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Innovation and control: universities, the knowledge economy and the authoritarian state in China

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ABSTRACT

Like many other education systems in the world, Chinese education has undergone various reforms in order to adapt to the challenges that are perceived to emanate from the knowledge economy. Central to this transformation is the concept of ‘innovation’, which is to guide the country on its path from a production economy to a knowledge economy. Chinese policymakers have been targeting the higher education sector both as a motor for innovation and as a realm to be innovated, and have invested heavily in the sector’s internationalization, above all in the form of international collaboration and student mobility, affecting higher education and academia worldwide. However, a number of structural and political constraints delimit the directions that innovation can take, both within Chinese education in general and within Chinese higher education. The article takes stock of these constraints and assesses the potential for innovation in Chinese higher education in terms of the underlying school system, exam and recruitment policies, the (re-)organization of universities, as well as the universities’ and science system’s performance according to indicators of innovation. The article then identifies four ‘Chinese innovation dilemmas’, that is, educational policies and developments that are to spur innovation but run counter to existing structures and practices of educational, social, and political governance: ideological control versus creativity; state planning versus grassroots innovation; old-boy networks versus anti-corruption; and exam-based student recruitment versus flexible recruitment.

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Introduction: China and the challenges of the knowledge economy

The globally dominant discourse surrounding the ‘knowledge economy’ has been influencing educational policies and practices over the past decades (Välilä & Hoffman, 2008). Nation states continuously realign their educational systems with what they perceive to be the needs of the knowledge economy. Developing countries face the particular challenge of not only providing broader access to higher education, but also of interlinking their universities with the knowledge economy, by producing competitive graduates and generating innovative research (Altbach, 2013; Teferra, 2016). China is no exception, and has been expanding and transforming its higher education sector over the last two decades in order to establish world-class research universities and build a national innovation system (Huang, 2015; Kennedy, 2016), as well as become a competitive producer of ‘future knowledge workers’ (Chen, 2012, p. 102). The underlying assumption is, implicitly or explicitly, that higher education facilitates innovation.

The Chinese efforts of establishing world-class, innovation-oriented universities have been accompanied by an increasing internationalization, for example through intensified international collaboration

and student mobility. China is with 11.1% of the total the largest country of origin among international students across the European Union. In six EU countries (Finland, Germany, Ireland, Italy, Sweden, UK), Chinese students constitute the largest international student group, reaching as much as 28.5 per cent in the UK (Eurostat, 2017). In Sweden alone, the number of Chinese students has doubled over the last decade and thus grown much faster than Sweden’s international student body in general, which shows an increase by 37 per cent in the same period (Universitetskanslersämbetet [UKÄ], 2017)—despite the fact that Sweden had introduced fees for students coming from outside the European Union in 2011. Yet there is only a limited understanding regarding the educational context from which these students originate, and with whose institutions there is increasing academic collaboration. How are we to understand the transformations of Chinese higher education over the recent decades and the increasing emphasis on innovation in education, while Chinese education continues to be subject to conventional understandings of learning, limited social mobility and political-ideological control?

The present article will provide an answer to this question by relating the developments in Chinese

higher education to the larger social and political context, paying attention both to past developments within (higher) education, and to more recent trends under the current leadership of Xi Jinping and Li Keqiang. After briefly discussing the interrelationship of innovation and (higher) education, the article will turn towards the Chinese school and university systems and their capacity for innovation. Particular emphasis will be put on the question of: (i) to which extent the Chinese school system is capable of producing innovative graduates; (ii) how Chinese universities have been re-organized to adapt to the knowledge economy and a perceived need for more innovation; and (iii) how the Chinese university and science system perform according to indicators of innovation. Finally, four dimensions of the Chinese ‘innovation dilemma’ will be identified that are judged to bear an impact on Chinese higher education: ideological control versus creativity; state planning versus grassroots innovation; old-boy networks versus anti-corruption; and exam-based student recruitment versus flexible recruitment.

Innovation: planning the unplannable

Innovation is a ubiquitous phenomenon, which characteristically combines ‘pre-existing possibilities and components’ (Lundvall, 1992, p. 9) in unprecedented ways, thereby inducing technological, social and economic change. Importantly, it is not just the actual invention that creates innovation but this invention’s successful integration and use in the society. To measure or predict innovation is a complex, and as some argue, an almost impossible task. What are reasonable indicators of innovation, and which indicators are both necessary and sufficient for enabling innovation to take place? The following section will take a brief look at what kind of indicators have been used for explaining and facilitating innovation—with regard to innovation in general and innovation in education. The OECD is one of the most crucial transnational players both when it comes to assessing innovation, and to setting an agenda for building innovative capacity.¹ Therefore, the following section will take into account the OECD indicators for innovation, but also point to important approaches within innovation research that can help us grasp why innovation happens, or fails to happen.

Innovation in general, and in education: indicators

The OECD (2010) uses innovation indicators such as economic growth, intangible assets, patents, (inter-)national cooperation, the convergence of scientific fields, interdisciplinary research, and education and training; the latter comprising a country’s performance

in PISA (Programme for International Student Assessment), higher education, international mobility and national expenditures on research and development. For education specifically, the OECD (2014a) draws on criteria such as innovation in teaching practice and collaboration, class organization and assessment methods, recruitment and evaluation practices as well as textbooks and digital media.

Regarding innovation processes in general, two research traditions have pointed to the difficulty of understanding these processes other than in retrospective. Historically oriented innovation research has emphasized path dependence and the resilience of national and regional innovation cultures (see e.g. Andersen, 2001; Fraunholz & Hänseroth, 2012; Thelen, 2003); social network analysis has underlined the importance of ‘structural holes’, that is the bridging of previously unconnected areas (Burt, 1992). Based on these two approaches—path dependence and novel combinations—it can be assumed that it is above all two aspects that need to be considered when trying to understand or even facilitate innovation: Firstly, innovative changes will only be successful if integrated in existing social and cultural traditions. Secondly, the best strategy for policy makers is to create conditions for maximal diversity instead of investing in science monocultures. Novel combinations connecting different areas can only emerge in a diverse and open academic environment; it is by definition difficult to anticipate these new connections since the productivity of these can often be assessed only in hindsight.

As regards education, surveys have revealed how difficult it is to operationalize the OECD criteria when collecting data at schools (Adams & Sargent, 2012). Also, educational anthropologists who have spent longer periods of time in classrooms have pointed out the gap between stated and enacted practices: depending on the setting, activities that are to facilitate innovative practices, such as group work or independent learning activities, can be highly formalized and thus rather constrictive on the individual student (Schulte, 2018). ‘Innovation’ and ‘creativity’ have strong cultural connotations, and what is called ‘innovative’ in one schooling context, may not necessarily be perceived as ‘innovative’ in another.

Based on both the OECD indicators and the insights from historical innovation research, social network analysis, and educational research on the ground, this article will choose patents and international scientific publications as well as national expenditures on education, academic performance as assessed by PISA and international academic mobility as performance indicators for the Chinese education and science system, while also taking into account the Chinese academic and schooling context and its opportunities for openness and diversity.

Innovation and higher education

Higher education and innovation can be related to one another in two ways. On the one side, universities are places that are supposed to produce innovative human capital; on the other, universities can themselves become targets of innovation, for example regarding curriculum, teaching and learning, and higher education management. The dual function of higher education as both motor and site of innovation is rooted in the fact that education and innovation share a number of characteristics that are deemed necessary for both to operate successfully. In order for new ideas or products to become adapted, innovation systems need to be capable of learning, and hence require actors who know how to learn and interact.

Both these aspects—universities as motor and targets of innovation—have also entered Chinese debates and policies. It is increasingly the ‘soft’ skills—learning ability, flexibility, collaboration—that are also emphasized in Chinese educational reforms.

Universities as production sites for human capital

This perspective is based on the assumed correlation between education, innovation, and economic growth, according to which economies can only grow if there is continuous innovation. Since innovative capacity is seen to depend on highly educated human resources (Lundvall, 2008), national innovation systems need to be linked to the higher education sector, for example by way of coordinating research activities between different sectors, or shared use of research infrastructure. Consequently, a great deal of literature on innovation and higher education deals with ‘education hubs’, the geographical condensation of educational institutions, companies, knowledge industries, and science and technology centres (Knight, 2011), investigating the impact these hubs may have on a country’s innovative capacity. In China, such hubs started to be designed and gradually implemented since the early 1990s (Leydesdorff & Zeng, 2001).

The actual impact of higher education developments on national or regional innovation is less well researched, despite the abounding literature on boosting national innovation systems through higher education policies. Saad, Guermat, and Brodie (2015) have noted a correlation between different types of higher education systems and the innovation capacity of a country, correlating for example innovation and successful higher education expansion, as well as innovation and higher education expenditures. For China, scholars have found a correlation between the number of higher education degrees and innovative activities (Wei & Qian, 2010). However, there is insufficient empirical evidence as to whether this is

due to a one-way causal relationship—that is higher education induces innovation—or whether there are other factors that favour both innovation, and higher education, such as a positive political and economic climate in certain regions.

Innovation of the university

There exists a great deal of literature on innovative changes within higher education (see the critical review in Winslett, 2014 with a focus on the Australian case). Changes include content of learning, methods of teaching and learning, collaboration outside the university and internationally, and higher education management. The latter is often associated with processes of commercialization and privatization, new modes of control and quality management, as well as a changed conception of autonomy and transparency (Christensen, 2011). China has increasingly become part of this global discourse of educational innovation and has introduced a number of higher education reforms since the 1990s (Postiglione, 2015), the most important of which will be mentioned below.

The Chinese educational system: innovative potential

Characteristics and tensions

Three main characteristics have been affecting the Chinese education system over the past decades: expansion, examinations, and inequality. Between 1949 and today, the Chinese education system has expanded enormously, having reached a school enrolment rate of nearly 100%. Today, 40% of an age cohort attend a university, compared to 17% in 2003. While the Chinese school system is officially non-tiered, the low number of places at high-quality universities makes the system highly competitive, placing heavy emphasis on high-stakes examinations. Pressures to perform well begin already in kindergarten age. Finally, even though the Chinese education system is meritocratic, the economic, social and cultural capital of families has a clear impact on their children’s education.² This has led to increased educational segregation and reproduction compared to the 1980s, resulting in an overrepresentation of students from the educated middle and upper classes at elite universities—an imbalance that Chinese professors have criticized in an open letter (‘Xuezhe huyu’ 2011).

The Chinese curriculum reform: innovation or old curriculum in new disguise?

Towards the end of the 1990s, China launched a comprehensive reform of the school curriculum that

was to reflect the transition into the twenty-first century (Zhong & Cui, 2001). By this time, the changes that were discussed globally as emanating from the ‘post-industrial society’ and the ‘knowledge economy’ began also to be debated in China; by 2005, the term ‘knowledge economy’ had become known to a wider Chinese audience through the book *The Copernicus Revolution of the Field of Economy* by the economist Chen Shiqing (Chen, 2005). China was to embark on a journey from a production site (‘made in China’) to a knowledge economy based on well-educated personnel (‘created in China’). In the eyes of Chinese policymakers, such a profound transformation could be achieved only through changes in education and learning. The curriculum reform that was to deliver these changes was therefore designed to replace the Chinese tradition of teacher-centred rote learning and exam orientation with ‘quality education’,³ placing emphasis on: learning as an active, holistic endeavour; cross-disciplinary learning; individual student experiences and personal development; practical usefulness of teaching content; local specificities and differentiation of curriculum; creativity and social responsibility; information and digital literacy; learning processes instead of exam results; and general goals to be reached instead of micro-managing learning input.

The Chinese educational discourse is by now literally drenched by the terms ‘innovation’ and ‘creativity’: the Ten Year Plan for Educational Reform (The Central People’s Government of the People’s Republic of China [PRC], 2010) refers to ‘innovation’ 63 times. However, whether ideas that are meant to be innovative will be *implemented* innovatively, thus leading to changes in cognitive learning patterns or new learning results, can only be assessed through contextualization. More fine-grained surveys suggest that many changes are more cosmetic than real (Adams & Sargent, 2012). Actors often adjust to policy buzz words, deliberately or not. Policy documents exert a strong normative influence on how actors such as local educational bureaus, school leadership and teachers are to perceive and describe the implementation of educational reform. Consequently, actors are quick to call any changes in teaching and learning practices ‘creative’ or ‘innovative’. In a study conducted by the author at 20 schools in three different regions in China, ‘creativity’ and ‘innovation’ were named by almost all participants (most of them school founders, principals and teachers) in order to describe their motivations, teaching practices and understandings of education and learning. However, teaching styles and classroom management were found to follow highly traditional patterns, for example involving rote learning, speaking in chorus and a strong orientation towards the teacher (cf. Schulte, 2018). In higher education, Yang and Welch (2012)

note that collaborative learning practices and active classroom participation are not very prevalent; only few students ever raise a question in the classroom, or do a class presentation.⁴

What makes the Chinese case particularly difficult for implementers is the fact that the reform is basically incompatible with existing educational structures. The current regulations and practices regarding examination and selection of students run counter to the points emphasized by the reform: the examinations, at least in their present form, embody an atomistic conception of knowledge and give rise to such time and performance pressures that there is little leeway for creative detours and in-depth confrontation with learning content. Those who make it into a prestigious university are not necessarily uncreative; however, the creativity these students may possess can be seen to exist despite and not because of the formal education they have received.

China and PISA: a success story?

As has been noted above, the OECD regards a country’s performance in PISA as crucial for that country’s innovative potential. China’s high performance in PISA in 2009 and 2012 seems to confirm the high quality of its educational system, and has even led to Western calls for learning from the Chinese (e.g. Tucker, 2011). However, China had been represented in PISA only by Shanghai, which occupies an exceptional position in Chinese education; after the Chinese PISA sample was expanded in 2015 to also include Beijing and the provinces of Guangdong and Jiangsu—still considered privileged regions—China dropped to the tenth place in the PISA ranking.

Apart from questions of sample bias and validity of results (see Loveless, 2014), scholars have criticized the results’ significance for innovation and entrepreneurship. Zhao (2012, p. 60) notes a negative correlation between PISA results and entrepreneurialism, and concludes that ‘[s]tandardized, narrow, and uniform educational experiences, high-stakes standardized testing, a push for conformity, and intolerance of exceptional talents are among the facts’ that destroy ‘creativity and entrepreneurial spirits.’ Even the OECD itself is presently developing a framework for assessing ‘creative and critical thinking skills in education’,⁵ which hitherto have been considered only insufficiently but are planned to become incorporated into PISA 2021. And while in general the OECD had been predominantly positive about the Chinese educational performance, it did suggest to introduce ‘more opportunities for [Chinese] students to develop and exercise the traits that are linked to success on interactive items, such as curiosity, perseverance and creativity’—without however going into

detail about what constitutes creativity (OECD, 2014b, p. 91).

All in all—and coming back to the previously discussed importance of social and cultural traditions (path dependence) as well as diversity and the possibility of novel combinations (social networks)—the Chinese school system can be considered an environment that subordinates all aspects of schooling to the students' performance in examinations. The road to high test performance again is operationalized through rote-learning within each exam subject. The central importance of exams, combined with the prevalent teaching and learning practices, impedes both interactive group learning and cross-subject learning, as well as it leaves little room for individual active engagement with learning content that goes beyond the content provided by the text books.

Chinese universities: organization, reforms and performance

The development of Chinese higher education

The Chinese higher education sector is characterized by an enormous expansion, particularly since the late 1990s, from initially 181 universities after 1949 (Yang, 2002) to 3,586 universities today (both public and private).⁶ A milestone in the development of higher education were the 'Guidelines for the reform and development of education in China', which are oriented towards the US-American model (CCCP 1993). These reforms included aspects such as joint university management at various levels (national, regional, local), emphasis on local needs and specificities, merging institutions to create synergies, cooperation between institutions and shared use of resources, and integration of other social sectors (firms, research facilities etc.). Higher education, as formulated by the Central Committee of the Communist Party (Central Committee of the Communist Party of China and State Council [CCCP], 1993), was to 'adapt to the development requirements of the economy, technologies, and the society'.⁷ However, a number of government decisions and announcements in the subsequent decades that proclaim very similar aims as the 1993 guidelines suggest that collaboration, shared use of facilities, and synergies between universities and the wider society continue to be malfunctioning. Often, laboratories and machines are perceived as exclusive property, and institutions are unwilling to share with others (e.g. Ministry of Education of the People's Republic of China [MOE], 2015a).

One side effect of the massive expansion of the Chinese higher education sector is the bifurcation into research universities and mass universities. The latter are to provide large parts of the population with

the much sought-after tertiary degrees but cannot compete with research universities in terms of allocation of funding and quality of research and teaching. While this bifurcation may not have been propagated openly, it was certainly part of the master plan as stated in the 1993 reform guidelines:

In order to tackle the global challenges caused by the new technology revolution, various central, local etc. forces need to be joined to construct approximately one hundred key universities and a number of scientific key disciplines and special research areas, we need to do everything to command, at the beginning of the next century, a number of universities, scientific disciplines and special research areas that can reach a level that is high in international comparison, with regard to the quality of education, scientific research, and management.

(CCCP, 1993)

This plan of establishing world-class universities under the name of 'Project 211'⁸ was launched in 1995 and today comprises 124 universities, which aim not only for high-quality teaching and research but also for the commercial exploitation of research results, university reforms, and international cooperation and exchange. In yet another attempt to create a Chinese equivalent to the North American Ivy League universities, then president Jiang Zemin, in 1998, additionally initiated the 'Project 985'.⁹ Universities belonging to this league—first 9, currently 46 institutions—are heavily prioritized by the government (cf. Rhoads, Wang, Shi, & Chang, 2014).

Finally, an important ingredient of Chinese higher education reform is the orientation towards the outside world. An increasing number of Chinese students study abroad¹⁰; in the USA, the largest receiving country, they make up one-third of all international students, and in Japan even 70%. In the 1990s, Chinese policymakers were concerned that the growing international mobility of Chinese students and scientists would lead to a brain drain (Deng, 1992). In recent years, China has created a number of incentives for Chinese scholars to return home and for international scholars to move to China; this and the generally positive development of the Chinese economy has led some scholars to speak of a 'brain gain' instead (Kellogg, 2012). To what extent the tightened ideological control as has been observed since 2013 will make scholars more reluctant to work in China is presently difficult to assess. From an innovation perspective, recent repressive measures by the Chinese government against universities and academics have been judged to be of concern (Pan, 2015). They endanger specifically the above-discussed factor of diversity and potential new connections irrespective of ideology.

A problem within Chinese higher education that has repeatedly received attention is corruption.

Corruption has been reported to occur in the form of fraud and plagiarism in research,¹¹ protectionism in the publishing business,¹² embezzlement or wilful waste of funds,¹³ illegal awarding of contracts (particularly regarding construction work on campuses), irregularities in student admissions, excessive admission of doctoral students and awarding doctoral titles to local business elites, as well as ‘academic overlords’ who reign over their departments like ‘absolutist rulers’ (Yang, 2005). The most recent anti-corruption campaigns launched by the current leadership are not only targeting economic and political actors but increasingly affect the higher education sector as well (He, 2013).¹⁴ Ironically, it is especially the collaboration between universities and industry—so much emphasized in government reforms—that has proven to be a breeding ground for corruption.¹⁵ Many corruption scandals at universities were preceded by privatization and commercialization processes, which again were triggered by the reforms of the 1990s. Thus, while new connections between universities and industry should be theoretically productive from an innovation perspective, China’s trajectory of privatizing the economy has in many cases resulted in mutual enmeshment rather than in mutual enrichment. While most anti-corruption campaigns seem to rest on sufficient evidence, Chinese leaders have been criticized of choosing their anti-corruption targets in order to purge their opponents (cf. Lu & Lorentzen, 2016).

Expenditures on research and development (R&D)

Expenditures on R&D are among the indicators used most often to assess a country’s capacity for innovation. Between 2000 and 2015, China has more than doubled its national expenditures on R&D from 0.9% of its GDP to 2.1%, thus almost reaching the OECD average of 2.4%. In comparison, Sweden—a country known for its innovative capacity—has reduced its expenditures during the same period from 3.9% to 3.3%. Only South Korea shows an increase comparable to that of China, from 2.3% to 4.2% (OECD, 2017; Vetenskapsrådet [VR], 2016). In the same period, the Chinese ratio of researchers per 1000 inhabitants also doubled, from one to two researchers. However, this ratio can be regarded comparatively low: OECD countries have eight researchers per 1000 inhabitants in average, with Finland ranking first (15 researchers; Sweden: 13.6 researchers; OECD, 2017). Researchers play an important role in innovation processes, not just as producers of knowledge but also as linkages between research, firms and society. According to Lundvall (2008), researchers operate as mediators who integrate innovative ideas and products in socially sustainable ways. In this

regard, the density of researchers in a country may be as crucial for innovation as the quantity and quality of the knowledge they produce.

A comparatively high proportion of Chinese national expenditures on R&D goes to firms: 77%, compared to 69% in OECD average. In contrast, Chinese universities profit from only 7% of expenditures (OECD 18% and Sweden 29%; VR, 2016). Chinese universities have been traditionally underfunded. In the past, it was the public sector, not the universities, who obtained the largest share of government funding: in 2000, 31% of expenditures for R&D went to the public sector, while only 9% were channelled into universities (VR, 2016). This entanglement of government and firms (or government and public sector in the past) and the relative exclusion of universities when it comes to research funds may impact China’s innovative capacity negatively, particularly if the personal networks that permeate the Chinese political, economic and industrial sector are taken into account (cf. McNally, 2011). Such exclusive networks make it difficult for external or new actors to participate in potential innovation processes, thus violating the above-mentioned prerequisites for innovation: openness and diversity.

Patents

Patents are frequently used for measuring innovation capability, even if, as noted above, technological inventions need to become embedded in other systems systematically and enduringly in order to have an innovative effect. Patents do not necessarily point to activities that facilitate innovation, such as research and development: a great number of patents are registered to block the product development of the competitor, rather than to advance science and technology.¹⁶ The following patent success story regarding China should therefore be read with caution, and not automatically taken as proof for innovation.

The current worldwide increase in patent applications is mainly due to the development in China, where only in 2014 applications have increased by 13% compared to the previous year; over the last decade, China has become an internationally significant patent applicant, with 7.6% of patent families coming from China (Japan: 60.4%; Korea: 16.4%; US: 7.3%; WIPO, 2015, p. 10). In absolute numbers, China can boast about the highest number of patent applications worldwide (WIPO, 2015, p. 27); however, the country ranks ninth if set in relation to its population size (Sweden ranks seventh; WIPO, 2015, p. 50). But even proportionally, China has been able to catch up: while for example Sweden had more than 11 times as many patent applications per inhabitant in 2004 compared to China, the differences between

the two countries are now negligible. China was able to increase its patent applications more than tenfold during this period, while Sweden had an increase of only 4.5% (WIPO, 2015, p. 50).

International scientific publications

As in the case of patent applications, the indicator of international scientific publications has to be viewed with caution: publications do not necessarily lead to innovation. It is equally possible that publications remain within a self-referential system, having a high impact within the science system but only a limited effect on the wider society, if there are no mediators or bridges between science and society.

In international comparison, rather few publications with Chinese authorship appear in international journals: China has only 0.14 international publications per 1,000 inhabitants (VR, 2016).¹⁷ The data look more positive if the effectiveness of publications is taken into account: 10% of Chinese publications between 2012 and 2014 were published in journals with a high impact factor (upper 10% of most cited journals). While this value is still lower than for the USA (14%), it is comparable to countries like Sweden (11%) and significantly higher than for Japan (6%). Moreover, if one looks at the development over the last ten years, China has improved its performance considerably: its international publications have increased by four times and the publications' proportion in top-ten journals grew by 67%. A comparable increase in the latter category can only be stated for Singapore (60%), while the

Chinese absolute growth of international publications is unique. In comparison, Japan shows a slight decrease in both categories (Figure 1).¹⁸

China is internationally most visible in the disciplines of chemistry, engineering sciences and material sciences, with proportions of 12% each among the top-ten journals. While the USA still performs higher in all disciplines,¹⁹ it is remarkable that South Korean publications, despite Korea's considerable investments in R&D, fare consistently below the level of their Chinese counterparts (in average 20% lower performance; VR, 2016). Also regarding co-authorship with scholars based outside China, Chinese scientists have been able to both strengthen their existing partnerships (especially with the USA and Japan) and diversify their international collaboration over the recent decades (OECD, 2010, p. 30). It is highly probable that China's rapid success in terms of international publications is due to the country's high specialization in selected research areas, in congruence with the above-mentioned reform guidelines from 1993.

However, there is a drawback: while countries like the USA and many European countries have publication profiles that are rather balanced in terms of academic disciplines, emerging academic nations such as China tend to be strong in a few selected number of disciplines, at the expense of the humanities and the social sciences. Even though this specialization may appear reasonable given the limited resources, such a strategy might backfire on potentially innovative developments, as the publication output in a few selected areas is prioritized over keeping the system of science diverse and open for novel combinations—a prerequisite for innovation to take place, as has been argued above.

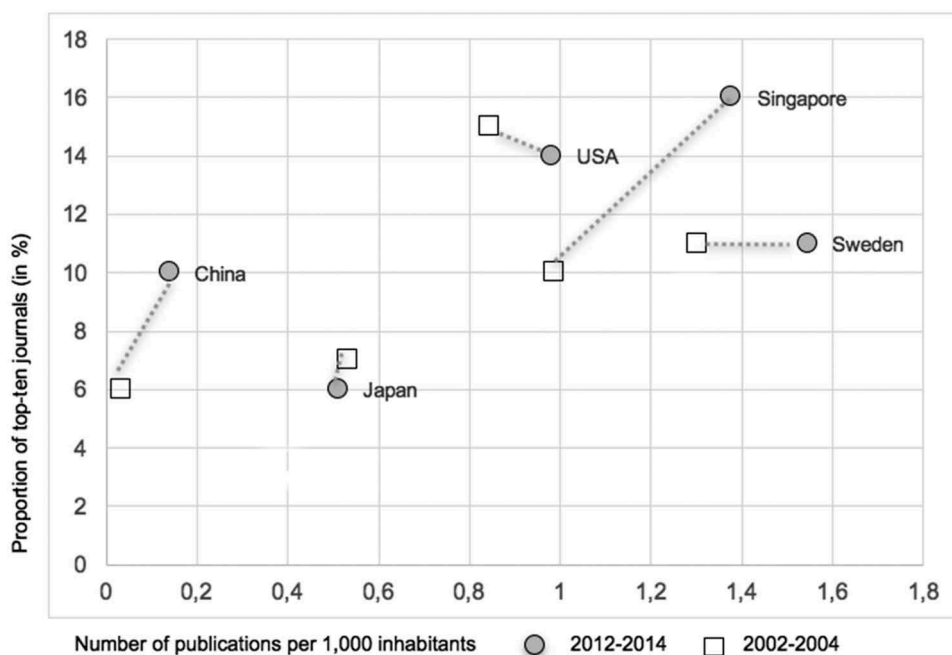


Figure 1. International journal publications in international and intertemporal comparison (data source: VR, 2016).

Chinese innovation dilemmas

Chinese universities have obviously made progress in what can be measured by the OECD indicators for innovation. At the same time, as has been discussed above both with regard to the schooling system and higher education, this progress needs to be considered with caution. Firstly, changes that are to make learning more creative and innovative are often more cosmetic than real; teaching and learning continue to move along social and cultural trajectories that are defined by the examination system. Secondly, openness and diversity, including the possibility of forging new connections between fields and actors, are compromised by an atomistic understanding of learning, unwillingness to cooperate across institutions and sectors, top-down modes of control, and networks of corruption.

The following section will condense these problematic areas into four innovation dilemmas; that is, dilemmas that reflect how educational policies and developments that are to spur innovation run counter to existing structures and practices of educational, social, and political governance.

Ideological control *versus* creativity

This common-sense argument claims that authoritarian control and creativity exclude one another, and considers authoritarian rule an obstacle to innovation. For example, Cao, Simon, and Suttmeier (2009, p. 253) see a ‘culture of creativity’ as the basic prerequisite for innovation and wonder

...whether China can become an innovation-oriented nation without being open to different ways of thinking [...] While on the surface Chinese researchers and entrepreneurs are encouraged to think outside the box and not to be afraid of failure, at least equally important is that other ingredients of a true innovation culture – autonomy, free access to and flow of information, and especially dissent, scientific as well as political – are not adequately applauded or tolerated.

(Cao et al., 2009, p. 258)

However, comparative empirical studies have shown that political indicators such as a democratic social order, political decentralization or free markets do not necessarily correlate positively with innovation (Taylor, 2016). Moreover, authoritarian regimes are not homogeneous over time but go through different phases of liberalization and repression, as has also been the case in China; besides, control and repression can affect different groups differently and might thus not necessarily impact potential innovators negatively.

Under the current leadership, ideological control has certainly tightened, also within higher education. As recently as in March 2016, the Chinese Ministry of Education released an announcement that aims to improve ideological-political education at the universities (Ministry of Education of the People’s Republic of China [MOE], 2016).²⁰ It remains to be seen whether these regulations can restrict the circulation of information and knowledge and thus impact innovative processes negatively. The Chinese government is well aware of the dilemma that information constitutes both the base for the knowledge economy, and a potential risk for social and political stability. However, for the time being, the government shows confidence in its increasingly refined information management and its self-proclaimed ability to differentiate between what it regards as ‘positive’ and ‘negative’ information. In a way, one can argue that China’s political leaders follow a trajectory of managing information that has proven successful so far. Moreover, it is far from certain that China’s information politics will deter actors who are potentially relevant for innovation processes. On the contrary: if one does not buy into the idea that innovation means improvement, actors may find more favourable conditions in a less democratic (and thus less ‘quarrelsome’) context as long as their interests do not clash with those of the ruling elite.

State planning *versus* grassroots innovation

The Chinese government’s belief in the capacity of its information management reflects its pronounced planning optimism, which is based on the leadership’s conviction that it can design the right kind of master plan for boosting innovation. However, as has been pointed out above, the ways in which innovation has emerged can often be understood only in retrospective. The risks of wrongly designed master plans can be reduced by ensuring a diversity of alternative plans and actors, who can be activated in case of failure. Chinese reforms have long operated by way of local experiments, combining grassroots perspectives with top-level master plans. Also in educational policy, bottom-up approaches have been encouraged. As recently as in December 2015, for example, the Ministry of Education declared to prioritize small and medium-sized firms and gives instructions as to how university graduates can innovatively engage with these firms (Ministry of Education of the People’s Republic of China [MOE], 2015b).

The current leadership has been judged to put heavy emphasis on a ‘top-level-design’, thus parting with the locally grounded, experimental approach and endangering the earlier flexibility and innovative capacity (Holbig & Schachtschneider, 2016). Hence, while grassroots approaches have contributed to

China's hitherto successful adjustment to new, local and global, challenges, the current stress on a top-down master plan may mean the end of this relatively open experimental phase.

Old-boy networks *versus* anti-corruption

Theoretically, the intensified battle against corruption should benefit innovation. By weakening personal, exclusive networks, outsiders get the opportunity to compete for resources based on their expertise and innovative potential rather than group membership. A recent study shows that the Chinese anti-corruption campaign has made firms invest more in R&D, which has increased these firms' innovative activities (Dang & Yang, 2016). The authors relate the previous lack of innovation to the fact that the costs to be invested in corruption were lower than those that would have had to be spent on innovative measures. Comparable studies investigating the influence of the recent anti-corruption campaigns on innovation within higher education do not yet exist. Possibly, and in congruence with Dang's and Yang's findings, higher education actors may become more incentivized to utilize their resources according to scientific criteria, rather than spending them on personal networks or individual pockets.²¹

For such changes in behaviour and investment to become comprehensive and consistent, however, the anti-corruption campaigns would need to be institutionalized and become legally binding for all. Similar to earlier campaigns, also the current anti-corruption measures operate in a system that is characterized by a high degree of despotism. Griffin, Liu, and Shu (2016) note that a firm is significantly less likely to become the target of an anti-corruption investigation if its leaders have attended the same university as the members of the central government. In light of China's weak rule of law, it can be assumed that most actors will continue to depend on (partially exclusive) social networks.

Recruitment through the exam system *versus* flexible recruitment

Examinations are not the best instruments for assessing a candidate's innovative potential. They prevent students from problem- and interest-oriented learning and instead cultivate a 'teaching to the test' attitude. Chinese educational policy has been tackling this problem for decades but has at the same time been reluctant to dispose of examinations as the most important means for selection and recruitment, for two reasons.

Firstly, examinations continue to be perceived as the most just of all selection methods, in particular regarding the rural population. Requirements that are more difficult to assess (e.g. a diffuse quality such as 'creativity') often put rural students at a disadvantage, who despite their legendary diligence have more difficulty to attain these

tacit competencies (Kipnis, 2001). If rural students were to exhibit culturally appropriate forms of 'creativity', rural ways of learning and examining would have to be transformed accordingly. Nation-wide examinations have in fact changed over the last years, putting more stress on judgment and discussion skills and less emphasis on rote learning. Moreover, acknowledgment of non-academic skills (such as in art, music or sport) as well as of social engagement (such as through volunteer work) has begun to open up alternative paths into the university. However, all these skills characterize the typical urban student. Additionally, some elite universities collaborate with secondary schools for recruiting excellent students through a recommendation system; again, all of the collaborating schools are located in urban areas.²² The Chinese government stands at the crossroads: Either it invests in educational equality and mass higher education; or it prioritizes the urban elites. More recent attempts at greater educational inclusion—for example through higher exam quota for disadvantaged groups—have encountered fierce resistance from the established middle class (Hernández, 2016).

Secondly, more flexibility in student recruitment entails higher risks for corruption. Experiments with more autonomy regarding student admission have been accompanied by a number of scandals. Recently, the person in charge of student admission at the renowned People's University in Beijing was convicted of accepting bribes for admitting students who otherwise would not have been admitted, and for letting certain students change their major (Forsythe, 2015). As a result of this scandal, the People's University has for the time being lost all autonomy in selecting its own students. Besides, the idea of granting more autonomy to universities has been called into question more generally.

Conclusion: from elite to mass innovation

The future path of Chinese education can of course not be predicted. More recent policy decisions suggest that the pendulum may swing back towards greater equality and inclusion in education. 'Innovation' could turn out to become a key concept in this re-orientation, through a strategic shift in the term's meaning. In older documents, 'innovation' was mainly understood in an elitist sense, associated with academic excellence and high performance. Presently, the term is increasingly used with regard to the wider population and the less developed regions. The Nine-Year Plan for the revitalization of higher education in the less developed regions of Central and Western China uses innovation as the document's central thread (MOE, 2013). In the above-mentioned MOE document on grassroots innovation among university graduates and small to medium-sized firms (cf. MOE, 2015b), the phenomenon of 'grassroots' attains a

developmental meaning: besides the engagement with smaller firms, the document aims further to recruit university graduates for the less developed regions in Central and Western China. In another recent move towards turning ‘innovation’ into an instrument that is to uplift the masses, Premier Li Keqiang stated at a symposium on educational reforms that the ‘competition between nations nowadays is in fact a competition of innovation’, urging universities to promote ‘mass innovation and mass entrepreneurship’ (China Daily, 2016).

The idea of an ‘innovation for the masses’ taps into earlier Maoist discourses of mass mobilization, and can thus be considered a particularly Chinese adaptation of the global discourse regarding innovation and the knowledge economy. Such a strategic move may in fact be used to reconcile the contradictions that have been characterizing the development of Chinese education, namely the contradictions between excellence and equality, or exclusivity and inclusion—while not jeopardizing the government monopoly of ideological control. The success of this path will depend on, firstly, whether China’s leadership will continue its previously successful approach of grassroots experimentation; and secondly, whether it will be able to put an end to corruption within a legal rather than a despotic framework.

Notes

1. See <http://www.oecd.org/innovation/>. For education, the OECD has come to play a pivotal role through PISA (Programme for International Student Assessment).
2. The lowest ranks of the social hierarchy are occupied by China’s internal migrants, who have moved from the countryside to the cities in search for jobs; see for example Zhou and Wang (2016).
3. By now there is a massive body of literature regarding the Chinese focus on ‘quality’ and ‘quality education’ (see e.g. Anagnost, 2004; Dello-Iacovo, 2009; Kipnis, 2006).
4. Li, Remedios and Clarke (2014) however point to the widespread phenomenon among Chinese university students of student-initiated group work outside the classroom.
5. See <http://www.oecd.org/edu/eri/assessingprogressionincreativeandcriticalthinkingskillsineducation.htm>.
6. For a historical overview, see Hayhoe (1989); on higher education expansion, see Zha (2009); and on university merging, see Mok (2005).
7. All translations from Chinese are the author’s.
8. The first two digits denote the twenty-first century; the last digit the number 100.
9. The first two digits denote the year 1998; the last digit the month of May, when Jiang Zeming announced the initiative on occasion of the 100th anniversary of Peking University.
10. The UNESCO Institute for Statistics reports a total number of 847,259 Chinese students abroad for 2017 (not including Hong Kong and Macao); see

<http://data.uis.unesco.org/Index.aspx?queryid=172>.

Chinese international students outnumber by now students from India, who is the second largest sending country, by a factor of three.

11. There is an on-going discussion of whether or not the apparently greater permissiveness among Chinese regarding plagiarism is culturally grounded (see e.g. the discussion in Ehrich, Howard, Mu, and Bokosmaty, 2016).
12. Tam and Chen (2010) find close ties between the university/faculty where journals are based, and contributing authors, a large share of whom are faculty members at these very universities.
13. According to a report in the *Epoch Times* from 16 November 2014, only 40% of Chinese research funds are actually used for research (Sun, 2014).
14. Anti-corruption measures are an important part of the current Five-Year Plan (2013–2017).
15. For example, the deputy vice-chancellor of the renowned Zhejiang University had to resign in late 2013 due to his alleged dubious involvement in associated technology firms.
16. See Moser’s (2013) historical study on the relationship between patents and innovation.
17. Only publications as listed in the Web of Science were counted.
18. There are a number of incentive structures for Chinese researchers to publish in international highly-ranked journals, including generous promotion policies and substantial individual remuneration.
19. Except for the engineering sciences, where both the US and China have a share of 12% among the top-ten journals.
20. Students are usually reluctant to participate in political-ideological education, and teachers often feel that they need to readjust the content (Lai & Lo, 2011), which has raised the government’s concern that these readjustments were no longer true to party principles.
21. This changed behaviour has so far been suggested to the author anecdotally by Chinese university professors but has not yet been substantiated systematically.
22. Previous research has shown that Chinese universities are more likely to recruit in regions that are judged to host the most excellent students (Gu, 2012).

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