. This exposure, along with perceptions of the increasing technological progress of its East Asian neighbors, reinforced Chinese understandings that the nation’s capabilities for research and innovation were falling ever further behind international trends.

In 1978, therefore, the post-Mao Chinese leadership headed by Deng Xiaoping initiated a set of policies to give the nation’s science and technology new directions, with science and technology named as one of the “four modernizations”, the pillars of modernizing China¹ (Suttmeier, 1980). In doing so, however, it also embraced practices from the Maoist era that were thought to have been successful. This was especially true of state-directed science and technology planning and the centralized mobilization of resources to support national programs for research and innovation, practices which continue today.

Thus at the dawn of the post-Mao era in the late 1970s, the challenges faced by Chinese leaders were seen more as ones of revitalization, rather than transformation. As noted, the radical politics of the Cultural Revolution had resulted in severe disruptions of Chinese scientific research and higher education. As China’s leaders sought to rebuild disrupted research and educational institutions, they understandably were guided by pre-Cultural Revolution models and practices, some of which – such as national science planning – were held in high regard. But, as the Deng-era policies of reform (gaige) and open-door (kaifang) began to take hold, key decision makers began to realize that pre-Cultural Revolution experience would have to yield to new approaches to policy and institutional design. Whereas the pre-Cultural Revolution experience had been strongly inspired by Soviet practices and assumptions about the role of science in a planned economy, the China of the Deng era was increasingly taking inspiration from the US and other OECD countries, the policies and institutions of which were seen as driving new scientific discoveries, dynamic technology-based economic progress, and formidable national security technologies. An initial challenge of reform was therefore to transform the science and technology system to one that would be more compatible with the market economy assumptions that were beginning to transform the economy.

**The role of the outside world**

This incipient transformation of Chinese science and technology was not only inspired by the experiences of the OECD countries. China also actively exploited the opportunities afforded by the closer contact with these countries made possible by the open-door policy. First, technology transfer to China from the OECD world began to revolutionize China’s industrial technology. As China’s foreign investment regime liberalized over the course of the 1980s and into the 1990s, foreign direct investment increased dramatically, and led to significant new modalities for technology transfer resulting from a growing number of joint ventures and wholly owned foreign enterprises.

By the middle of the 1990s, foreign companies began establishing R&D centers in China, a trend that continues today.² While the nature of the spillover benefits from these foreign invested centers continues to be debated, there is no doubt that their existence, and the other technology transfer experiences that have occurred over the past 30 years, have greatly changed Chinese R&D practices, the level of industrial technology and, perhaps more importantly, the thinking and orientations towards the management of R&D among Chinese managers.
In addition to technology transfer, China’s opening to the outside world has also resulted in hundreds of thousands of Chinese students going abroad for advanced education. Those that have returned, especially those at the PhD level, have brought back knowledge of the leading fields of research and cutting-edge research strategies (methods, technology, research organization, etc.) and have often stepped into influential positions in universities and research institutes. Recent returnees have also assumed roles as technical entrepreneurs who started the high technology firms that are often seen as China’s most innovative. Those who have not returned – constituting China’s substantial brain drain – have nevertheless often contributed to the transformation of Chinese science as well through co-authoring with colleagues in China, by hosting new generations of Chinese graduate students, by establishing their own research groups in China, and through providing advisory and consulting services to Chinese institutions. Those “lost” to the brain drain, thus, have nevertheless served as important bridges between the Chinese research environment and leading centers of research in the US and other countries.

Finally, China has established active programs of cooperation in science and technology with the governments of OECD countries and the EU. These too have provided enabling linkages for the acquisition of foreign knowledge and experience contributing to the enhancement of Chinese scientific and technological capabilities. This is especially true with regard to the STI policies of other governments, and the ways in which government science programs are organized.

The evolution of domestic policies

The transformation of Chinese science and technology over the past 35 years is usefully understood as a combination of a creative exploitation of those resources in the international environment noted above, and an evolving set of domestic policies focusing on the provision of material resources for scientific development and ongoing institutional reform (cf. Fu, Woo and Hou, 2016). These policies began to take shape in the 1980s, as seen, for example, in the institutional reforms of 1985, the initiation of a patent system, the establishment of the Chinese National Natural Science Foundation (inspired in part by exposure to US NSF), the launching of the “863” national high-technology program, the initiation of special high technology zones and more permissive policies for high technology “spin-off” enterprises originating in universities and the Chinese Academy of Sciences (Gu, 1999). During the 1990s, as the Chinese economy continued to develop, wealth accumulated, and expenditures on R&D began to increase steadily. In the course of the 1990s, however, we also begin to see a more complex and nuanced understanding of innovation as something “more than R&D,” with China beginning to experiment with a series of indirect policy instruments – preferential tax policies, export subsidies, targeted government procurement, growing attention to patents and technical standards, etc., in addition to direct R&D support. By the end of the 1990s, Chinese “science policy” was giving way to a more complex “innovation policy,” the transition to which has yet to be completed, as noted further below.

The dawn of the 21st century saw China beginning to question its heavy reliance on foreign technology. Dissatisfaction over licensing fees charged by foreign patent holders, and concerns over the future ability to access more advanced technologies in the face of foreign export control policies and the commercial strategies of foreign companies to protect their core technologies, drove a rethinking of the balance between foreign technology and indigenous innovation. China’s accession to the WTO in 2001, and expectations of further liberalization of the foreign investment regime, created the possibility that technology dependency would actually increase. As a result, the leadership began national discussions over research and innovation strategies – now more feasible given the enhancement of human and institutional
resources built up over the previous 15 years – that would strengthen Chinese technological sovereignty. These discussions culminated in the launching of the 15-year “Medium to Long-Term Plan (MLP) For Scientific and Technological Development” in 2006 (Cao, Suttmeier and Simon, 2006).

The MLP is an ambitious strategy of development which specifies major R&D projects in basic and applied research and includes a package of tax, trade, and human resource development policies intended to make China an innovative, knowledge-based society by the year 2020, and a major international player in science and technology (OECD, 2008; Schwaag-Serger and Breidne, 2007). The Plan embraces the concept of zizhu chuangxin, often translated as “indigenous innovation,” a concept that has led to considerable confusion and controversy internationally as well as in China. While the term might better be rendered as “self-directed” innovation, implying a degree of technological independence and strategic control over technological development (Lazonick, Zhou and Sun, 2016), it has led to internationally controversial trade and investment policies which have been seen by foreign stakeholders as protectionist and inconsistent with the spirit of WTO and its provisions (McGregor, 2010).

Current reform initiatives

One of the more curious aspects of scientific and technological development in China since the initiation of the MLP has been that rapid spending increases on research and development have occurred in the face of an institutional environment that has been unsettled and not always well-suited to the effective use of generous funding. In short, the R&D spending surge over the past 15 years has clearly outpaced institutional design, leaving a legacy of problems including considerable derivative research, scientific misconduct, widespread filing of low-quality patents, waste and misuse of R&D funding, and the development of a technical talent pool, a large portion of which seemed to lack the training and socialization needed for original research. And, in spite of calls for “indigenous innovation,” reliance on foreign science and technology for major national research and engineering projects remains high, reflecting ongoing problems of technological dependency. Thus, despite the substantial investments China has made in science and technology and the progress these have facilitated, the resulting research accomplishments, technological innovations, and creation of the innovative society envisioned in the MLP and other national plans have been seen as disappointing by key national decision makers. Not surprisingly, therefore, further reforms of the systems for research and innovation are again on the agenda.

In July, 2012, the Chinese leadership convened a new National Conference on Science and Innovation at which then premier Wen Jiabao bemoaned the performance of China’s systems for research and innovation and called for further reform. Two months later, in September, 2012, with the issuance of the “Opinions on Deepening the Reform of the Science and Technology System and Speeding up the Building of a National Innovation System,” the Chinese Communist Party (CCP) Central Committee and the State Council brought a sharper focus to the need for further institutional reform (Ministry of Science and Technology, 2012). The “Opinions” served as an important aspirational document, offering a comprehensive statement of reform directions that presaged things to come. Clearly, as the second decade of the 21st century began, China’s top political leaders were asking hard questions about the efficiency and effectiveness of all the money that was going into science and technology.

During 2014, these hard questions were being converted into a series of science and technology reform initiatives by the new Xi Jinping government, which at the Third Plenum of the 18th Party Congress in November, 2013, announced a comprehensive package of economic...
reforms, many of which pertained to science and the national innovation system. President Xi Jinping and other Chinese leaders understood that in order to avoid a “middle income trap,” China needed an innovation-driven growth strategy which, in turn, directed attention to the effective functioning of a national innovation system. In addition, pressing environmental problems have made environmental sustainability a more important consideration in devising a new growth strategy, prompting calls for innovative energy and pollution control technologies. The STI reform policies growing out of these concerns, therefore, seek to incorporate knowledge from international best practices, rationalize the relationships among budgets, expenditures, and research programs, ensure that there are effective linkages between research and production, clarify the relationships between government and the market, and ensure honesty and integrity in the implementation of STI policies through greater administrative transparency.

The pace of reform announcements quickened in 2014. In March, the State Council issued an important document directed at reforming the financing and financial management of government science and technology programs which was then followed up in December by a more comprehensive reform directive for changing the central government funding system (State Council, 2014a, 2014b). Since the beginning of 2015, the political regime has continued to issue a flurry of reform documents. In March, the challenges of promoting a market-oriented innovation system were addressed in an important industry-focused document proposing a whole series of policies dealing with industry structure, venture capital, intellectual property, government procurement, R&D management, etc. (State Council, 2015). Other important policy statements were also issued, dealing with the funding of research, research management and governance of the research and innovation systems, human resources, local (as opposed to national) innovation strategies, technology transfer regulations affecting relationships between universities and government research institutes and enterprises, international cooperation, and the promotion of “mass innovation” and technical entrepreneurship. The scope of the reforms is therefore very broad and, as a result, some of the reforms are to be phased in over several years.

Progress has already been made in clarifying the legal environment for government STI programs, especially with regard to transparency in the administration of research funding and the conduct of research projects. Project budgeting procedures have been improved by allowing for more rational salary and overhead allowances; whereas salary support from a grant, for instance, had been limited to 5 percent, this has now been increased to 20 percent. This should help discourage investigators from attempting to maximize the number of grants received in order to enhance income, a practice which contributed to insensitivity to research quality and integrity. New web-based procedures have been introduced to make the funding of research, and the results of research, more transparent. Nationwide databases have been established to aid in research administration and to identify qualified scientists and engineers to participate in project selection and evaluation activities.

An especially significant change is the reconfiguration of major government funding programs into five main categories. In the first, the work of the National Natural Science Foundation of China (NSFC), long considered the best administered of the previous funding streams, is reaffirmed, with a significant increase in funding for basic and exploratory research – a longstanding gap in Chinese science and source of continuing criticism. A second category is focused on China’s major projects (da xiangmu), such as the 16 identified in the MLP (large aircraft, nuclear power plants, advanced manufacturing, space, etc.) The major national R&D programs that had been administered by the Ministry of Science and Technology, and which had come in for considerable criticism – including the 863 high-technology program, the 973 basic science program and the zhicheng, or “support” program – have now been reorganized and consolidated into a third category referred to as the “main R&D plan” (zhongdian yanfa
Whereas the previous design of these programs – especially 863 and 973 – was based on different segments of the innovation chain, the new approach focuses on the solution of national problems across the spectrum of R&D activities (Hou, 2016).

A fourth category focuses on technological innovation and involves the leveraging of various governmental and non-governmental sources of funding to support innovation in industry and agriculture, including support for the transfer of research achievements from universities and research institutes to industry. Finally, a fifth category focuses on rationalizing the use of facilities (research institutes, engineering research centers, etc.) and infrastructure, and includes support for the development of creative human talents to lead research and innovation initiatives. In this context, there is a new interest in the development of national laboratories in keeping with instructions from President Xi at the Fifth Plenum of the 18th Party Congress in October, 2015 to develop national labs.

Progress has also been made in attacking some of the procedural difficulties that had developed in implementing Bayh-Dole type policies in China that would allow patenting and/or commercialization of publicly-funded research findings. Good results were received from pilot programs introduced in the high-tech parks in four cities (Beijing, Shanghai, Wuhan, and Hefei) in which research institutes and universities were given clearer rights to the benefits, use, and transferability (san quan, or “three rights”) of the intellectual property they develop, and in February, 2016, the State Council approved a policy that would allow academics greater freedom to do part-time work with companies. Successful technology transfer experiences would be given greater weight in future evaluations of research institutes and universities, and the latter would be allowed to retain “no less than half of the income earned” from the products resulting from successfully transferred achievements (MOST, 2016). To further stimulate the integration of research and technology with the economy, reforms were introduced to stimulate the growth of an S&T service industry (keji fuwu chanye) to include the strengthening of capabilities for the management and utilization of intellectual property.

Adjusting central policy institutions

Not surprisingly, such system-wide reforms will also require changes in the national science and technology bureaucracy. Importantly, a new approach to the inter-ministerial coordination (a perennial bugbear of Chinese government) has been introduced with the establishment of an “inter-ministerial joint conference system” (bùjì liánxì huìyì zhìdù) to coordinate and “unify” the government science and technology programs. Leadership for this new inter-agency mechanism is being shared among MOST, the Ministry of Finance and the National Development and Reform Commission (NDRC), with MOST hosting its secretariat and having responsibility for national R&D activities. The Ministry of Finance is expected to establish a stronger organic link among policy, program, and budgeting, with NDRC taking the lead on innovation issues. The importance of this joint conference system can be seen when we consider that a number of mission-oriented ministries (for health, agriculture, environment, information industry, etc.) now play a greater role in government research programs.

In addition, representatives from industry and trade associations are also participating more actively in important national priority setting activities in keeping with the call from the State Council for the establishment of a high-level strategic consulting/policy advisory mechanism (zhànluè zìxún yù zōnghé píngshěn wéiyuánhuì). During 2015, the “Joint Conference” convened a series of meetings to map out priorities for the new “major R&D plan” (zhòngdiǎn yànfā jíhuà). This was intended to be an inclusive exercise, with industry well represented, and with the results reviewed by the new high-level advisory mechanisms consisting of 240 experts organized
into seven specialized panels. It led to the identification of 59 key national priorities in the seven areas of “modern agriculture,” “public health,” “strategic perspectives on major scientific issues,” “resources and ecological environment protection,” “industrial transformation and upgrading,” “energy saving and new energy,” and “new approaches to urbanization” (Hou, 2016).

Prior to these latest reforms, the administration of research programs was in the hands of officials in Chinese government ministries, especially the Ministry of Science and Technology. This arrangement was the object of considerable criticism from the technical community which alleged that it produced favoritism, a degree of corruption, and inappropriate incentives for high-quality work. An important new development, therefore, has been the decision to take government agencies out of the active administration of research programs and put it into the hands of “professional organizations” (zhuanye jigou). As of this writing, seven such organizations have been identified, all of which are quasi-governmental agencies (shiye danwei) affiliated with government ministries, but not officially part of the bureaucratic system. These professional organizations, in turn, organize working panels of experts for project selection, review and evaluation, reminiscent of the operation of research councils in Europe. Government ministries, therefore, are supposed to be removed from active management activities, their role changed to that of overseeing and monitoring the operation of the “professional organizations,” in keeping with broader reform objectives intended to redefine the role of the state in the nation’s innovation system.

“Transforming” CAS

The national reform program, discussed above, carries implications for a variety of research performers, including the Chinese Academy of Sciences, universities, government research institutes, and industry. Reforms in the Chinese Academy of Sciences serve as an interesting case of how the community of research performers are responding to the broader national reform environment. But, in addition, as one of the most prominent legacy institutions from the Soviet-inspired, pre-reform era, it has faced distinctive challenges to redefine its identity in a China characterized by an ever-enlarging university research sector and the expansion of industrial research.

The CAS reform, referred to in English as the “Pioneer (shuaixian xingdong) Initiative,” has the potential to bring about the most radical changes in the Academy since the 1950s. It grows out of the policy instructions issued by President Xi Jinping during his July, 2013 visit to CAS, and the need to respond to the broader national S&T reform program discussed above. The initiative involves reorganizing CAS’s 100+ institutes into four major thematic categories, enhancing its educational missions through the establishment of the University of the Chinese Academy of Sciences, and through reforms in its academician (yuanshi) system to strengthening its policy advisory functions. As noted, these changes can be seen as the latest in a series of attempts to overcome long-standing problems of mission definition and management within CAS as it has had to face the significantly different national innovation system in the post-1978 era. But, in addition, the changing expectations from the new central political leadership, reflected in the new national reform program, have given the reform program a new urgency.

The reorganization of CAS institutes is an attempt to clarify Academy missions and devise management and policy strategies appropriate to the functions and capabilities of the numerous and diverse research institutions (Bai, 2014; Chinese Academy of Sciences, 2014). According to the current plan, institutes would be reorganized into one of four categories: centers of excellence; innovation “academies” (chuangxin yuan); platforms for large facilities; and centers for supporting national environmental and resource needs and those of local economies. In
principle, this categorization is an imaginative approach that recognizes diverse capabilities and functions provided by the institutes and the need, therefore, to develop managerial strategies appropriate for the different missions and competencies. Complicating this reorganization initiative, though, are the broader national STI reform trends, such as the new five-part funding arrangements and the interest in establishing a network of national labs, some of which would undoubtedly be drawing on the resources of CAS institutes.

Conclusion

At a recent national science and technology conference in May, 2016, President Xi Jinping called attention to the many achievements that have been made over the past 35 years. And, indeed, as reflected in both quantitative and qualitative indicators, there is no doubt that the changes in Chinese science and technology are transforming China into a major power in science and technology. At the same time, however, Xi also echoed the elite concerns of the last five years, noted above, about unmet expectations, and issued renewed calls for further changes intended to realize an innovation-based development strategy.

As seen from the discussion above, there is no shortage of reform initiatives being driven from the political center, a phenomenon often referred to as “top-level design” (dingceng sheji). Although the current reform program does reflect the influence of the “top-level,” it is important to note that the views of the members of the technical community are being sought, and are being reflected in policy statements. At that same May 2016 science conference, for instance, the remarks of Premier Li Keqiang indicated that complaints and criticisms from scientists about STI policies were being listened to, with the new measures announced at the meeting being well received by the technical community (Xinhua, 2016).

That said, there are many questions and uncertainties about current reform initiatives and their implications for further transformation of Chinese science and technology. Apart from the perennial problems of policy implementation in China, there are also questions about the urgency attached to reform by the political leadership. Some argue, for instance, that the trajectory of Chinese scientific and technological development has been a successful one, and that many of the problems with the system are likely to work themselves out as the system continues to mature. For instance, concerns about the relative scarcity of notable qualitative achievements, in the face of impressive quantitative indicators, need not cause alarm, in this view, since trends toward qualitative improvements are evident. That is, there is less need for major structural and policy changes, which are inevitably disruptive of research routines, than there is for a degree of patience as the system becomes more mature and sophisticated, as many trends indicate.

A less sanguine view, however, would point to the difficulties of implementing reform policies, and the resistance and confusion that is evident in doing so. It is clear that some of the long-standing problems with China’s innovation system – the weaknesses of R&D in the business enterprise sector, difficulties of transferring research results into production, corruption and misconduct, the intrusive role of the state, etc. – persist and resist solution. While many of the reform initiatives show promise of offering new solutions to these problems, it is unlikely that their solution or amelioration will result from the system’s maturation alone. Thus, the importance of reform policies in need of urgent implementation.

Underlying the current reform agenda are two themes which warrant particular attention. As noted above, a fundamental objective of reform since the 1980s has been the redesign of the innovation system to better serve a market, rather than a planned, economy. Hence, the emphasis placed on strengthening R&D in industrial enterprises and on market-oriented approaches to the building of an innovation-driven economy. These themes have been
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reiterated vigorously by Party leaders in each of the plenary meetings of the 18th Party Congress, and, although the existence of powerful vested interests has made progress much slower than hoped for, there are signs that the Chinese enterprise sector is beginning to discover its potential for technological innovation.

The second theme has gotten less attention in discussions of reform, but arguably identifies a core issue for the future transformation of Chinese science. As we have seen, changes are being made in research administration that give “professional organizations” a prominent new role. The meaning of “professional” in the Chinese context, however, does not quite accord with that used in the West. In particular, Western ideas associate professionalism with high levels of political autonomy reciprocally linked to fiduciary responsibilities, with autonomy seen as necessary for the responsible exercise of expertise expected by society. Since the establishment of the People’s Republic of China, however, professional autonomy has been circumscribed, and viewed as antithetical to the political formula of the Chinese Communist Party. Professional scientific societies that had begun to take root in the pre-1949 era, for instance, were in the 1950s brought under the control of the All-China Federation of Scientific Societies, a Party-sponsored “mass organization” (quntuan zuzhi), which subsequently became the China Association of Science and Technology, or CAST. And, as noted, the “professional organizations” charged with research administration under the current reforms are all affiliated with ministries. Thus, although the review panels they will convene will represent a step towards greater professionalization and a degree of insulation from the operation of the state, their autonomy from the state is somewhat limited.

Interestingly, under the current reforms, new attention is being given to the role of CAST, and the science and engineering societies under it, in enhancing scientific development and the operation of the innovation system. This new policy emphasis further illustrates the puzzles of “professionalism with Chinese characteristics.” CAST serves as an umbrella organization for scientific and engineering societies, and also serves as an instrument for the popularization of science and technology; in this sense it is reminiscent of the American Association for the Advancement of Science in the U.S. and similar organizations in other countries. But, as a mass organization in China, CAST is subordinate to the Party, and by design is intended to bring Party control over the technical community. As part of the reforms, CAST has enhanced its in-house technical expertise, built new policy analysis capabilities to become a “think tank” (as called for by Xi Jinping), and is expanding into areas of research and program evaluation as one of a number of “third-party” (di san fang) organizations intended to provide more objectivity and transparency to evaluation activities. In addition, it is expanding its organizational reach to universities, research institutes, and enterprises, by establishing CAST “chapters” (or local branches) in these institutions, with the hope that these will provide information to policy makers about conditions at working levels, facilitate greater inter-organizational cooperation and coordination, and promote understanding of STI policies in the interest of more effective policy implementation. These enhancements of CAST activities are in keeping with a wider directive to revitalize mass organizations, thus strengthening the role of the Party system in society as part of the broader effort to reduce and redefine the role of government (see, Xi, 2015).

To the Western observer, the absence of professional societies enjoying high levels of autonomy from political pressure has long been seen as a fundamental structural problem in China’s scientific development efforts. It has contributed to problems of research evaluation and effective peer review mechanisms, helped perpetuate an overly tolerant attitude toward scientific misconduct, impeded the development of a strong and creative basic research tradition, and compromised the objectivity of policy advice from the technical community. These are all problems that the current reform initiatives hope to solve or ameliorate. The legitimation of
autonomous professional organizations, however, is not included in this suite of reforms. Instead, while the need for “professionalization” is recognized, the Party’s political formula requires that professionalization be pursued through modernized and expertise-infused instruments of political guidance. Whether this approach validates a successful “Chinese model” of scientific development remains to be seen. But it serves as an abiding central issue in the fascinating and complex process of transformation begun in 1978.

Notes

1 The “four modernizations” are agriculture, industry, national defense and science and technology, with the latter seen as the key to the other three.
2 According to a 2014 report in Forbes, there are now more than 1,500 foreign R&D centers in China. (Yip and McKern, 2014).
3 Four of these are affiliated with MOST: the China Agenda 21 Management Center, the High Technology Research and Development Center, the China Rural Technology Development Centre, and the China Biotechnology Development Centre. The Agricultural Science and Technology Development Center is affiliated with the Ministry of Agriculture, the National Health and Family Planning Medicine Health Science and Technology Development Research Center and the Ministry of Information Industry and Industry Development Promotion Center are affiliated with the ministries of those same names.
4 Mass organizations facilitate Party penetration and control of social groups; others include trade unions, the Communist Youth League, and the All-China Federation of Women.

References


