Front. Educ. China 2018, 13(4): 486–512
https: //doi.org/10.1007/s11516-018-0027-8

RESEARCH ARTICLE

[Penultimate version – not final published version]

Simon MARGINSON

National/Global Synergy in the Development of Higher Education and Science in China since 1978

Abstract The paper reviews the rapid development of higher education and science in China in the last forty years. It discusses the conditions and strategies of that development, including the ways that it embodies a distinctive Chinese approach to higher education. In particular, the paper reflects on the policies whereby China coordinated with globalization in higher education and science after 1978, in building national capacity and global influence. Scale, nation-state policy goals and accelerated investment on their own are necessary but not sufficient (otherwise Saudi Arabia's research universities would be stronger than they are). The effective national/global synergy developed by China, made possible by the international openness and part-devolution to science communities that was implemented in the Deng Xiaoping era, has been crucial in the rapid rise of China's universities and science. This national/global synergy—and its potentials, tensions and limits—in turn has determined the nature of the achievement and will shape its future evolution.

Keywords China, higher education, universities, research, science, globalization, devolution, Deng Xiaoping

Simon MARGINSON (✉)
ESRC/OFSRE Centre for Global Higher Education, Department of Education, University of Oxford, Oxford, OX1 3JA, UK
E-mail: simon.marginson@education.ox.ac.uk

Introduction: "The Most Crucial of the Four Modernizations"

How did China modernize its higher education and science systems in the last twenty-five years at a scale and speed which jointly are without precedence? What role was played by Deng Xiaoping's policy of opening the nation and the world to each other after 1978? This article reviews the growth of science and higher education, and provides an explanation.

China's Trajectory

The development of higher education and science was a slow burn that became more intense over time. In 1972, towards the end of the Cultural Revolution, Zhou Peiyuan, the Vice President at Peking University, was asked to report to Zhou Enlai on the condition of science. Zhou Peiyuan said that in all 32 areas of science that were assessed, China had fallen seriously behind (Vogel, 2011, p. 138). At that time the gross enrolment ratio in tertiary education was 0.2 % of the age cohort (UNESCO, 2018). When Deng Xiaoping assumed a leading role in the government, first in 1974−1975 and again from 1977 onwards, he asked for special responsibility for science, technology and education. Ezra Vogel in his biography of Deng reports that Deng "considered science to be the most crucial of the four modernizations, the one that would drive the other three (industry, agriculture and national defense)" (Vogel, 2011, p. 197).

The national examinations for merit-based university entry, the *gaokao*, were reintroduced in late 1977. Deng and colleagues knew that after the Cultural Revolution it would take a long time to rebuild the leading universities, expand higher education to meet national needs and revitalize science. In 1995 the enrolment ratio was still only 4.5 % (Figure 1, UNESCO, 2018); and China's total output of science papers was at fourteenth place in the world, below the level of the Netherlands with one hundredth of China's population (NSF, 2018). The first special funding designed to build international research capacity in universities, Project 211, opened in 1995. In a speech at Peking University in May 1998 on the occasion of the one hundredth anniversary of the University's foundation, President Jiang Zemin stated that China should establish top world-class universities to realize the four modernizations. The more concentrated Project 985 grants to enable World-Class Universities (WCUs) began to flow in 1999, first to nine leading universities and ultimately to 39 institutions altogether.

After that higher education and research took off. The gross enrolment rate rose from 5 % in 1996 to 51 % in 2017 (UNESCO, 2018). The number

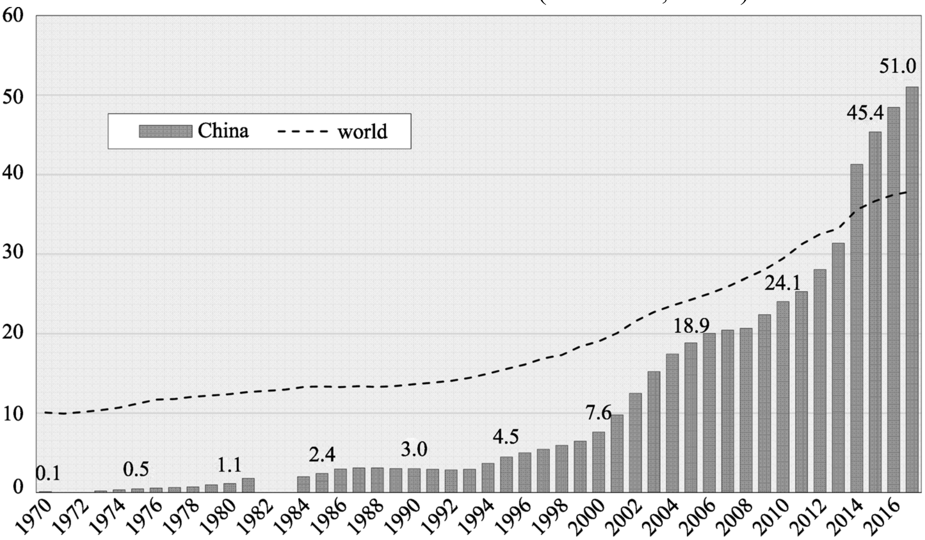

Figure 1 Gross Enrolment Ratio of Tertiary Education, China and the World: 1978−2017

Source: Adapted from data in (UNESCO, 2018).

of Chinese mainland universities listed in the Shanghai Academic Ranking of World Universities, which uses a template grounded in a model of the Anglo-American science university, grew from eight out of 500 universities in 2005, to 51 in 2018 (ARWU, 2018). Between 1991 and 2015, China's R&D spending as a share of the rapidly growing national GDP rose from 0.72 % to 2.07 %. Within national R&D the universities have an important role in basic science; and the output of science papers, centered on universities and scientific academies, has grown in proportion to national investment. Between 2003 and 2016 China's total number of research papers multiplied by 4.9 times. The total annual output of published papers exceeded that of the US in 2016, lifting China to number one in science quantity (NSF, 2018).

Spectacular as these figures are, they underestimate the growth in science associated with China. An U.S. National Bureau of Economic Research paper by Xie and Freeman (2018) finds that when papers by researchers with Chinese names in Europe or North America are added, with weighted allocations based on shares of collaborative papers, China's share of all 2016 papers in Scopus rises from 18 % to 23 %. Further, when all papers with at least one Chinese address or name are included, regardless of country of work or residence (i.e., using a Chinese definition of national citizen in terms of familial descent) and without weighting for shares, China was associated with 35 % of global science (Figure 2). In addition, there were 4,216 Chinese language journals focused on STEM research and published in China in 2017, only 329 of which were in Scopus. The authors conclude that when all STEM papers published in the Chinese language are included, people with Chinese names are associated with about 45 % of global science. That last figure is too high because not all the STEM-related scientific work in languages other than English and Chinese is included in the denominator. But it is clear, as the authors find, that China has "a huge role in developing the knowledge-based economy" (Xie & Freeman, 2018, p. 9).

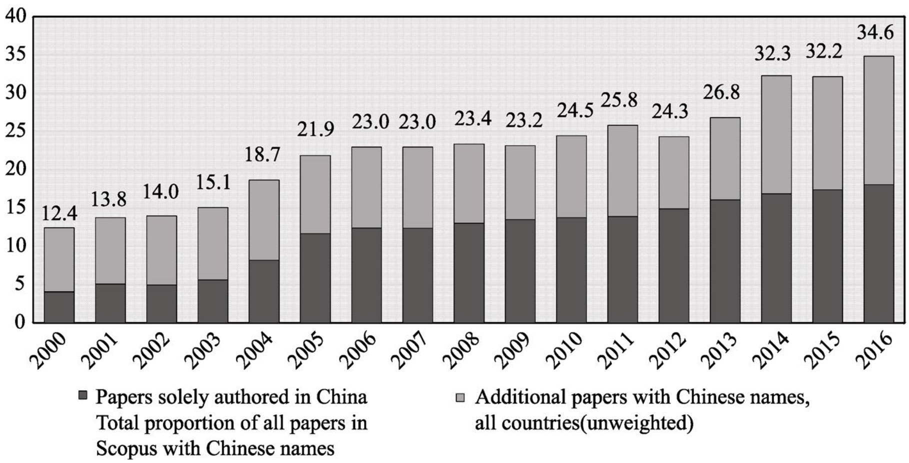

Figure 2 Growth of China-Associated Science Papers in the STEM Disciplines, Proportion (%) of Total Worldwide Papers in Scopus (2000−2016)

Source: Adapted from data in (Xie & Freeman, 2018).

The quality of science has also improved sharply. This shows more in the number of top 5 % or 1 % papers as measured by citation rates, than in average citations to all papers, indicating the impact of WCU concentration policies. Taking all fields of science into account, the average citation of papers from China rose from 0.46 in 1996 to 0.96 in 2014, below the world average of 1.00.

However, the proportion of papers in the top 1 % of their field rose from 0.31 % to 1.01 %, just above the world average (NSF, 2018).

China remains well behind the US in its overall share of top 1 % science papers by citation rate. One reason is that much of China's research in medicine and the social sciences, and nearly all scholarship in the humanities, are published in Chinese not English and are under-estimated or absent in global publication and citation counts. However, these disciplines also receive less support in China than they do in North America and Western Europe as the pattern of research grant allocation shows. It is a different story in the physical sciences STEM disciplines that have been the main focus of China's policy.

The physical sciences STEM cluster includes mathematics, physics, chemistry, materials, engineering and computing. China's citation rates in the physical sciences STEM disciplines are much stronger than its citation rates overall and are near the level of the US. Tsinghua University may be in the process of becoming the world's leading research university in physical sciences STEM. In terms of the total number of papers in all STEM fields ranked in the top 5 % of their field by citation rate and published in 2013−2016, Tsinghua with 875 papers was ahead of MIT in second place with 860. In research in mathematics and complex computing Tsinghua with 230 papers far outstripped Harbin and MIT. In research in engineering, physics and chemistry Tsinghua (645) was second behind MIT (see Table 1).

Table 1 Universities with the Highest Number of Papers in the Worldwide Top 5% by Citation Rate, STEM Disciplines Only, Papers Published in 2013−2016

University	System	Top 5% papers in maths & computing	University	System	Top 5% papers in engineering & ph/ch
Tsinghua U	China	230	Massachusetts IT	United States	705
Harbin IT	China	165	Tsinghua U	China	645
Massachusetts IT	United States	155	U California, Berkeley	United States	625
Zhejiang U	China	153	Stanford U	United States	559
Nanyang TU	Singapore	147	Harvard U	United States	538
Huazhong UST	China	142	Nanyang TU	Singapore	528
Xidian U	China	140	Zhejiang U	China	460
NU Singapore	Singapore	134	U Cambridge	United Kingdom	451

Stanford U	United States	131	U S&T	China	444
South East U	China	121	NU Singapore	Singapore	384
U Electronic S&T	China	121	ETH Zurich	Switzerland	366

(*To be continued*)

(*Continued*)

University	**System**	**Top 5% papers in maths & computing**	**University**	**System**	**Top 5% papers in engineering & ph/ch**
City U Hong Kong	Chinese Hong Kong	112	Caltech	United States	364
Shanghai Jiao Tong U	China	112	Peking U	China	354
U Texas, Austin	United States	109	Shanghai Jiao Tong U	China	353
U California, Berkeley	United States	108	Imperial College	United Kingdom	350

Source: Adapted from (Leiden University, 2018).

Note. ph/ch = physics and chemistry.

In STEM papers in the top 1 % of their field by citation, the very strongest papers in terms of recognition, Tsinghua was number one in the world in mathematics and computing with 42 papers (it had been 66th on this measure seven years earlier in 2006−2009), ahead of MIT and Harbin which each published 38 such papers. Tsinghua was fifth in the number of top 1 % papers in engineering and physics/chemistry with 117 papers in 2013−2016, behind MIT (179), Stanford (159), Berkeley (144) and Harvard (139). As Table 1 shows, in top 5% papers China had nine of the leading 15 universities in mathematics and computing and five in engineering and physics/chemistry (Leiden University, 2018).

National/Global Synergy

What then is the explanation for China's achievement in creating the world's largest research output and a layer of STEM-focused WCUs, and lifting participation in higher education from 4 % to 50 % (UNESCO, 2018), in one generation, a national mobilization on the scale of war but in a period of peace? Salmi (2009) finds that in building WCUs the essential ingredients are governance, finance, and talent. China has a distinctive form of governance in its higher education and research institutions, applies a Post-Confucian state policy effective in mobilizing institutions and persons (Marginson, 2011; 2013), and has increased national investment in science and universities on an annual basis. Yet there must be more to the explanation than this. If national control, goals, policy, and growing finance were enough then, for example, Saudi Arabia's universities would be as strong as those of Singapore. However, Singapore's strategy is more effective than that of the larger and wealthier Saudi Arabia, because it is more *globally* effective. To understand the basis of China's policy and the meaning of its achievement, it is necessary to look beyond the "national container," the mindset of "methodological nationalism" in which the nation is the ultimate horizon of meaning (Shahjahan & Kezar 2013; Wimmer & Schiller, 2002).

It must be said that methodological nationalism is pervasive in studies of national systems of higher education and research. [1] Those systems are often explained as if they exist solely in themselves, and the rest of the world is marginal, being mentioned in the national story only when it becomes impossible to ignore. In this framework, globalization, the process of partial integration and convergence at world or world-regional level, is an uncomfortable intrusion on the normal. Policy problems are understood in terms of national versus global, as if the two dimensions are zero-sum. But they are not. Nations exist in the global context and routinely interact with it. Global relations do not programme all national practices, but they are a permanent part of the conditions of possibility. In the rise of science and higher education in China both national and global factors have been continually in play, especially in science, which is an interactive worldwide system. Here what has been especially important is the *connection* between national factors and the global science system.

This article argues that the explosive growth of higher education and research in China was made possible by a *national/global synergy*, which was facilitated and engineered by Deng Xiaoping's reform and opening up policies of 1975 and 1978−1992 (Vogel, 2011). These policies were maintained and extended by Deng's successors. In general, the explanation for China's rise in science and higher education lies on one hand in the global conditions (the evolving global

[1] Methodological nationalism, which still dominates in social sciences, is reproduced by the nation-bound character of law and politics, and of the social science disciplines themselves. Most social sciences, regardless of the universal terms in which it is expressed, serves governments bound to the "imagined community" of one territory (Anderson, 2006).

science system), on the other hand in the national conditions, and especially the conjunction between global and national drivers that national policy achieved.

Deng's policies largely depoliticized and devolved higher education and science within the framework of the Communist Party of China (CPC)-led state, in contrast to the hyper-politicized universities of the Cultural Revolution (though no doubt the profound innovations in higher education and science after 1978, as in other sectors, were facilitated by the "blank sheet of paper"[2] left behind after the devastation of the Cultural Revolution). China's state opened the universities to two-way flows with the world, much as in Deng's special trading zones in the political economy, and applied strategies of internationalization, in which the goal of catch-up to global norms, mostly American norms, became the theme of self-cultivation in universities in China and thereby embedded as continuous improvement in daily practices.

There was luck in all of this. The period after 1978 was an especially favorable time to plug into global forces. In the economy, China benefitted from the comparative advantage then enjoyed by labor-intensive manufacturing and did well in the open trade regime. In science there was an even more dynamic global growth. The opening up in China's universities coincided with the post-1990 globalization of science and the formation of networked relationships across the higher education world that followed. As it turned out, the Deng Xiaoping approach to higher education and science proved especially well fitted to the era of accelerated globalization that was beginning when he stepped down in 1992. As in the global economy, so in higher education and science: The global developmental momentum has carried China's own momentum, and also vice versa. Moreover, in science and the universities, the global momentum has continued despite the faltering of economic globalization after the 2008−2010 recession in North America and Europe, and the fall in foreign direct investment, the declining potency of the multinational form and a slowdown in global supply chains that has followed (The Economist, January 28, 2017), and the political push-back against global trade and migration in some countries (Rodrik, 2017). There are certain tensions around academic mobility where it interfaces with migration (Marginson, 2018), but so far, the growth of science and higher education in China and on a worldwide basis (Cantwell, Marginson, &

[2] Mao Zedong's words at the outset of the engineered transformation that occurred prior to the Cultural Revolution, the Great Leap Forward in 1958.

Smolentseva, 2018) has continued unabated.

Perhaps the path-breaking character of the Deng policies, combined with ideological hangovers from the Cold War, explains why the flourishing of global science in China has puzzled many observers in the West. How could a Leninist state develop such a science system, mostly using university forms like those found in North America and Europe, and with American levels of performance in physical sciences? (This feeds the imagining in some quarters that China's scientific community must have done so by "stealing our intellectual property," despite the fact that the achievement under discussion is mostly in public science). The answer to the question is that in China's political system academic agency is not eliminated but regulated. It is a tool used for nation-building. "Deng said that science had no class character; it could be used by all classes and all countries despite their different political and economic systems" (Vogel, 2011, p. 201). Scientists with little interest in politics could still be useful (p. 198). It was enough that they were loyal to the country and the party (p. 202).

> For the people (scientists) who are not anti-party or anti-socialist … give them full play for their expertise, respect their work, and help them make progress with care and enthusiasm (Deng, 1994, p. 93).[3]

China's science since Deng Xiaoping has been a hybrid that combines the national and the global. It also combines the unique Leninist state in China with the corporate university familiar across the world and academic norms of open science and decision-making on the basis of disciplinary judgment. Arguably, all these elements are integral to China's exceptional progress in the knowledge-intensive sectors. If any was fundamentally weakened, or the balance between them was altered, the outcomes would be affected.

This is not to say the outcomes are the best possible that could have been achieved, either on the basis of China's policy objectives, or any other set of values; nor does the Deng policy have all the answers for the future. However radical is a policy innovation, once it has become established then institutions, processes and human agents that have adapted to the policy become path-dependent (at least until they are diverted into new directions). There are

[3] The full quote in Chinese is as follows: "对于他们，只要不是反党反社会主义的，也要团结教育，发挥他们的专长，尊重他们的劳动，关心和热情帮助他们进步."

problems within the Deng system that probably cannot be resolved from within that system. China's post-1978 national/global synergy and its administration in universities and research agencies continue to shape the potentials, tensions, and limits of higher education and science. The Xi Jinping era has not fundamentally changed the system settings, including international benchmarking. The original gaps in the Deng assemblage remain difficult to fill, while its continued achievements in selected areas of science are dependent on its reproduction.

The remainder of the article fills out these statements. It begins with the first of the two essential conditions for modern Chinese universities and science at scale: the evolving global science system. It then looks at the second essential condition, which is the nationally-specific elements: the Chinese state, the Confucian ethic of self-cultivation, and the Deng Xiaoping policies and the national/global synergy that they achieved. The final section considers the question of to what extent China has achieved a distinctive higher education and science with Chinese characteristics, and reflects on the tensions, gaps, limits and future of the national/global synergy in the universities and science.

The Global Conditions

Though international scientific collaboration and competition have a long history, the present global science system is less than thirty years old. The worldwide web, generally attributed to Tim Berners-Lee, was created in 1989. Commercial Internet providers emerged at the same time. From 1990 the Internet expanded rapidly. In research universities, information and knowledge are both product and currency; and led by the well-resourced and prestigious American institutions, universities were early adopters of web technologies. Academic disciplines in the sciences quickly evolved as a synchronous world conversation and data exchange. The Internet and the cheapening cost of travel facilitated cross-border collaboration and the leading English-language journals consolidated their hegemony as a single global system of codified science (Marginson & Ordorika, 2011). With world scientific output visible everywhere, most science-based innovations became sourced from the global system rather than national science systems, except in the US given the size of its scientific capacity. Over the 1990s the global research system of publication, networked collaboration and exchange became increasingly dominant in science.

As noted, the global integration and convergence in science that began in the 1990s has continued unabated, largely unaffected by the post-2008 ructions of economic globalization and global/national tensions in trade and migration. The globalization of science has been associated with a major expansion of total scientific output with both national and global drivers. One driver is the relative growth in knowledge-intensive production and research-based commercial innovation. Another driver is the stimulatory effects of global science on national activity. Ironically, the rise of the global science system made it more not less essential to develop national capacity. Nations found that to access the all-important store of global science they needed their own trained people, not just users but producers of research who routinely interacted with researchers abroad. A generation after the beginnings of the Internet, more than sixty countries now produce enough research papers to suggest that they have an indigenous scientific capacity, with their own doctoral students and research programmes in a range of disciplines (NSF, 2018). Almost all high-income and many middle-income countries are building a national science system, and the large multi-disciplinary research universities (the WCUs in the rankings) seen as optimal for housing research and facilitating the necessary cross-border circulation of knowledge and people.

Hence in science, global system and national developments have enhanced each other. With the global science system continually stimulating both national systems and discipline groups, most research-active countries have increased research spending more rapidly than GDP. For example, between 1990 and 2015 R&D spending in the US increased from US$152 billion to US$497 billion, tripling in real terms, while China's grew from US$13 billion to US$409 billion between 1995 and 2015 and moved close to the U.S. level (NSF, 2018). The growth in aggregated national research capacity of nations has fed back into growth in global research output. That global growth has accelerated over time. Between 1995 and 2005 the total number of published science papers increased by 25.8 % at world level and 89.9 % in rising Asia. In the next decade, 2005–2015, research output grew by 55.6 % at world level and 102.9 % in Asia (NSF, 2018). At the same time, cross-border collaboration has increased more rapidly than has science as a whole. The proportion of all articles that were co-authored by international teams rose from 14.0 % in 1995 to 16.4 % in 2010 and then more sharply to 20.9 % in 2015. In China the proportion of articles that involved collaboration was 18.2 %, in the US it was 35.2 %. Rates of collaboration were higher in Europe (NSF, 2018).

Yet while national science and global science tend to generate each other, the relations between them are not symmetrical. The advance of measured national research is associated with a form of global capture made possible by the fact that scientists, not governments, carry out research. In an analysis of science networks, Wagner, Park, and Leydesdorff (2015) conclude that although expanding capacity is shaped by nation-state investment, "the growth of international collaboration" is "decoupling from the goals of national science policy" (p. 3). They identify two patterns in research networking. In two thirds of national science systems, including China, the US and Germany, the global science network is primary in shaping the patterns of networked activity at national level. In the other one third of countries, including Japan and the UK, national networks appear to shape global engagement more than vice versa. Wagner and colleagues emphasize the open agency-driven character of disciplinary research. The global network can be crossed from anywhere in no more than three steps. Strong nations and universities operate not as gatekeepers but as nodes facilitating the expansion of science. While the research system has biases—English-language uniformity, prestigious universities, discipline hierarchies—no one controls it. "International cooperation is particularly advantageous for less advanced countries" (p. 12) that gain ready access to the field of cooperation.

The openness of global science, with universities and researchers actively seeking partners, has facilitated the growth of science in China. Though global science is conducted in Anglo-American-European cultural terms, it is not a Western monopoly. Emerging science powers such as China, South Korea, Iran and Brazil, while following global templates have contributed effectively to the global network, especially in the physical sciences STEM disciplines that they consider to be economically, militarily, and developmentally strategic, and where cultural barriers are modest. At the same time, China has made effective use of the global science system because of the way its own research system and WCUs have been organized. The next section of the article will explore these national aspects.

The National Conditions

What then are the key national elements in China’s rise? First, China shares with most education systems in the Chinese civilizational zone, including Chinese Taiwan, South Korea, and Singapore, those features of post-Confucian higher education that facilitate accelerated development. Second, as noted, the Deng era policies. These elements are now considered.

Post-Confucian Higher Education

At different times in the last half century, almost all nations/systems in the Chinese civilizational (post-Confucian) zone, once achieving a threshold level of wealth, have undergone exceptional growth in global science and student numbers. This is presently the case in the Chinese mainland, Singapore, and South Korea and until recently was true of Chinese Taiwan. Japan experienced accelerated growth in the 1960–1990 period. In both Chinese Taiwan and Japan the research universities are now inhibited by budget constraints. In Vietnam, the outlier in the group, the nation-state is not sufficiently focused, and national wealth is probably too modest to finance a post-Confucian take-off in higher education.[4]

Post-Confucian countries share two distinctive features integral to the accelerated development of science and education. First, the Chinese or East Asian form of state, and the dominance of the political sphere in relation to other spheres such as the economy and markets, the military, religion, the towns and civil society (Gernet, 1982). The classical Chinese state, which began in the Qin and Han dynasties 2,200 years ago (Fukuyama, 2012), was responsible for common systems such as language and measurement. Day to day management of the rural economy was devolved to the local level, but the state saw itself as free to intervene at need to secure the overarching objectives of order and prosperity. The Song dynasty 1,200 years later installed a system of devolution with high provincial autonomy. The dynastic state retained control at the center by training and allocating provincial leaders (Blockmans & de Weerdt, 2016). The comprehensive and centralizing Chinese state followed a different path to the state in Europe and the English-speaking world. The Anglo-American state distinguishes between the executive, the elected legislature, the judiciary, the

[4] For more discussion of higher education in Vietnam see Tran, et al., 2014.

economic market and civil society. The state's right to intervene is habitually questioned. In contrast East Asians mostly accept the generic state as supervisor of society and social conduct (Tu, 1996). Whereas in the U.S. universities are positioned in civil society, or the market, in East Asia it is impossible to imagine them (or society) without the state. However, as in South Korea and Singapore, China's universities are a *semi-autonomous* part of the state. Note that private higher education is regulated as part of the routine responsibility of the state.

The fact that CPC-led government in China combines politics and administration on a continuous basis while also being sensitive to the need for popular consent, as with the Dynastic state of Imperial times, both stabilizes long term planning and facilitates the implementation of major changes in policy (Singapore has the same strategic advantage in higher education and science, but even in contested Post-Confucian polities such as Japan and South Korea, the continuity in policy and administration seems to be less disrupted by the electoral process than is the case in Europe or the US). Post-Confucian states have high social standing and bureaucratic continuity. Like the Qin and Han, they refrain from local micro-management; budgets as a share of GDP are typically smaller than in Europe; but they apply central intervention selectively in order to achieve specific purposes. This is what happened in the take-off of higher education and science in post-1978 China. The state facilitated the take-off in higher education and science because these sectors were seen as essential to economic development, global effectiveness, and popular aspirations. Modern universities serve the twin goals of the classical Chinese state: prosperity and social order. Once the state in modern China decided to build higher education and science at scale it was able to mobilize both public infrastructure and the population with impressive speed—not so much because of its command of instruments of coercion but its capacity to secure consent.

The second distinctive Post-Confucian element is Confucian educational self-cultivation in the family (Li, 2012). Education is understood as part of the duty of child to parent and the duty of parent to child. It is also the source of personal virtue, of social standing and of meritocratic advance. This again is very long standing. Education in China is more deeply rooted than in Europe. The drive for reflexive self-improvement, in which the individual is responsible for his/her formation as a social being, is at the core of Confucian thought. Like all East Asian families, Chinese invest heavily in time and money in formal schooling, shadow schooling outside formal class, and private tutors. Confucian self-cultivation is also in play in higher education in another way. Reflexive self-transformation, on the basis of social norms, can be installed as an organizational identity and the shaper of group as well as individual behavior. This is used to drive continuous improvement in education and science.

The Post-Confucian state and the forms of the Post-Confucian family have been central to the expansion and qualitative improvement of higher education and science. The state sets standards, applies resources, focuses on goals, tests their achievement and moves on to the next and higher level. It is mostly effective in deploying financial resources and linking investment to performance. At the same time, it has at its disposal tools of what Foucault (2009) calls "governmentality"—the "conduct of conduct", the capacity to mobilize self-managing persons by causing them to behave in desired ways—via aspirations for education and the desire for self-improvement among scientists, faculty, administrators, and university leaders. When the state signaled expansion in the late 1990s, aspirations and enrolments soared and outstripped the rapid growth of supply. In Post-Confucian universities, motives based in self-cultivation can be as powerful as the drive for competitive advantage in English-speaking settings. But the state in China also uses competition for university prestige to drive behavior, tapping into the desires of both families and universities for educational status. When other methods fail, the state can financially punish those that do not conform to the requirements of policy. It is a formidable array of longings, nudges, and pressures.

Administration in higher education and science is ultimately coordinated through the political structure, in which there is a regulated space for initiative at each level of authority. The Leninist state imposes a layer of communication and supervision that synchronizes WCUs and science with government, installing each new goal dictated by policy, while enabling university leaders and scientists to operate with day to day autonomy and responsibility. The leaders of WCUs are controlled by the process of central allocation to positions, as in the Song dynasty's policy in relation to provincial leadership almost a thousand years earlier. The dynastic Chinese coupling of central discretion and local discretion in universities, which seems paradoxical in Western eyes, is part of the legacy of Deng Xiaoping. This is now discussed.

Deng Xiaoping, the State and Science

In 1973 Mao Zedong handed Deng Xiaoping the task of readjusting the party and government, though Deng's first tenure was to be brief. As Vice-Premier he focused on the portfolios of science and industry. He supported the rehabilitation of scientists who had been exiled and disgraced. "Scientists were members of the laboring class (劳动者 *laodongzhe*)," he said. He also argued that political theory could not be used as a substitute for science. "Deng complained that some were even afraid to use the word 'expert.' In his view, China should cherish its experts." (Deng, 1983, p. 32; Vogel, 2011, p. 132).[5] However, while Mao remained alive Deng was not able to restore normal operations in the universities. His initiatives in education, especially at Tsinghua University, provoked Mao's opposition and were a key factor in his fall from power in early 1976.

Deng returned to the leadership in 1977 and resumed responsibility for science and education. At the Third Plenum of the 10th National Congress of the CPC in July he said that his two priorities were to improve the treatment of intellectuals, and party building (Vogel, 2011, p. 199). He repeatedly advocated science and scientists. He called for lists of China's leading scientists to ensure that they were provided with adequate facilities and living conditions so as to get on with their work. Building research was crucial. One of his early moves was to establish a new military university (ultimately opened after 1978), where research would be better protected from criticism from within the party. He attacked the tendency to advocate practical technicians at the expense of theory (p. 203), emphasizing the need for basic research to achieve scientific breakthroughs in China (p. 201). Basic research would be conducted in both the universities and industry, with industry R&D focused on applied research.[6] Deng highlighted the need for basic science, rather than the applications of science in engineering, that were normally more valued in the CPC than was basic science.

A crucial issue for Deng was to catch-up to the US and other advanced nations. "We must admit falling behind. There is hope if we admit it" (Deng, 1983,

[5] "中央表扬了这样的人，对他们应该爱护和赞扬." (The party central committee has praised such people. We should cherish and praise them.)

[6] "生产部门也会有搞基础科学的，但要着重搞应用科学. (The production units will also carry out basic science research, but they should focus on applied science). See Deng, 1983, p.53.

p. 40).[7] In a five day trip to France in 1975 he had been deeply impressed by Western technology. He repeatedly urged the need open up China to facilitate learning and help from abroad. To catch up, he said, China would need to develop its own talent (Vogel, 2011, p. 198; Deng, 1983, pp. 53–54.). “Chinese history shows that it makes great progress only when the country is open,” he said. Problems arose from opening, but they could be solved (Vogel, 2011, p. 466; Deng, 1994, pp.90–99). Deng always felt that the CPC was strong enough to manage any issues arising from opening (Vogel, 2011, p. 476). Even while ordering the campaign against bourgeois liberalization in 1987, and suppressing the Tiananmen protests in 1989 amid condemnation from Western nations, Deng again reaffirmed his commitment to “opening to the outside” and remaining visible (p. 585, p. 641).

Deng emphasized internationalization in science policy not as a source of borrowed science but as a guide to building China’s own capacity. Science was universal and could be used by all countries, he said (Vogel, 2011, p. 209). He drew on leading Chinese-American scientists for advice. He invited foreign scientists to visit. He said that scholars should collect foreign textbooks to update their teaching materials, and established programmes to enable young people to study abroad (pp. 203–204). In 1978 he negotiated with the Carter administration the first visit of science students to the US. In the next five years another 19,000 followed (pp. 322–323). In several days of talks with the Ministry of Education and Academy of Sciences in July/August 1977, designed to speed up the reform process in science and higher education, Deng stated:

> Chinese scholars who go aboard for study should be given incentives to return, and if they decline to return, they should still be considered patriots and invited to come back and give lectures (Vogel, 2011, p. 203).

Deng believed that in the long run “they would be an asset” to China (Vogel, 2011, p. 322), as he told a visiting U.S. delegation in 1978.[8] This proved far-sighted. For two decades most of the people who went aboard to study did not return, but matters changed when science and WCUs took off from the late 1990s

---

[7] The full quote in Chinese is as follows: “要承认落后，承认落后就有希望了.”

[8] For further referencing of the early student visits to the US and Deng’s views about China’s students going abroad, see Vogel (2011), pp.791–792, note 33.

onwards as U.S. National Science Foundation data show (NSF, 2018). Many sent abroad by Deng and his successors later played a key role as returning diaspora.

Deng did not focus solely on the natural sciences. He knew that philosophy, social sciences and studies of other countries were also necessary to guide modernization. In 1977 the Chinese Academy of Social Sciences was established. It was independent of the Ministry of Education and the obligation to generate propaganda, so as to enable it to concentrate on research (Vogel, 2011, p. 209).[9] However, because the content of social sciences was that of government itself, and the CPC, which led government, itself defined the nature of social problems, the Academy of Social Sciences could not be depoliticized as readily as could an academy serving the natural sciences (social sciences are discussed further below).

In the governance of the universities and research institutes, not long after taking office in 1977, Deng ordered the withdrawal of all workers' propaganda teams sent in during the Cultural Revolution that were still giving direction to scientists. "There will be no exceptions." (Deng, 1983, p. 69).[10] He advocated giving more flexibility to local officials, who could then take the initiative. (Vogel, 2011, p. 243).[11] The devolution of science and higher education was consistent with Deng's politically managed marketization of industry and trade. He supported growing devolution over time in education and science, as in the economy. In the universities he established a new distribution of authority in which state control was counter-balanced by scientific expertise. This laid the basis for today's dual system of governance, with party secretaries alongside academic leaders at each level. Again, the motivation was to foreground expertise and provide space for autonomy:

> Deng also responded to the continuing complaints of scientists that their professional work should be directed by someone familiar with the content. He directed that scientific institutes be reorganized with three top leaders at each institute. The party leader would manage overall policy, but the basic work of the institute would be under the direction of a leader trained in science. A third leader would be in charge of "rear services", with

[9] Vogel (2011) cites Cheng and Xia (2003).
[10] Vogel (2011, p. 208) mentions also that Deng ordered the withdrawal of "the troops sent in to support the left."
[11] "各省自己去搞，办法由他们自己定." See Deng, 1983, p. 68.

> responsibility for improving the living conditions and for ensuring that the scientists had adequate supplies to carry on their work. Aware that intellectuals were upset that they had to spend so much time engaged in physical labor and political education, Deng established a new rule that at least five-sixths of the scientists' work week was to be spent on basic research (Vogel, 2011, p. 208).

Hence, in his approach to governance, Deng spliced the Leninist state together with a classically Chinese devolution structure; that is, governance with an advanced scope for local adaptation and grass roots initiative, in an organizational system in which ultimate control remained at the center. Maintaining control was Deng's bottom line. He supported the maximum devolution and democratization consistent with that, but he had no desire to import Western political systems. If he thought CPC control was in doubt he moved quickly to maintain public order (Vogel, 2011, p. 250). Arguably, however, Deng's system of governance, by combining Leninism with dynastic system norms, was an original departure and a significant modification of the unilaterally top-down Leninist polity. With accuracy Deng's approach to governance can be called "Leninism with Chinese characteristics."[12]

This is not the place for a comprehensive review of the changes in China's university governance since Deng (but see Wen, 2013; Li & Yang, 2014). It suffices to state that within the framework of the Deng system, the autonomy of university leaders has been increased over time as he had advised. This has enhanced the scope for global action. A 1985 policy document called for a reduction in the authority of ministries over universities (The Central Committee of the CPC, 1985). Successive policy changes in the 1990s expanded the financial freedoms and responsibilities of university leaders, who were expected to raise their own funds. Devolution took the form of corporatization, as in many national higher education systems. In the late 1990s the mission of the state apparatus in higher education was redefined, from state control to state supervision. Article 30 of Chinese *Higher Education Law* of 1998 defined universities as legal persons (NPC Standing Committee, 1998). Devolution reform in the sense of corporatization has continued under Xi Jinping.

---

[12] Vogel reports that Deng began using the term "socialism with Chinese characteristics" in 1984 to promote his goal of market decentralization and reforms to science and education (Vogel, 2011, p. 465).

The Deng policy stances of opening up and learning from abroad, trusting scientists, university autonomy and depoliticization, were implemented with great consistency in China, as befits a Post-Confucian state practicing democratic centralism. This provided the platform for the wholesale transformation of China's higher education and science in the more global era of the 1990s and 2000s that followed, during which there has been a profound commitment to internationalization strategies in the WCUs (e.g., of many studies see Wang, Wang, & Liu, 2011). Deng's emphasis on theory and basic science was also important, given China's traditional understanding of knowledge as being for practical ends (Hall & Ames, 1998; Hayhoe, 2011), and as noted, the CPC's inclination for utilitarian engineering applications rather than scientific theory (except for matters of political theory). The focus on basic science fed the content of much international benchmarking (e.g., ARWU, 2018) and by taking root in the WCUs intensified China's connections to global science. The Deng policies also provided China's emerging universities with an effective basis for science diplomacy: openness to all, welcoming to visitors, preparedness to go anywhere and learn other languages, ceaseless searching for opportunities and collaborators, humility about achievements, clarity about their limits. Joined to determination to improve and a relentless work ethic, it was a formula for continuously lifting performance while also engendering respect.

In sum, the Deng formula encouraged and enabled China's WCUs and scientists to pursue effective global strategies and ensured that the WCUs would develop so as to resemble American and European universities in most respects, but on an accelerated basis. It is likely that Deng Xiaoping would have been pleased with how it has all turned out.

Tensions, Gaps and Limits

The national/global synergy that sustains China's accelerated development in higher education and science carries within its tensions, gaps, and limits. As was noted earlier, WCUs in China have successfully combined three elements: the political element which is the Leninist state, the administrative practices of the corporate university, and academic norms of open science and decision-making on the basis of disciplinary judgment. The last element, which was the gift of Deng Xiaoping, is essential to effective participation in the global science system.

The obvious tension within this assemblage is the potential for the balance between the three elements to shift in favor of the first, so that the political state overwhelms the autonomous disciplinary cultures. Something like this danger exists in many countries but it is larger in universities in China because the traditional East Asian preponderance of the political sphere is joined to the potency of Leninism in top-down control. Given the effectiveness of central governance only a small tweak is needed to shift the balance and to collapse Deng's dual authority system into a unitary state authority. The state always has the means to enlist not just the party-secretary apparatus but the academic leaders in support of its policy. There are signs of the potential for an overwhelming unitary authority in the expectation that university presidents should restrict student activism, for example student support for labor rights or gender-based social movements. Properly speaking, however, those issues are matters of political regulation not academic regulation, and state action in these areas does not in itself constitute the undermining of disciplinary cultures.

The revision of Deng-style academic governance could occur for a number of reasons: not just tightened political control of the universities but, say, the imposition of a more instrumental regime in higher education which tied research or teaching more closely to national priorities. If some autonomous WCUs or disciplinary communities lost ground, such is the nature of the centralized polity in China that a new era would be quickly established. If so, it is likely that the state would find it necessary to restrict cross-border academic collaboration because of its potential to undermine the revised governance of academic communities in China. Such a weakening of global engagement would not necessarily unwind China's science capacity, but it would slow the future evolution of both national effectiveness and global impact.

A second tension within the science system lies in the relations between corporate managers and academic cultures. All over the academic world, managed performance is associated with hyper-production, superfluous papers and pathologies such as fake journals, bogus credentials and a range of corrupt practices. In China there is much concern about these phenomena in universities (e.g., see Yang, 2016), given their potential to undermine collegial cultures, authentic knowledge creation and creative capabilities. The problem also affects China's global engagement. Because of the priority placed on internationalization a proportion of the work sent to the global journals has no value as knowledge. It may be that the academic/corporate tension associated with performance management is larger in China than in most other countries because of the ambitious accelerated targets and the comparative effectiveness of central state and managers in shaping behavior.

A third tension lies in the financial relationship between on one hand the central state, and on the other hand the universities and the disciplinary cultures. Episodic top-down intervention and performance pressures are easier to bear when the annual budget grows each year and new initiatives are readily financed. After more than two decades of budget increases sustained by the growth of the national economy, a high level of dependence on continuing growth has been established. But as night follows day, eventually the flow will slow. At that point there will be new financial pressures on institutions and academics; it is likely that financial dependence will be used to more directly shape the content of the work (for example, austerity in university financing is associated with heightened government control in the English-speaking countries); and without the flow of growing finance the other tensions in the assemblage will increase.

Each of these three tensions—deriving from top-down control of academic work, managed hyper-production, and financial dependence - creates uncertainty and instability. None are necessarily disabling. With care the balances between state, managers and academic disciplines can be maintained. However, there are other problems in China's science and the universities, gaps harder to deal with because they have never been effectively acknowledged or addressed.

One gap is generated by the skew in favor of physical sciences STEM. Other science-based disciplines, social sciences and the humanities are under-developed. Arguably, only a handful of WCUs in Chinese mainland, including Peking University, Fudan and Nanjing, make a determined effort to resource the full range of globally common disciplines, including the non-science fields, at an adequate level.[13] This gap limits inter-disciplinary work and affects potentials for engagement with universities outside China. It also sets practical limits on the contribution of higher education to nation-building. For example, compared to problems in urban construction, problems in public health are under served; and in the work of national, provincial and local government there is less

[13] However, most universities in Hong Kong SAR are similar to European or North American universities in their comprehensive commitment to all academic disciplines, including instances of influential work in the humanities.

capacity to address the social policy side of urbanization than issues of energy, transport and water. There are also further problems in the social sciences and humanities (Yang, 2014). Here, arguably, the gaps are due to inherent limitations in the Deng national/global synergy. The social sciences and humanities in China do not have the same level of visibility in global disciplinary networks as do the physical sciences and hence do not share the same level of collegial protection. There are also domestic constraints.

Though it has never been fully tested, there is a limit to which a Leninist political system can sustain social science that is on one hand state supported, on the other hand independent and critically minded like, say, as the famous Jixia Academy in the state of Qi in the Warring States period (Hartnett, 2011). Deng's formula of managed autonomy, with space for intellectuals whose work is seen as essentially non-political, works better in the natural sciences than the social sciences. In the social sciences academic and party-political discourses are more likely to collide. The state naturally expects university-based social science not only to support its goals and policies but to adopt (or at least, not target for sustained criticism) its concepts and terminology. However, critically-minded economists, sociologists and political scientists routinely develop ideas for new and better government. In social science theory is not a medium for coded internal political conversation but a way to imagine and model the social world. To enable such social science would require a larger mutation of the Leninist polity than that achieved by the Deng formula in the universities.

Meanwhile, the potentials of the humanities to draw on China's scholarly tradition in response to Westernization, develop renovated and hybrid ideas, and form new national narratives, are endemically under-valued (Yang, 2014; Zha & Shen, 2018). As with social science, the state does not require a diversity of possible national narratives. "Chinese characteristics" in the Jixia form are not welcomed. This also points to another limitation in the Deng national/global synergy, particularly its internationalization agenda. The emphasis on international benchmarking and publication, which often means publication in American-led journals, requires researchers and scholars to conform to foreign norms and topics rather than develop indigenous ideas. Social scientists are squeezed between conformity to state requirements and conformity to global academic requirements, which can point in different directions. Neither necessarily point towards new understandings of China in the terms of China.

The work of most humanists by definition lacks international presence, so again it is under-valued. Further, the potential of both the humanities and the social sciences to inject new Chinese cultural themes into civil society poses political risks. Arguably, both sets of disciplines require an open public sphere of the kind discussed by Habermas (1989), where criticism and alternatives are fostered, to maximize their contribution. In the post-1949 period this kind of public sphere has been episodic rather than permanent. Academic researchers have more opportunity for constructive criticism inside the CPC than in public, but again, the size of the space for new ideas tends to fluctuate with the rhythms of party politics.

These limitations have bordered the potential for a distinctive Chinese model of the university. Despite the sophistication of Confucian and Daoist thought and the long tradition of self-forming scholarship, modern Chinese universities have not established a distinctive approach to knowledge that draws on the classical tropes of diversity, partiality and fusion (though the classical commitment to knowledge that serves the common good is alive and well). In the evolution of the sciences the WCUs are closely affected by global templates that are more Western and American than anything else, while the disciplines such as philosophy that could lead a more contextualized approach are in eclipse. The Chinese university is yet to integrate the Western university with Chinese thought (Yang, 2014; 2016; 2017). Arguably, the Chinese university is still pursuing its foundational project of the late Imperial and early Republican periods, that of a force for modernization that is largely external to China. Where China has developed a unique model of the university is in the *governance* of higher education—in the manner in which a focused state has been combined with autonomous disciplinary science engaged in global networks, and regulated by dual university/state authority. The exceptional dynamism of this assemblage is a sign of its distinctive character.

Conclusion

China's connection with worldwide university networks and global science, a connection deliberately formed and sustained by China's policy in the Deng Xiaoping years and after, was, is, and will be crucial to China's success. The WCUs have worked the globalization of knowledge to their own and the nation's advantage by adapting successfully to it. This has had ambiguous consequences. On the one hand, hyper-internationalization has retarded the potential for a distinctive Chinese approach to knowledge and to the university as an institutional form. On the other hand, China has achieved a growing weight within world science and higher education. Historically Anglo-American WCUs have dominated at global level, leading the rules and conventions governing science, but science and university power is becoming more plural on the world scale. China has played the largest part in the global process of the diversification and distribution of scientific and university capacity.

If both local focus and global engagement are sustained, the global weight of China's science and WCUs must continue to increase. It is unclear whether and how the gaps in the Deng national/global synergy will be filled and its limits overcome. Nevertheless, all else being equal, the stronger China becomes on the world stage, the greater will be the scope of its universities to develop (and export) more indigenous approaches—provided that there is space within the universities and the disciplines for such indigenous approaches to take root.

References

Academic Ranking of World Universities, ARWU. (2018). Shanghai Jiao Tong University Graduate School of Education. Retrieved November 24, 2018, from http://www.shanghairanking.com/index.html

Anderson, B. (2006). *Imagined communities: Reflections on the origin and spread of nationalism.* Revised edition. London, UK: Verso

Blockmans, W., & de Weerdt, H. (2016). The diverging legacies of classical empires in China and Europe. *European Review*, *24*(2): 306–324. doi: 10.1017/S1062798715000654

The Central Committee of the CPC. 1985. *The decision of the CPC Central Committee on education system reform.*

Cheng, Z. and Xia, X. (2003). 历史转折的前奏：邓小平在 1975 [*The prelude to the historical turning point: Deng Xiaoping in 1975*]. Beijing, China: China Youth Publishing House.

Deng, X. (1983). 邓小平文选（第二卷) [*Selected works of Deng Xiaoping*, Vol. 2]. Beijing, China: People's Publishing House.

Deng, X. (1994). 邓小平文选（第三卷) [*Selected works of Deng Xiaoping*, Vol. 3]. Beijing, China: People's Publishing House.

The Economist. (January 28, 2017). The retreat of the global company.

Foucault, M. (2009). *Security, territory, population: Lectures at the College de France*

1977–1978. G. Burchell Trans. London, UK: Palgrave Macmillan.

Fukuyama, F. (2012). *The origins of political order: From pre-human times to the French revolution*. London, UK: Profile Books.

Gernet, J. (1982). *A history of Chinese civilization*. J. R. Foster & C. Hartman. Trans. Cambridge, UK: Cambridge University Press.

Habermas, J. (1989). *The structural transformation of the public sphere.* T. Burger Trans. Cambridge, MA: The MIT Press

Hall, D., & Ames, R. (1998). *Thinking from the Han: Self, truth and transcendence in Chinese and Western culture.* Albany, NY: State University of New York Press.

Hartnett, R. (2011). *The Jixia Academy and the birth of higher learning in China.* Lewiston, ME: The Edwin Mellen Press.

Hayhoe, R. (2011). Introduction and acknowledgements. In R. Hayhoe, J. Li, J. Lin & Q. Zha (Eds.), *Portraits of 21st century Chinese universities: In the move to mass higher educatio*n (pp.1−18). Hong Kong, China: Springer/Comparative Education Research Centre; The University of Hong Kong.

Leiden University (2018). *CWTS Leiden ranking 2018*. Centre for Science and Technology Studies, CWTS. www.leidenranking.com

Li, J. (2012). *Cultural foundations of learning: East and West.* Cambridge, UK: Cambridge University Press.

Li, M., & Yang, R. (2014). Governance reforms in higher education: A study of China. IIEP Research Papers. Paris: UNESCO International Institute for Educational Planning.

Mao, Z. D. (1958). Introducing a cooperative. In *Selected works of Mao Zedong*. Retrieved November 19, 2018, from https://www.marxists.org/reference/archive/mao/selected-works/volume-8/ mswv8_09.htm

Marginson, S. (2011). Higher education in East Asia and Singapore: Rise of the Confucian model. *Higher Education*, *61*(5), 587−611. doi:/10.1007/s10734-010-9384-9

Marginson, S. (2013). Emerging higher education in the Post-Confucian heritage zone. In D. Araya & P. Marber (Eds.), *Higher education in the global age* (89−112). New York, NY: Routledge.

Marginson, S. (2018). World higher education under conditions of national/global disequlibria. *CGHE Working Paper 42*. London: ESRC/OFSRE Centre for Global Higher Education. Retrieved December 1, 2018, from https://www.researchcghe.org/publications/working-paper/world-higher-education-under-conditions-of-nationalglobal-disequilibria/

Marginson, S., & Ordorika, I. (2011). El central volumen de la fuerza' global hegemony in higher education and research. In D. Rhoten & C. Calhoun (Eds.), *Knowledge matters: The public mission of the research university* (pp.67−129). New York, NY: Columbia University Press.

National Science Foundation. (NSF). (2018). *Science and engineering indicators 2018*. Retrieved March 20, 2018, from https://www.nsf.gov/statistics/2018/nsb20181/assets/nsb20181.pdf

NPC Standing Committee. (1998). *Higher education law of the People's Republic of China*.

Retrieved October 1, 2018, from http://www.npc.gov.cn/englishnpc/Law/2007-12/11/content_1383570.htm

Rodrik, D. (2017). *Populism and the economics of globalization*. John F. Kennedy School of Government, Harvard University. Retrieved March 15, 2018, from https://drodrik.scholar.harvard.edu/files/dani-rodrik/files/populism_and_the_economics_of_globalization.pdf

Salmi, J. (2009). *The challenge of establishing world-class universities*. Washington, DC: World Bank Publications.

Shahjahan, R., & Kezar, A. (2013). Beyond the "national container": Addressing methodological nationalism in higher education research. *Educational Researcher*, *42*(1), 20−29. https://doi.org/10.3102/0013189X12463050

Tran, L., Marginson, S., Do, H., Do, Q., Nghuyen, N., Le, T., Vu, T., Pham, T., & Nghuyen, H. (2014). *Higher education in Vietnam.* Houndmills & New York, NY: Palgrave.

Tu, W. (1996). *Confucian traditions in East Asian modernity: Moral education and economic culture in Japan and the four mini-dragons*. Cambridge, MA: Harvard University Press.

United Nations Educational, Social and Cultural Organization. (UNESCO). (2018). UNESCO Institute for Statistics data on education. Retrieved November 24, 2018, from http://data.uis.unesco.org/

Vogel, E. (2011). *Deng Xiaoping and the transformation of China*. Cambridge, MA: The Belknap Press.

Wagner, C., Park H., & Leydesdorff, L. (2015). The continuing growth of global cooperation networks in research: A conundrum for national governments. *PLoS ONE*, *10*(7), e0131816. doi:10.1371/journal.pone.0131816

Wang, Q., Wang, Q., & Liu, N. (2011). Building world-class universities in China: Shanghai Jiao Tong University. In P. Altbach & J. Salmi (Eds.), *The road to academic excellence: The making of World-Class Universities* (pp.33–62). Washington, DC: World Bank.

Wen, W. (2013). *The formulation and transition of China's educational policy from 1978 to 2007: A policy discourse analysis.* Columbus, OH: Foreign Language Publications, The Ohio State University.

Wimmer, A., & Schiller, M. (2002). Methodological nationalism and beyond: Nation–state building, migration and the social sciences. *Global Networks*, *4*(2), 301−334. https://doi.org/10.1111/1471-0374.00043

Xie, Q. N., & Freeman, R. B. (2018). Bigger than you thought: China's contribution to scientific publications. *NBER Working Paper* No. 24829. Retrieved September 17, 2018, from http://www.nber.org/papers/w24829

Yang, R. (2014). China's strategy for the internationalization of higher education: An overview. *Frontiers of Education in China*, *9*(2), 151–162. doi: 10.3868/s110-003-014-0014-x

Yang, R. (2016). Toxic academic culture in East Asia. *International Higher Education*, (84), 15–16. https://doi.org/10.6017/ihe.2016.84.9112

Yang, R. (2017). The cultural mission of premier universities in East Asia. *International Higher Education*, (91), 29–30. doi: 10.6017/ihe.2017.91.10138

Zha, Q., & Shen, W. (2018). The paradox of academic freedom in the Chinese context. *History* *of Education Quarterly*. doi: 10.1017/heq.2018.22