Higher Education for Sustainable Development in China: Policy and Progress

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Abstract: The purpose of this paper is to review the development of green universities in China from the perspective of education for sustainable development (ESD), and to assess the significant factors influencing their development. This paper reveals the significance of the Ministry of Housing and Urban-Rural Development (MoHURD) and the Ministry of Education (MoE) in the development of green universities in China. In the past two decades, a series of initiatives taken by the MoHURD has been critical in promoting the construction of green campuses. However, the overemphasis on the green infrastructure also poses significant challenges for the development of ESD in Chinese universities. Analysis suggests that the responsibilities of MoE in guiding the environmental research and curriculum planning are critical to continuing and strengthening efforts in Chinese green universities over the longer term.

Résumé: Le but de cet article est de passer en revue le développement des universités de type environnemental en Chine du point de vue de l'éducation pour le développement durable (EDD), et d'évaluer les facteurs importants qui influencent leur développement. Cet article révèle l'importance du ministère du Logement et du Développement urbain-rural (MoHURD) et du ministère de l'Éducation (MoE) dans le développement d'universités de type environnemental en Chine. Au cours des deux dernières décennies, une série d'initiatives prises par le MoHURD a joué un rôle essentiel dans la promotion de la construction de campus verts. Cependant, l'accent mis sur l'infrastructure pose également des défis importants pour le développement de l'EDD dans les universités chinoises. L'analyse suggère que les responsabilités du ministère de l'Éducation dans l'orientation de la recherche environnementale et de la planification des programmes d'études sont essentielles pour poursuivre et renforcer les efforts des universités de type environnemental chinoises à long terme.

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Introduction

The education for sustainable development (ESD) aims at integrating the principles and practices of sustainable development into all aspects of education and learning, to encourage changes in knowledge, values and attitudes with the vision of enabling a more sustainable and just society for all (UNESCO, 2014). Chinese higher education institutions are indisputably important participants in the field of the ESD and environmental sustainability is regarded as the core of the ESD campaign in China. However, in-depth research on the experience of Chinese universities in this field is insufficiently reported in international academic journals, except for some initial surveys (Niu et al., 2010). When referring to higher education institutions that strive towards goals of environmental sustainability, "green university" is the most commonly used term in China. This trend is illustrated in the CNKI (China National Knowledge Infrastructure) , the most comprehensive academic journal database in China. As such, this paper uses this term in line with the trend of systemic innovation in Chinese higher education.

This paper gives a critical review of the significant practice of green universities in the field of higher education in China and points to the historic green transitions and innovation underway in Chinese universities towards the goal of ESD development. Since the concept of "green university" was introduced into Chinese higher education in 1996 (Zhu and Dewancker, 2021), governments at all levels, including the central government, provincial governments, and urban and local governments, have been the major drivers for the development of green universities. More significantly, however, the environmental sustainability campaign in Chinese higher education was initiated and dominated by central government departments, particularly the Ministry of Housing and Urban-Rural Development (MoHURD), and the construction of green buildings and facilities on campus has been regarded by the government as central to the development of green universities (Gou, 2020).

Although the relationship between the government and higher education institutions has changed greatly from the "government directly running universities" to the "government guiding and supervising universities" during the more than 40 years of implementation of the reform in China, higher education is still under the strong influence and control of the government, especially the Ministry of Education (MoE). This can be demonstrated by the existence of private universities which represent only 25% of

Chinese higher education institutions (Levy, 2013): the owners of which are mainly public universities and state-owned enterprises and institutions (MoE, 2019). The government has strictly implemented national evaluation mechanisms to assess universities and allocated vast research funds (such as national key funding projects and public research grants) to elite universities, particularly since the MoE issued the Quality Evaluation of Undergraduate Education (QEUE) in 2002 (Cao and Yang, 2019). Given the characteristics of the Chinese higher education system, such as national regulation and funding (Zhu and Lou, 2011), it is necessary to pay special attention to government policies and initiatives in studying the developments, challenges and prospects for green universities in China.

The analysis contained here uses mainly qualitative methods in conducting research on relevant literature, policy and practice that influence the development of Chinese green universities. This paper first presents an overview of the challenges faced by higher education institutions with regard to environmental sustainability in China, as well as significant policy initiatives from the government. This is followed by a review of the achievements of green universities in China, focusing on the role of the government in the environmental sustainability of higher education. In conclusion, the progress and prospects for green universities in China are discussed, based on the above analysis.

Challenges for Environmental Sustainability in Chinese Higher Education

The Chinese national higher education system consists of General Colleges and Universities (GCU), such as universities, colleges, vocational universities, independent colleges (affiliated to universities) , vocational colleges and junior colleges, and Adult Higher Institutions (AHI), such as open universities, spare-time colleges, medical colleges for further education, management cadre colleges, and colleges of education (MoE, 2020). This paper focuses on the GCU, because according to the latest statistics, they dominate the higher education sector in China (MoE, 2020). While there are 2740 general colleges and universities, there are only 265 adult higher institutions (MoE, 2020). In China, “university” is the most frequently used generic term for higher education and the terms “university” and “college” are usually used interchangeably when referring to higher education; therefore, the words

"university" and "higher education" are used interchangeably hereafter (Mok and Jiang, 2017).

With the rapid development of higher education, increasing pressures to respond to high energy-consumption, environmental pollution and various social responsibilities have been challenging the ESD of Chinese universities in recent decades. At the beginning of the 21st century, the energy consumption in Chinese universities have reached the brink of crisis (Ho, 2008). In 2005, the per capita energy consumption of 45 universities was 0.775 tons of standard coal, and the per capita water consumption of these universities was 145.2 cubic metres (Ho, 2008). In contrast, the annual energy consumption per capita in Beijing was 0.47 tons of standard coal, and the national urban water consumption per capita was 74.5 cubic metres (Ho, 2008). Since 1999, university enrolments and scale have increased rapidly under the government policy to expand higher education (Yang, 2007). For example, in 2015, the number of students in universities reached 37 million, the highest in the world (MoE, 2016). In 2013, compared with 2003, national higher education funding increased by 360%, the public budget education funds increased by 490%, and the average public budget education expenditure of university students increased by 170% (MoE, 2016). From 2010 to 2014, the total value of university fixed assets across China increased by 42.15%, and the total value of teaching and scientific research instruments and equipment increased by 57% (MoE, 2016). As a result, the Chinese higher education sector is now facing a dilemma of balancing the expansion tasks stipulated by the government without sacrificing environmental interests.

The rapid expansion of higher education inevitably requires universities to concentrate on infrastructure construction and increased numbers of high-level laboratories and research centers, within the tight deadlines set by the government. For example, the MoE planned to build about 500 state-level Experimental Teaching Demonstration Centers within the three years from 2007 to 2010 (MoE , 2007 a). This caused Chinese universities to bear enormous environmental risk while pursuing high-speed development. In recent years, the university sector in China has become one of the main sources of environmental pollution, such as air pollution, water pollution, noise pollution, and solid waste pollution. Additionally, Chinese universities are increasingly required to undertake necessary social responsibilities in environmental governance, which includes promoting the education and research of environmental science.

Compared with the higher education sector in European nations and the United States of America, China began to assign importance to environmental sustainability relatively late. In particular, the MoE seemed to lack effective approaches and prompt actions to help the higher education sector cope with environmental challenges. In 1996, the National Action Plan for Environmental Publicity and Education (1996-2010) was jointly issued by the National Environment Protection Agency (NEPA), the State Education Commission (SEC) and the Publicity Department of the Communist Party of China Central Committee (PDCPCCC). The national plan included a proposal to gradually launch activities to develop "green schools" throughout China by 2000. However, the implementation of this initiative mainly focused on primary and secondary schools. For example, in 2000, a total of 105 educational institutions were rated as advanced schools (all of which were primary and secondary schools) during the activity of green schools in China (MoE, 2000). It was not until 2001 that universities were considered as a target of the green school movement and written into the official document "Guide of the Green School" issued by the State Environmental Protection Administration (SEPA, 2001).

At present, a severe challenge for the development of green universities is that government policy cannot keep pace with the appeal for environmental sustainability in the higher education field. In April 2001, the concept of "green university" was first put forward by the central government in the National Environmental Publicity and Education Program (2001-2005). According to the report, the characteristics of a "green university" would mean that the university can provide sufficient environmental education materials, information, equipment and places for all teachers and students; environmental education would become an essential part of the university curriculum; students have a good command of relevant knowledge of environmental protection, and teachers and students show a high level of environmental awareness; and the university actively carries out and participates in socially oriented environmental supervision, publicity and education activities (SEPA, 2001). In 2001, the MoE approved Tsinghua University as the first higher education institution to develop into a green university. However, up to now, there is still no official definition of, and evaluation standard for, a green university in China.

Chinese higher education is confronting an irreconcilable contradiction between economic development and environmental sustainability. It has been very hard for the government to regard ESD as the most important consideration. In the view of

policymakers, the environmental sustainability of Chinese higher education may sometimes need to give way to the vital task of universities as a significant instrument for achieving national economic development (Wang, 2010). The lagging and uncertainty of government policies on green universities had become the main sources of the environmental challenges for Chinese higher education. Therefore, the orientation of government policies towards the ESD of higher education has been proved to be the key driver for Chinese green universities to overcome challenges and realize environmental sustainability.

Government Policies on the Development of Green Universities in China

Since the implementation of the economic reform and opening-up policy in 1978, the Chinese economy has made remarkable progress. At the same time, the environmental crisis has also become more serious. The government has always tried to strike a difficult balance between the economy and the environment. The development of ESD in the higher education of China is a profound reflection of this historical process. Due to the characteristics of the Chinese education system, universities have little independent power and are subject to excessive administrative intervention. In the past twenty years, government policies have played an important role in the development of green universities in China (see Table I for a summary of key government policies).

Table I. Chronology of Chinese government policies on green universities

2001	National Environmental Publicity and Education Program (2001-2005) (SEPA)
	Guide of the Green School (SEPA)
2003	Notice on strengthening the management of laboratory pollution discharge in colleges and universities (SEPA/MoE)
2006	Notice on the construction of economical schools (MoE)
2007	Notice requiring schools to conserve energy and reduce emissions (MoE)
2008	Management and technical guidelines for the construction of economical campuses in colleges and universities (for trial implementation) (MoHURD/MoE)
	Opinions on promoting the construction of economical campuses and further strengthening the work of saving energy and water in colleges and universities (MoHURD/MoE)
2009	Technical guidelines for construction of the campus buildings' energy-saving supervision system in colleges and universities (MoHURD/MoE)
	Technical guidelines for the operation and management of the campus buildings' energy-saving supervision system in colleges and universities (MoHURD/MoE)
	Measures for the publication of statistical audit of the energy consumption of campus buildings in colleges and universities (MoHURD/MoE)
	Management measures for energy-saving operation of the campus facilities in colleges and universities (MoHURD/MoE)
	Index system and evaluation method of the economical campus in colleges and universities (MoHURD/MoE)
2013	Notice on further carrying out activities of saving grain, water and electricity (MoE)
	Notices on thrift in the educational sector and the construction of economical campus (MoE)
2014	Management measures for acceptance of demonstration projects for the construction of the economical campus energy-saving supervision system (for trial implementation) (MoHURD/MoE)
2019	Green campus evaluation criteria (MoHURD)

Around 2005, China became the world's largest carbon emitter and was denounced by the international community as the main culprit in stalling global emission reduction (Wu and Edmonds, 2017). The increasingly severe crisis at home and abroad caused by ecological environment problems forced the government to focus on energy conservation and emission reduction. In June 2005, the State Council issued two important documents, namely, "Notice of the State Council on the Recent Key Work of Building a Conservation Oriented Society" and "Opinions of the State Council on

Accelerating the Development of Circular Economy". In 2006, building a resource-saving and environment-friendly society was officially written into the 11th Five Year Plan Outline of the Chinese government as an important strategy to promote the transformation of the national economic development mode (State Council, 2006). Subsequently, the MoE launched the Building Economical Schools initiative, which was regarded as an important part of the 11th Five Year Plan and of the medium and long-term development plan of China's education sector（MoE, 2006）.

The leading role and influence of the central government has been clearly demonstrated, even in the initial stage of the development of green universities in China. In 2007, the launch of China's National Climate Change Programme marked a milestone in the determination and actions of the Chinese government to participate in global climate governance. The central government decided to take energy conservation and emission reduction as the focus of macro-control, establish an accountability system as an important part of the comprehensive assessment and evaluation of government leaders, and require the departments of education, science, culture, health and sports to formulate and implement their own work plans for energy and resource conservation (State Council, 2007). Under the auspices of the National Development and Reform Commission, the MoE participated in the formulation of the National Action Plan for Energy Conservation and Emission Reduction and initiated the schools' action for energy conservation and emission reduction (MoE , 2007 b).

In response to the initiatives of the MoE, Chinese universities began to put forward the development goals of resource-saving and environment-friendly campus (Mu, 2015). Among these goals, the economical campus is the most commonly used term, which aims to improve the efficiency of resource utilization, such as energy saving, water saving, material saving and land saving (MoE, 2006). However, because the MoE lacks administrative authority in energy conservation and emission reduction, they were unable to effectively undertake alone the arduous task of promoting the nationwide construction of the economical campus. Inter-ministerial cooperation, especially between the MoHURD and the MoE, has been a decisive presence in the development of green universities in China (MoHURD and MoE, 2014).

With the participation of the MoHURD, the construction of the economical campus has obtained a reliable guarantee in terms of systems and operations. In 2008, the MoHURD joined the MoE to formulate initiatives, in order to guide the work of energy and water

conservation in universities, which were the most important government decisions for the implementation the nationwide construction of economical campuses in the initial phase. The overall goal during the 11th Five Year Plan (2006-2010) period was to reduce per capita consumption of energy and water by 15% compared with the volume in 2005 (MoHURD and MoE , 2008 a). As such, conservation of energy and water was selected as the priority task in the construction of economical campuses in universities.

The Assessment and Evaluation Method of the Economical Campus in Colleges and Universities (2008) is the first implementation standard of economical campus, and also fully represents the important position of the MoHURD in the construction of the economical campus. Universities are required to bring the advocacy and education of resource-saving concepts into the scope of ideological and political theory courses for students, and offer courses with economical use of resources and environmental protection as the main content. It is worth noting that although environmental education, research and publicity are regarded as a necessary part of an economical campus, its weight only accounts for 5% in this assessment and evaluation scheme (MoHURD and MoE, 2008 b). The focus of economical campuses is clearly defined as the conservation of energy, water, land, and material of campus infrastructure, which is far beyond the authority of the MoE.

In 2009, a series of international political disputes and negotiations around reaching a global climate governance agreement further highlighted the importance of energy conservation and emission reduction. In November 2009, China and the United States issued a joint statement on tackling climate change, and officially signed the U.S. - China Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and Environment (Schreurs, 2017). In December 2009, the United Nations Climate Change Conference (COP 15) was held in Copenhagen, Denmark (Parker et al., 2012). Since the end of the 1990s, the Chinese government implemented a stimulus policy which promoted the explosive growth of building facilities in universities, and the nearly 3000 universities in China gradually became major carbon emitters during the ten year period (CCLE, 2018. Therefore, it became an urgent task for the Chinese government to realize efficient energy conservation of campus buildings. With the introduction of technical guidelines and methods for the construction, management, operation, audit, and assessment of university campus buildings' energy-saving

supervision system (MoHURD, 2009), the responsibility taken by the MoHURD also became more prominent.

Funding support following the new government policies was effective in guiding and managing the development of green universities in China. It provided the opportunity for the Ministry of Finance (MoF) to work as a positive factor in promoting the construction of economical campuses. In 2008, the MoF, the MoHURD and the MoE launched the demonstration work of the construction of the economical campus supervision system in universities. In 2011, the State Council issued the Comprehensive Work Plan for Energy Conservation and Emission Reduction in the 12th Five Year Plan (2011-2015), which included energy conservation and emission reduction into the higher education system, and selected demonstration schools as one of the ten special actions for the national movement of energy conservation and emission reduction (State Council, 2011). Driven by the policies of the central government, the MoF also began to increase levels of cooperation with the MoHURD to further promote the energy conservation of public buildings and expand financial support for the construction of the economical campus energy-saving supervision system (MoHURD and MoF, 2011). For example, the number of demonstration universities of energy-saving supervision system supported by central government funds increased from 12 in 2008 to 191 in 2012, with a total subsidy of RMB 657.3 million Yuan (Zhang, 2013). The MoF was given the right to check the use and management of central government funds for universities as the energy-saving campus demonstration projects in accordance with the state regulations (MoHURD and MoE, 2014). The important functions of the MoF were confirmed in the Management Measures for Acceptance of Demonstration Projects for the Construction of the Economical Campus Energy-saving Supervision System.

In reviewing the development of green universities in China, universities help the government with policy making as an important participant. In 2008, the MoHURD and the MoE entrusted six universities (namely Tongji University, Zhejiang University, Tianjin University, Chongqing University, Tsinghua University, and Shandong University of Architecture) to jointly compile Management and Technical Guidelines for the Construction of Economical Campus in Colleges and Universities (MoHURD and MoE, 2008 b). This policy document specifies the supervision, implementation, publicity and education, and evaluation of the energy conservation on campus (MoHURD and MoE, 2008 b).

In 2012, three sustainable development concepts: green, cyclic and low carbon were first proposed in the Report of the 18th National Congress of the Communist Party of China (Hu and Guan, 2017). Thereafter, "green" became the most popular word and mainstream concept in the field of sustainable development in China (Song et al., 2020), which is a testament to the transformation of Chinese extensive growth. The 13th Five Year Plan for Economic and Social Development of China (2016-2020) emphasized the significant impact of green development as a national economic and political strategy, and shows China's great ambition to firmly embrace the green industrial revolution and aspiration to become the twenty-first-century green powerhouse (Clark II and Cooke, 2015). In the Report of the 19th National Congress of the Communist Party of China, the establishment of green schools is designated as an indispensable activity to promote green development and accelerate the reform of the ecological civilization system in China (Xinhua News Agency, 2017). This means that sustainable development in the field of higher education in China will have great potential due to the political guarantee of the ruling party in long-term governing planning.

With the adjustment of national policies, the concept of energy conservation of universities also began to transform from the economical campus to the green campus in China (Tan et al., 2014). In March 2019, the MoHURD approved the Green Campus Evaluation Criteria edited by the China Society for Urban Studies, and with participation by 13 universities. The "green campus" refers to a harmonious campus that provides teachers and students with safe, healthy, applicable and efficient learning; uses space, saves resources, protects environment and reduces pollution to the maximum extent; and has educational significance for students (MoHURD, 2019).

Achievements and Impacts of Green Universities in China

Over the past two decades, government policies have shown their powerful effects in guiding and shaping the development of green universities in China. For instance, the emphasis of the economical campus initiative has been on energy conservation and emission reduction. Chinese prestigious universities have become the bellwether of green change in the higher education field. A fine example among these green pioneers is Tsinghua University, which has saved 2 million kwh of electricity every year by transforming

power consumption and public lighting and adjusting cleaning times and power consuming behavior in the teaching building (MoE, 2010). Tsinghua University has also reduced 1.97 million cubic metres of gas consumption each year through energy-saving transformation of bathrooms and canteens (MoE, 2010). In 2009, Peking University, following Tsinghua University, announced its objectives: by 2010 reducing the carbon emission per unit building area by 15% on the basis of 2005 and reducing both energy and water consumption per student by 5 percent in five years, based on the statistics in 2008 (McBeath et al., 2014).

The economical campus initiative has contributed to deepening cooperation between higher education institutions in the field of environmental sustainability, which has also promoted networking among green universities in China (Yuan, Zuo and Huisinh, 2013). In June 2010, one hundred Chinese universities established the National University Energy Conservation Alliance (NUECA) whose plan is to build 10 energy conservation projects in each participating university, establish 100 energy conservation demonstration universities, organize thousands of student associations with the theme of "green, energy conservation and environmental protection", and train 10,000 energy conservation management personnel in China. (Xinhua News Agency, 2010). In 2011, as the core founders, eight Chinese first demonstration universities of the energy-saving campus launched the China Green University Network (CGUN) at Tongji University in Shanghai, aiming to jointly provide support for government policy decision, serve society, deepen the construction of green campus, and lead and promote the development of green universities in China (CGUN, 2011). Furthermore, the networking of green universities has also become more beneficial for strengthening the implementation of the economical campus initiative, such as establishing a platform for sharing campus energy efficiency data on the basis of the established energy-saving supervision system. By the end of 2014, approximately 300 universities across China had joined in the construction of the energy-saving supervision system (Song, 2016).

The cooperation and exchange between Chinese green universities and international counterparts began to grow vigorously. The CGUN is an open network based on the concept of exchange, complementarities and sharing mechanism, and establishing the Asia Pacific green campus alliance as the medium and long-term development goal. In 2015, China, Japan and South Korea jointly launched the Asian Conference on Campus Sustainability (ACCS), aiming to promote the construction and

development of sustainable green campuses in Asia (ASCN, 2019). In November 2016, the CGUN hosted the second ACCS at Shandong Jianzhu University in Jinan, Shandong Province, China (CGUN, 2016). During the conference, representatives of the green campus from China, Japan and South Korea jointly signed the Jinan Declaration, in order to further promote the development of green campus in Asia (CGUN, 2016). Chinese green universities have earned praise and recognition in the field of international higher education for their remarkable progress on environmental sustainability (Zhao and Zou, 2015). In 2012, the International Sustainable Campus Network (ISCN) presented the Excellence in Campus Award to Tongji University for its contribution to energy conservation, environmental sustainability education and research, as well as community development (Tongji University, 2012). In May 2019, twelve world-renowned universities from nine countries (namely China, the UK, France, the United States, Japan, India, South Africa, Australia and Brazil) gathered at Tsinghua University to announce the establishment of the Global Alliance of Universities on Climate (GAUC), and appointed Tsinghua University as the first chair of the alliance (GAUC, 2020) .

Inspired by the example of the international society, Chinese green universities, especially the pioneers such as Tongji University and Tsinghua University, are striving to achieve comprehensive development, in addition to the application of energy-saving technologies. The transdisciplinary minor programme offered by Tongji University contributes to embedding environmental sustainability into the higher education system as an alternative platform for researchers and students to involve in a transdisciplinary teaching and learning process (Jia, Wang and Li, 2019). Tsinghua University employs three dimensions (green education, green research and green campus) to frame its green university initiative, which is considered as a response to its strategy of establishing a world-class university, with the goal of bearing more responsibility in promoting a sustainable society (Zhao and Zou, 2015). As the centre of environmental science in Chinese higher education, Tsinghua University actively conducts lectures and long-distance training on the theme of green, low-carbon and circular development for guiding the sustainable development of communities (SOE of THU, 2017). For example, in April 2014, Tsinghua University and the Ministry of Commerce jointly hosted the first training course on promoting ecological civilization construction in the state-level Economic and Technological Development Zone (ETDZ), which trained more than

50 managers from over 40 ETDZs in China (Lu, 2014). Since 1998, Tsinghua University has been committed to serve national and regional green development through undertaking over 1000 green scientific research projects and also attaching great importance to constantly promoting the greening of the scientific research process and inter-disciplinary research (Sun, 2008).

University students, as valuable actors of green change, are encouraged to engage in serving society through environmental education and publicity. Student associations have grown to be one of the five main types of environmental non-governmental organizations (NGO) in China and undertake significant activities throughout the country (OECD, 2007). For example, in 2019, more than 10,000 students from 108 universities across 19 provinces in China participated in the volunteer activity "University Students in Action" to introduce environmental knowledge to farmers and community residents through various forms such as market lectures, self-made dramas, primary school classes and door to door publicity (Information Daily, 2019). Student research in environmental science is also supported by the government. Since 2008, the MoE has, thirteen times, successfully held the National University Students Social Practice and Science Contest on Energy Saving and Emission Reduction, which has become one of the most influential contests in the field of energy saving among Chinese universities (Secretariat of the NUSSPSCESER Committee, 2021). In addition, student associations have become an undeniable impetus for the development of green universities in China. One valuable example is the China Youth Climate Action Network (CYCAN), which is the first non-profit environmental organization in China to focus on empowering university students to advocate for tackling climate change, and has now engaged over 100,000 students from more than 500 Chinese universities (CYCAN, 2020). In 2018, the CYCAN launched the 2030 Carbon-Neutral Campus Project with the aim of improving low-carbon transformation on campuses through the establishment of a multi-cooperation mechanism involving universities, enterprises, NGOs and students (CYCAN, 2020).

Despite some achievements of these positive practices, there have been serious limitations in the development of green universities in China. On broad scale universities are thought of as the hub of social change, however, their leading role is often overlooked, even by university leaders (Alabaster and Blair, 1996). Similar problems have also been exposed explicitly in the

development of green universities in China. Some scholars have argued that Chinese universities should take the opportunity to review and adjust their work (Tian et al., 2017).

At present, the issue of institutional change geared at green university still lacks matching government guidance policies. These institutional defects result in a common misunderstanding of green universities as campus greening, while ignoring the fact that the comprehensive development of green universities includes not only environmental management of the campus, but also other actions, such as teaching, research and development, vision and mission of universities (Huang and Lee, 2014). Given the complex geographical distribution and characteristics of Chinese universities, the current technical guidelines and standards on green campus are not specific enough to satisfy the diversified needs. In particular, the integrated systems of the energy-saving statistics, monitoring and assessment that can be applied to various regions and different types of universities in China need to be improved (Lu, Weng and Ma, 2015). Within most Chinese universities, there has also been a lack of special institutions responsible for the green development. Tsinghua University is one of the few Chinese universities with a "Green University Office" on campus. The survey found that the administrative power of green campuses is mainly undertaken by logistics departments (which are responsible for the meals, accommodation and living services for teachers and students) in 81% of Chinese universities (CYCAN, 2015).

Students are actively involved in environmental management on campus and attach the greatest importance to the role of their universities in promoting sustainable development, but most of them only have a superficial understanding of the concept of sustainable development (Kagawa, 2007), and even show least concern with sustainability curricula and research (Wang, Yang and Maresova, 2020). All in all, many thorny issues remain about policy planning and efforts to ensure the long-lasting innovation and all-round development towards the goal of environmental sustainability in Chinese higher education.

Conclusion

The history of ESD in China shows that government policies have a decisive influence on the development of green universities. Over the past two decades, energy conservation and emission reduction have been the focus of university efforts towards green development. The demonstration project of economical campus

initiated by the MoHURD has promoted the networking of green universities in China (e.g. NUECA and CGUN). The exchange and cooperation between Chinese green universities and their international counterparts has expanded the world influence of the ESD of Chinese higher education, and also contributed to the introduction of advanced ideas on environmental sustainability from developed nations (e.g. ACCS, GAUC and ISCN).

The recent practice of green universities in China also reveals the novel trend of comprehensive development in terms of education, research and community service. Some prestigious universities such as Tongji University and Tsinghua University are always at the forefront of exploring the orientation of green universities in China. These green pioneers have carried out distinctive education or research innovations based on their own strengths, such as the transdisciplinary minor programme at Tongji University. Another trend is to emphasize community-level action, such as government-supported training projects at Tsinghua University, which is regarded as an important component of national environmental education.

A significant challenge for the continuity of green universities is the adjustment and reorientation of government policies in the future. Past experience illustrates that the MoHURD has led the green change of the ESD in Chinese higher education, through the promulgation of technical guidelines for campus construction (e.g. Green Campus Evaluation Criteria). The recent adjustment of national strategy from pursuing rapid GDP growth to green development has reflected at the higher education level, but the response of the MoE is still delayed and lags behind that of the MoHURD. This suggests that the MoE needs to pay more attention to underpin and shape the development of green universities in the Chinese context.

The participation of student NGOs brings some vitality to the development of green universities, through community-level actions (e.g. University Students in Action) and campus environmental management projects (e.g. 2030 Carbon-Neutral Campus Project). However, these student volunteer activities also reflect the crucial influence of government support on shaping the student associations.

Despite new impetuses, the Central government still dominates the top-down reform of the ESD of higher education in China. Accordingly, the key to further and continued progress of green universities in China lies in government support. It is worth noting that China has shown great determination and willingness to

support sustainable development and lead green economic and technologic change in the 21st century.This should further encourage government departments to promote the ESD of China's higher education in order to serve the social sustainability. Especially, the MoE should make a more positive response to the development of truly green universities, that is, universities which not only have green infrastructure but which also offer education, research and training in environmental sustainability for the betterment of Chinese citizens and the whole global community.

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