

Exploration of Sustainable University Development Strategies in China from a Comparative Perspective

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Abstract. This paper first explains the concept of sustainable development and sustainable university and also the significance of constructing sustainable universities. Subsequently, it will state the development status of sustainable universities in China from three aspects: research and teaching, campus management, and social participation, and analyze the deficiencies and corresponding reasons for the domestic sustainable universities by comparing the development of international sustainable universities. Finally, this paper will put forward relevant suggestions from the government and universities, aiming to provide reference for the construction of sustainable universities in China.

Keywords: sustainable university; sustainable education; sustainable development;

1 Introduction

1.1 Research background

Sustainable development is an important global issue today. Sustainable development has a bearing on the destiny of all humankind and the dynamics of global development, guaranteeing the survival, health and power of future generations in three dimensions: environmental, social and economic. In order to better address global climate change, social imbalances and economic uncertainty, the 2030 Agenda for Sustainable Development was unanimously adopted by all members of the United Nations Member States at the United Nations Summit on Sustainable Development in 2015. The Agenda's 17 Sustainable Development Goals (SDGs), 169 targets and 231 unique indicators guide the global sustainability process and embed the concept of sustainable development into a global framework for action, forming a comprehensive guide for national development actions. Many of the sustainable development goals are directly or indirectly related to education, so it is clear that the sustainable development of education has a multidimensional significance. In addition, the Ministry of Education of China organized a seminar on "building sustainable campuses" in 2008 to reach a strategic consensus on the sustainable development and transformation of China's universities. At present, the sustainable development of Chinese

universities has a strong sense of autonomy and independent development, but due to the late start compared with foreign countries, it is only at the initial stage of practice.

1.2 Research structure

This paper will first explain the concept of sustainable development and sustainable university. Subsequently, it will state the development status of sustainable universities in China from three aspects: research and teaching, campus management, and social participation, and analyze the deficiencies and corresponding reasons for the domestic sustainable universities by comparing the development of international sustainable universities. Finally, this paper will put forward relevant suggestions from the government and universities, aiming to provide reference for the construction of sustainable universities in China.

1.3 Current research status in China and research significance

The research on sustainable universities in China mainly covers five categories. The first category is research on the connotation of sustainable universities. For example, Zhao Zongfeng (2008) pointed out that a sustainable development university means the sustainable development of individuals, the sustainable development of the university itself, and assuming corresponding responsibilities for the sustainable development of society.^[1] The second category is an exploration of the problems existing in the sustainable development construction of higher education in China. Scholars believe that there are problems with sustainable higher education in China, such as insufficient comprehensiveness of curriculum and disciplines, and utilitarianism. The third category is to explore the impact of sustainable higher education on society. Most domestic scholars believe that building sustainable universities can not only enhance the literacy of college students, but also promote the sustainable development of the entire society. The fourth category is a systematic evaluation of the sustainable development of higher education. Chen Wenrong et al. (2003), and Lv Bin et al. (2011) established an evaluation system with different focuses.^{[2][3]} The fifth category is the exploration of the implementation path of sustainable development universities. For example, Zhang Xiaoxin and Zhang Bin (2017) proposed a sustainable development path for regional university alliances, including clarifying the construction system, constructing and improving the development system, strengthening government macro guidance and policy support.^[4] In addition, although there are many articles introducing the sustainable development actions of a foreign university to provide reference for the sustainable transformation of Chinese universities, there are few articles that analyze the problems and underlying reasons of sustainable development in China from a comparative perspective. For example, Sun Jingyi (2016) compared the elements of sustainable development in education between China and the United States.^[5] This article will summarize the main types of sustainable development practices in Chinese universities, analyze the shortcomings of sustainable universities in China compared to international sustainable development universities from a comparative perspective, and provide development suggestions.

2 The concept of sustainable development and sustainable universities

2.1 The concept and meaning of sustainable development

People's understanding of sustainable development has its origins in the awareness of environmental protection. With rapid economic development, many developed and developing countries around the world encountered environmental problems, and the issue of balanced development between the environment and the economy began to be discussed globally at the United Nations Conference on the Human Environment in 1972. In 1987, the World Commission on Environment and Development published the report "Our Common Future", in which the concept of "sustainable development" was first proposed and defined as "development that meets the needs of the present without jeopardizing the ability of future generations to meet their own needs". Through conferences such as the United Nations Conference on Environment and Development and the deepening of the theory of sustainable development, sustainable development has been expanded to include three major areas: environment, society and economy. In the 2030 Agenda for Sustainable Development, released in 2015, the concept of sustainable development has clear development goals, including 17 sustainable development goals, 169 targets and 231 unique indicators.

This paper looks at the connotation of the concept of sustainable development from three dimensions. From the ecological dimension, sustainable development emphasizes ecological balance, nature protection and the permanent use of resources, and is aimed at reducing the damage caused by economic development to the environment and the harm caused by climate change, so as to promote the harmonious coexistence of human beings and nature. From the sociological dimension, sustainable development emphasizes sound personality, perfect human relations and equality of rights, and the final destination of sustainable development is society, with the purpose of promoting the smooth operation of human society. From the economics dimension, sustainable development emphasizes steady and sustained economic growth and long-term social welfare, on the premise of not damaging the quality of nature and the environment.

2.2 The concept and significance of a sustainable university

A sustainable university is a university that is "committed to sustainability". It includes the realization of sustainability in all aspects of the university itself, as well as in the broader contexts of the environment, society and the economy. The four key components of a sustainable university are education, research, campus operations and governance, and social services.

Sustainable universities are the trendsetters of sustainability education and an important part of the field of sustainable development. On the one hand, universities are important for sustainability because they can be seen as small societies whose practices in the field of sustainability will eventually be carried out in communities, cities and countries, and thus the development of sustainable universities can provide guidance and valuable experience for the sustainable development of society; on the other hand, as a place for cutting-edge research and a prominent area for training talents, universities not only promote specialized scientific research in the field of sustainability, but also train future workers with sustainable vision and

knowledge in various fields for society, thus promoting sustainable development in various fields.

3 Analysis of the current status of sustainable university development in China

In the following, we will sort out the main types of practice of sustainable universities in China from three aspects: scientific research and teaching, campus management, and social participation. Then, analyze the deficiencies and corresponding reasons for the development of sustainable universities in China by comparing the current development status of international sustainable universities.

3.1 Research and teaching

Domestic colleges and universities attach importance to the concept of sustainable development. However, the relevant practice is still in the preliminary stage, and there is a strong correlation between the integration of the school's teaching with the concept of sustainability and the level of the school's research in the field of sustainability. The practices of sustainable universities in China related to research and teaching are as follows.

Collaborate with foreign universities or research institutions to build platforms in the field of sustainability. By leveraging the advantages of the platform, they attract more partners and integrate the strengths of both or multiple parties. On the one hand, they promote academic exchanges and joint research in the field of sustainable development, and on the other hand, they leverage the advantages of teaching staff and educational resources to strengthen educational sustainability. For example, Tongji University has established a cooperative relationship with the United Nations Environment Programme, working together to establish the Institute of Environment for Sustainable Development (IESD) at Tongji University. Based on its platform and resource advantages, IESD has launched flagship projects such as the International Student Conference on Environment and Sustainable Development and the Urban Ecology and Energy Conservation Forum. It has also invited well-known experts in the field of sustainable development at home and abroad to give lectures or speeches. In addition, other well-known universities have also established cooperative relationships with international institutions, such as the University of Hong Kong Cambridge Clean Energy and Environment Research Platform, Tsinghua University's initiative and invitation to universities such as the London School of Economics and the University of Cambridge to establish the World University Climate Change Alliance.

Establishing sustainable related majors and courses. The establishment of sustainable related majors and courses is more prominent in comprehensive and engineering universities, which may be related to the advantageous majors in the fields of environment, materials, civil engineering, etc. The higher ranked universities have more scientific research exploration in the field of sustainability, and their penetration of sustainable concepts in education and teaching is also stronger. According to the official website of Tsinghua University, 1151 undergraduate courses related to sustainability and 1166 graduate courses were offered in 2020, and a general education course model of "large class teaching+small class discussion+extracurricular practice" was formed throughout the school. Universities with strong characteristics in science and engineering, such as Beijing Jiaotong University, offer

courses closely related to environmental sustainability, such as air pollution control engineering, environmental planning and management, clean production and sustainable development; North China University of Technology has established majors such as Urban Underground Space Engineering (Smart City) and Building Environment and Energy Application Engineering (Green Building and New Energy). Universities with strong characteristics in humanities and social sciences, such as Renmin University of China, established and admitted graduate students majoring in carbon economy in 2021; Capital University of Economics and Trade will begin admitting undergraduate and MBA students in ESG investment and management in 2023.

In summary, both foreign and domestic universities have high foresight and willingness in the field of sustainable development. However, sustainable practice in scientific research and teaching lags slightly behind foreign universities in China. In the field of scientific research, domestic universities tend to apply for projects funded by the National Natural Science and Social Science Foundation in accordance with national policies, while sustainable universities ranked high abroad collaborate with enterprises, and market-oriented support leads to high conversion rates of scientific and technological achievements and stronger innovation motivation; Domestic universities tend to expand sustainable design in advantageous majors, while achieving fewer results in interdisciplinary or collaborative research with other disciplines. In terms of education and teaching, although Chinese universities offer courses related to sustainable development in majors such as environment, geology, and materials to improve the impact of engineering, technology, and materials on the environment, the designed majors themselves are closely focused on the environmental field. Few technical and vocational universities integrate sustainable development concepts into majors such as clothing design, decoration, beauty, and hairdressing, such as the Fashion Design course at the De Montfort University in the UK.^[6] More noteworthy is that many courses offered by major universities have been included in the category of sustainable development. However, in reality, it only introduces the concept of environmental protection and does not realize the connotation of sustainable development in the three major aspects of environment, society, and economy, and cannot be truly included in the curriculum of sustainable development.

3.2 Campus Management

The construction of green campuses is of great significance for sustainable development. The energy-saving renovation and low-carbon operation management of campuses not only improve environmental conditions, but also bring about economic savings through its energy-saving model, which is beneficial in three aspects: environmental sustainability, social sustainability, and economic sustainability. The following are the main practical contents of campus management.

Green building and energy-saving renovation. Domestic universities have a high willingness to build green and energy-saving campuses, and have now formed models and models for energy, water resources, waste treatment, and construction that can be imitated. At present, in terms of green buildings, Tsinghua University's Sino Italian Tsinghua Environmental Energy Building integrates ecological, environmental protection, and energy-saving concepts, and uses advanced technologies and materials such as natural lighting, green building materials, and intelligent control for sub intelligent management; In terms of water resource conservation, Beijing Jiaotong University uses a three-level filtration system to collect rainwater and filter it before introducing it into the lake. Through underground

pipelines connected to the automatic sprinkler irrigation equipment of the campus seal, 70% of green spaces can meet irrigation needs by passing through the lake water; In terms of energy management, multiple schools have built smart energy control platforms and smart street lighting control systems, and carried out energy-saving renovations for surrounding furnaces.

Campus operation and concept promotion. Domestic universities have achieved certain results in campus operation and management. In terms of campus greening, the Beijing residential area of China University of Geosciences has become a model of ecological landscape university, and Beijing Institute of Technology has become a garden style unit for greening and beautification in Beijing; In terms of garbage treatment, Beijing Forestry University has also implemented a project for on-site resource utilization of kitchen waste, utilizing microbial liquefaction technology to rapidly degrade microorganisms, and then converting waste back into resources through subsequent treatment; In terms of operational management, over 60% of universities are equipped with energy management specialists for specialized energy management; In terms of concept promotion, many university associations promote the concept of "Clean Your Plate Campaign" through design activities and fun competitions.

In summary, domestic universities have implemented various practices in the operation and management of green campuses, but they are limited to local or superficial aspects and lack systematic changes. In terms of campus operations, only some universities in China, such as Tsinghua University and Fudan University, have released sustainable development reports or plans based on 17 SDGs. However, sustainable universities ranked high internationally, such as the University of Pennsylvania and McGill University, have also developed specialized action plans on this basis, covering green and low-carbon campus construction, research, education, external exchanges, and more, and dividing campus operations into more detailed actions. In terms of promoting the concept, domestic universities are mainly organized by student organizations such as student unions, and can only attract some students through prizes or comprehensive evaluations, resulting in poor promotional effects. For example, Princeton University and Johns Hopkins University, which rank higher in sustainability rankings, have created specialized web pages for sustainable development, publishing research, commitments, practices, etc. in the field of sustainability,^[7] and promoting the university as a "living laboratory" for sustainable development, elevating sustainable development to a higher ecological niche and allowing various aspects of the school to be influenced by the "sustainable concept". Domestic universities generally lack plans for sustainable transformation as a whole. The reason for this may be that the government has not yet implemented a sound green campus indicator system to guide and supervise the sustainable development of universities in operation and management; On the other hand, it may be due to a lack of financial support and allocation.

3.3 Social participation

Serving society is an important responsibility of sustainable universities. By leveraging their professional advantages, universities aim to apply scientific research achievements and technology patents to surrounding areas, remote rural areas, and even African countries.

At present, universities have the following practices in social participation. In terms of poverty alleviation, many universities shoulder the task of assisting impoverished areas, and are also building assistance platforms in areas such as healthcare and food to promote education equality and narrow the urban-rural income gap to support sustainable development;

In terms of international participation, Tongji University has launched multiple South South collaborations to provide free water treatment technology and other assistance to African countries; In terms of serving the surrounding areas, Beijing Agricultural University applies production safety and green prevention and control of harmful organisms to soil remediation and fruit quality improvement in Pinggu District to support regional industrial and economic development; In terms of cooperation with enterprises, central enterprises integrate resources and complement advantages by jointly establishing research centers with universities. Universities provide intellectual and scientific research support to enterprises to promote the development and transformation of local enterprises.

In summary, domestic universities can respond to national poverty alleviation efforts, targeted assistance, and school enterprise cooperation, bringing educational resources to local areas. For example, volunteer service projects have been carried out related to sustainability such as "helping homeless people", "supporting refugees", and "campus greening" in the University of Bristol.^[8] Compared with international universities, the participation and closeness of Chinese universities in serving surrounding communities are insufficient, and some support and social practice projects are only superficial.

4 Development Strategies and Suggestions for Sustainable Universities in China

Development suggestions will be proposed for the construction of sustainable universities from the perspectives of government and universities as follows.

4.1 From the government perspective.

Promote the implementation of relevant policies and systems. Strengthen top-level design and refine goals. Currently, governments in various regions have mainly focused on energy conservation and emission reduction in their policies towards sustainable development of universities, and have not formulated policies and action plans for sustainable universities in the triple bottom line, resulting in a lack of top-down sustainable transformation momentum. In view of this, the government should accelerate the top-level design of sustainable universities, provide guidance for the systematic sustainable transformation of universities, and strengthen the exchange and cooperation between regional sustainable universities and the linkage between universities and surrounding areas, providing strong guarantees for the sustainable development of universities, regions, and society. At the same time, the government should pay attention to the differences and characteristics among universities, and formulate detailed goals and plans based on the classification and characteristics of universities, in order to achieve better transformation effects.

Strengthen evaluation and support. Improve the evaluation index system for sustainable universities and implement it, enhancing the relationship between the implementation method and the assessment and report tools.^[9] Currently, Chinese scholars have proposed an evaluation index system for sustainable universities based on research, but all of them are for practical use, and the focus of each index system is different, without forming a sound and strong evaluation index system. In addition, the government should strengthen supervision

while expanding the autonomy of universities, allowing them to fully leverage their own advantages in planning, and provide timely financial and resource support to universities

4.2 From the university perspective.

Strengthen cooperation and communication. On the one hand, by jointly building cooperation platforms with domestic and foreign universities or international institutions, drawing on international experience, and relying on research and educational resource advantages, promoting the exploration of sustainable development in the field of scientific research and teaching in universities; On the other hand, universities should actively connect with the government and enterprises, understand their needs for sustainable development talents, determine the direction of sustainable talent cultivation and employment opportunities, and provide intellectual support for the sustainable transformation of enterprises by jointly building research centers with enterprises.

Actively integrate into the national development strategy. Universities should actively integrate into national development strategies and meet local development needs. On the one hand, promoting the comprehensive participation of universities in the construction of the national innovation system, actively participating in the national science and technology plan, actively undertaking major research projects, and ensuring sustainable scientific research; On the other hand, rooted in local development needs, promoting the connection between universities and geographical and natural endowments, contributing to the development of communities, surrounding areas, and regions, and promoting sustainable social development.

Expand professional boundaries and interdisciplinary research. Universities should expand the integration of sustainable development concepts into their majors, not only integrating sustainable concepts into disciplines closely related to the environment, materials, architecture, etc., but also incorporating sustainable ideas into technical schools such as art schools, clothing design, beauty and hair care, which may seem unrelated to sustainable development but are actually closely related to life. In addition, attention should also be paid to emphasize interdisciplinary research for innovative breakthrough and link the research, curriculum and sustainable campus operations to promote all-round sustainability in campus.^[10]

5 Conclusions

Sustainable universities have important research significance and development prospects. A sustainable university that combines small-scale social and resource characteristics is a benchmark and main driving force in the field of sustainable development. The development of sustainable universities in China is still in its early stages. Although practices such as co construction and cooperation, innovative professional settings, and rich research results are adopted in scientific research and teaching, there are still problems with interdisciplinary research and insufficient infiltration of sustainable concepts; Although there have been significant improvements in campus operations and management, there are still problems with incomplete and incomplete transformation, as well as an incomplete rating indicator system; Although the technical assistance provided to communities, regions, and impoverished countries has had good results in terms of social participation, there is still a problem of

universities being superficial and imperfect. To this end, the government and universities should work together, focusing on policy formulation and the establishment of evaluation systems, thus promoting universities to actively penetrate and expand sustainable issues, and actively integrate into national development strategies as well.

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