Article

Comparing Sustainable Universities between the United States and China: Cases of Indiana University and Tsinghua University

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Abstract: It is widely accepted that universities can play critical roles in promoting sustainability. In the United States and China, many universities have initiated sustainability programs. Employing Indiana University, Bloomington, the U.S. (IUB) and Tsinghua University, Beijing, China (Tsinghua) as two cases, we examine the conceptualization and implementation of university sustainability programs through a comparison of their respective definitions, goals, organizational dynamics, and strategies. We find that IUB's sustainability scheme is more detailed and specific, while Tsinghua's is more general; this is principally attributable to differences in national and local contexts. Furthermore, IUB values the environmental, economic, and social aspects of university sustainability equally, while Tsinghua focuses more on the environmental aspect. In addition, IUB has a more loosely-structured and more inclusive sustainability organizational dynamic while Tsinghua has a more hierarchical one. This comparative study helps us to understand how these two research universities understand and implement sustainability within the respective cultural, political, and institutional contexts of the United States and China.

1. Introduction

Since the 1970s, environmental awareness has been emerging in the field of higher education. In 1990, a group of university leaders proposed the Talloires Declaration, which recognizes that universities should play a primary role in the education, research, policy formation, and information exchanges necessary to address environmental changes caused by inequitable and unsustainable production and consumption patterns [1]. Since then, many organizations and individuals have made efforts to promote the role of higher education in sustainable development. In 2005, the UN's Decade of Education for Sustainable Development (2005–2014) established a series of goals and strategies to strengthen and focus global efforts in education for sustainable development [2]. Higher education plays an important part in advancing these goals and strategies. Universities, as leading institutions in higher education, have reflected upon, rethought, and reconstructed their roles as part of this new global trend.

The role of higher education in sustainable development is to facilitate the fundamental moral and cultural changes necessary for creating a sustainable society [3–6]. To promote a sustainable society, higher education has a duty to engage with social and political issues and to foster environmental justice. Through this process, universities are, on the one hand, bringing about cultural change; on the other hand, they also reflect certain existing cultural characteristics that may limit the scope for change. Within these competing cultural contexts, universities may develop a diverse range of sustainability strategies and practices.

In this paper, we explore how universities develop sustainability in two distinct university cultures, within two distinct political systems. We have chosen Indiana University, Bloomington (IUB) and Tsinghua University, Beijing (Tsinghua) as our two cases, discussing the similarities and differences regarding university sustainability in the United States and China. While IUB's approach has developed within a larger "American framework" for campus sustainability, Tsinghua's approach is representative of a characteristic Chinese approach. IUB set up its Office of Sustainability in 2008, and has been ranked as a silver member in the national-level Sustainability Tracking, Assessment and Ranking system (STAR). In 2011, 56% of participating universities were ranked as silver, which is one of four levels (bronze, silver, gold, and platinum). Based on the STAR indicators and ranking results, the sustainability situation at IUB appears to be quite representative of American universities that are promoting sustainability. In China, Tsinghua is the first university to propose a sustainability program for higher education, and its sustainable development model has been adopted by many other universities in China. From this perspective, choosing IUB and Tsinghua allows for effective comparisons between the universities promoting sustainability in the United States and China. Through this comparative study, we seek to illuminate the general trends and contextual differences as universities develop sustainability practices and programs and, furthermore, to explore how cultural, political, and institutional factors explain the similarities and differences.

The paper is organized as follows. The next Section conducts a literature review, focusing on the trend of sustainable university development worldwide. The third Section examines two universities' similarities and differences in promoting sustainability, including definitions, missions, organization, goals, and strategies. The fourth Section provides a discussion and explores the contextual and cultural elements. The fifth Section concludes, based on the comparative studies.

2. Literature Review

Over the past several decades, scholars have reached a consensus that university-level sustainability requires system-wide and transformative change, involving diverse stakeholders, practices, and policies [1,3,7–12]. For instance, Bowers (1997) points out that sustainability thinking is changing the way we live and work [5], while Orr (2004) argues that movement toward more sustainable universities will entail changes affecting entire institutions, including operations and resource flows [3]. Cortese (2003) contends that in order to achieve greater sustainability, higher education leaders should change ways of thinking, learning, teaching, researching, and modeling, and rebuild strong and culturally-sustainable communities [7]. More concretely, many researchers believe that the sustainable university should integrate the curriculum with operations and buildings management, as well as combine the efforts of faculty and administrators [1,3,9]. Calder and Clugston (2003) list the essential elements of sustainable universities; these include curriculum, research, operations, outreach and service, and institutional missions and planning [9]. Among those elements, a critical challenge is the interaction/cooperation among different disciplines. Barlett and Chase (2004) argue that current narrow disciplinary foci need to give way to interdisciplinary studies in promoting university sustainability [1]. In addition, the university's diverse constituents further the complexity of achieving a more sustainable university; as Barlett and Chase (2004) point out, students, parents, alumni, boards of trustees, local communities, and state legislatures all are indispensable to the transition to sustainability [1].

Universities develop sustainability programs within a complex, system-wide, and transformative context. For instance, the non-profit organization Second Nature has strongly influenced sustainable development in higher education in the United States, focusing on four components of campus sustainability: teaching, research, outreach, and stewardship [1]. These four elements have been widely adopted by U.S. universities that are promoting sustainability. In 2005, universities in the United States created the organization AASHE (Association for the Advance of Sustainability in Higher Education), for the purposes of building and coordinating campus sustainability efforts [13]. AASHE developed a sustainability tracing, assessing, and rating system (STARS) to evaluate the process and outcomes of sustainability efforts within universities. The STARS system follows the conception of sustainable development advanced by the United Nations, embracing the three aspects of environment protection, sustainable economic development, and social justice [14]. Member universities adopt the indicators and commit to advancing sustainability efforts within their institutions in the areas of environment, economy, and society. AASHE also supports member efforts to integrate sustainability into teaching, research, and operations. By April 2015, AASHE had grown to include 714 colleges and universities [15].

Existing literature describes sustainability initiatives and practices at universities in the United States in some detail. For instance, Barlett and Chase (2004) examine sustainability initiatives of

16 different colleges and universities, covering the range of green curricula, green building, and green operations [1]. These cases show that most sustainable university initiatives are proposed by individuals or groups of volunteers. While some of the leaders may be top administrators in their universities, often they are not. For instance, while some initiatives are led by university presidents or vice presidents leaders, more typically, come from the faculty or student body, student administration, or the local community [1]. From this perspective, many green practices of U.S. universities are bottom-up. Striving for wide recognition, involving large numbers of participants, developing institutional movements, and acquiring sufficient funding are important components of sustainable practices of universities in the United States.

China's Agenda 21 plan of 1994 authorized the higher education system, under the guidance of the Ministry of Education, to promote sustainable development [16]. In response, a considerable number of universities began to integrate sustainability into their curricula. Since 1997, more than 300 universities have introduced courses on sustainable development [16]. Some universities also worked with international organizations to create research and knowledge bases for sustainable development. For instance, Tongji University in Shanghai cooperated with the United Nations Environment Programme (UNEP) to establish the UNEP-Tongji Institute of Environment for Sustainable Development in May, 2002 [16]. Some universities also began to unite and share resources to promote the green campus concept in China. In 2011, Tongji University, Zhejiang University, and eight other universities set up and co-hosted the China Green University Network (CGUN) in Shanghai [17]. Its purpose is to provide a platform for universities to communicate and develop the green campus concept. So far, 18 universities have become members of CGUN [17].

As the sustainable development of universities has attracted more and more attention from educators and the public, scholars have begun to study the development of university sustainability in the China context. For instance, Niu *et al.* (2010) describe the status of higher education for sustainable development in China from the national perspective [16]. Xiong *et al.* (2013) analyze the status of green curricula across Chinese universities and colleges [18]. However, case studies of sustainability at the university level in China remain scarce, with only a few having been conducted. For instance, Geng *et al.* (2013) describe the status of sustainability efforts at Shengyang University [19]; Yuan and Zuo (2013) and Yuan, Zuo and Huisingh (2013) analyze the initiatives and implications of sustainability efforts at Shandong University [20,21]. In contrast with the American bottom-up approach, existing studies indicate that university sustainability programs in China usually are initiated and led by university authorities through a top-down approach.

Some studies examine sustainable development in universities from an international perspective. Such studies are usually based on surveys or literature reviews covering many countries and regions, and the analyses tend to be introductory or summary in nature. For example, van Weenen (2000) examined, in a general manner, the diverse strategies of various universities for engaging in sustainable development [22]. Most of the global studies still only explore single cases within a specific context or framework [23–25]. In terms of university sustainability in the United States and China, there is scant research comparing specific cases in detail with regard to similarities and differences between the two countries. Employing the cases of IUB and Tsinghua, we try to fill this gap through examining the initiatives, strategies, and implementation of university sustainability programs in the United States and China.

3. Comparing IUB and Tsinghua's Sustainability Definitions, Missions, Organization, Goals, and Strategies

While higher education seems poised to play a pivotal role in sustainable development, some researchers contend that the university does not facilitate, but rather impedes the development of a sustainable society [7]. Traditional educational practice, which still dominates, typically fails to integrate sustainability into institutional missions, goals, organization, and strategies. Those NGOs and educational institutions that are embracing environmental sustainability seek to "fix" the traditional system, by transforming all aspects of the educational enterprise [7]. This emergent perspective suggests that sustainability is a system-wide transformation for universities, requiring fundamental reorientation of institutional missions and practices.

Most universities that are promoting sustainability seek to include—indeed integrate—academic and operational aspects. Sustainability in higher education increasingly addresses curriculum, research, leadership, management, community outreach, policy analysis, institutional visions, and associated challenges [26]. In this paper, we distill these themes into a focus on strategies, organization, and goals. By comparing institutional strategies, organization, and goals, we examine how the two universities implement sustainability in their academic and operational policies and practices.

In the following Section, we discuss the similarities and differences in sustainability policies and practices between IUB and Tsinghua. We examine their respective sustainability missions in order to more fully understand the macro-level transformations taking place within the two universities. We also explore their general sustainability organization, goals, and strategies, in order to comprehend how they transform vision into practice.

3.1. Definitions

IUB's definition of sustainability is based on that of the 1987 report of World Commission on Environment and Development (WCED), within which sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [27]. This definition was adopted by IUB in its Campus Sustainability Report, which emphasizes the importance of addressing social, environmental, and economic equity aspects of sustainability [28]. More specifically, IUB defines sustainability as "thriving within our means to achieve balance between environmental health, economic prosperity, and social equity" [28]. Clearly, this definition is in tune with the concept and philosophy of sustainability espoused by the United Nations. It contains and tries to balance three aspects—economic development, social justice, and environmental protection. In addition, IUB adopts the word "thriving" to emphasize an engaged, energetic approach to shifting consumption and resource-use patterns not only within the university itself but also the larger community. This perspective suggests that sustainability at IUB means maintaining a balance among social, economic, and environmental equity aspects of sustainability, as well as shifting lifestyles and providing more opportunities to the larger community to become involved with promoting sustainability.

Tsinghua is the first university in China to introduce the concept of sustainability into its development framework. In 1998, Tsinghua proposed the concept of the green university and

promoted it as an important component of its world-class university scheme. In the early stages, the green university concept was understood and implemented mainly with regard to controlling environmental pollution, improving air and water systems, and planting trees and grasses on the campus. In the early 2000s, Dr. Dazhong Wang, then president of Tsinghua, clarified the green university concept as a broader notion that entails protecting the environment, conserving resources, and promoting sustainable development [29]. President Wang also emphasized the central importance of "education for people", indicating that all the principles, policies, and strategies related to the green university concept should be embedded in the education process. Tsinghua intended to educate students broadly regarding sustainability, and help them to become citizens who can contribute to balancing economic growth and environmental protection. From this perspective, the definition of sustainability adopted by Tsinghua focuses more on the environmental and economic aspects of sustainability than its social justice component.

The definitions of sustainability adopted by IUB and Tsinghua are both adopted from international environment conferences. Tsinghua's concept is based on Agenda 21, while IUB derived the concept from WCED. Both universities are concerned with pressing environmental issues, and hope to play their parts in promoting sustainable societal development. However, the definition adopted by IUB gives equal attention to the social, economic, and environmental aspects of sustainability, with its key elements distributed across the themes of environmental protection, economic growth, and social equity. Tsinghua is more concerned with economic and environmental issues than social equity, emphasizing the need to balance economic growth and environmental protection. Furthermore, IUB focuses on community in its definition, stressing the idea of "thriving" to take advantage of opportunities that involve the broader community. In contrast, Tsinghua's concerns are much more with the university itself than the community around it, with much more focus on its students and researchers rather than "outsiders". These definitional differences reflect the two universities' contrasting understandings and principles regarding sustainability and, in turn, influence their missions, organization, and strategies, which we discuss below.

3.2. Missions

IUB defines its sustainability mission clearly—"to catalyze a thriving culture of sustainability in academic, research, operations, administration, campus life and community outreach to enhance environmental health, economic prosperity and social equity" [28]. In addition, IUB has proposed 20 goals for 2020 in seven areas, including leadership, academic programs, built environment, transportation, food, environmental quality, and funding [28]. These missions and goals can be summarized into three aspects: environmental issues, social justice, and economic growth. Besides education, research, and campus life, IUB also includes community outreach as part of its mission.

The mission proposed by Tsinghua is also based on its understanding of sustainability—"our mission is to enable Tsinghua University to be an education and research center of environmental protection and sustainable development in China. More specifically, the mission is to educate graduates regarding environmental protection and sustainable development; the research should be environmentally friendly; the campus should be ecologically beneficial" [30]. We find two major differences between the two universities' missions. First, compared to IUB, Tsinghua places greater

emphasis on environmental issues, and especially the university's educational function and research functions in solving societal environmental problems. Second, compared to IUB, Tsinghua's sustainability mission emphasizes "students, research, and campus life" but ignores community [28]. The mission statement also addresses university responsibilities regarding societal environmental issues, but this responsibility involves educating students to be responsible citizens.

3.3. Organization

The organizational structure for university sustainability at IUB consists of a sustainability office, two administrative posts, and a campus advisory board (Figure 1). Though the office and advisory board need to report to two administrators, the advisory board, which consists of students, faculty, staff, and community volunteers, has advisory and autonomous rights within the system. Therefore, the system is not strictly hierarchical. In 2008, the university set up the Office of Sustainability to manage daily sustainability activities. The office is the fundamental unit for operationalizing sustainability across the university, bridging policy makers, faculty, staff, and students, as well as organizing related internships and programs. The Office of Sustainability is co-chaired by academic and operations representatives [28]. Due to the fact that academic and administration/operations are two central elements of the sustainability mission, they are jointly responsible for its implementation. Therefore, the Office of Sustainability reports to two vice presidents: the provost (executive vice president), who is in charge of academics, and the vice president for capital planning and facilities, who is in charge of operations. In addition, a Campus Sustainability Advisory Board was set up to provide recommendations for sustainable development. The advisory board consists of approximately 40 members, including faculty, staff, students, and community volunteers. They serve as members of seven working groups—academic initiatives, energy and the built environment, environmental quality and land use, food, resource use and recycling, sustainable computing, and transportation [28]. Being the major driving force for campus sustainability, these members propose policies, participate in events, and monitor campus sustainability generally.

Figure 1. Sustainability organization at IUB [28].

Furthermore, the Office of Sustainability cooperates with student sustainability organizations, such as the Green Teams and Student Sustainability Council, through which students can actively participate in campus sustainability initiatives. Therefore, through a loosely structured but

comprehensive operational system, IUB involves diverse university members, including faculty, students, staff, and community members, in different aspects of its sustainability efforts.

The organization of sustainability efforts at Tsinghua consists of three parts: the Green University Initiative Leading Group, the Office of Green University, and the Advisory Committee of Green University (Figure 2). The Green University Initiative Leading Group, headed by the university president, plays the lead role with respect to sustainability efforts. The Office of Green University reports to the leading group, coordinates sustainability efforts across different departments within the university, and fosters sustainability partnerships with government agencies, private enterprises, and NGOs. The Advisory Committee of Green University consists of experts in green university initiatives, and is responsible for providing advice to the Green University Initiative Leading Group and the Office of Green University [31]. Similar to IUB, the organizational structure of sustainability efforts in Tsinghua also includes academic and operations aspects. Two vice presidents of the university are in charge of academics and operations, respectively.
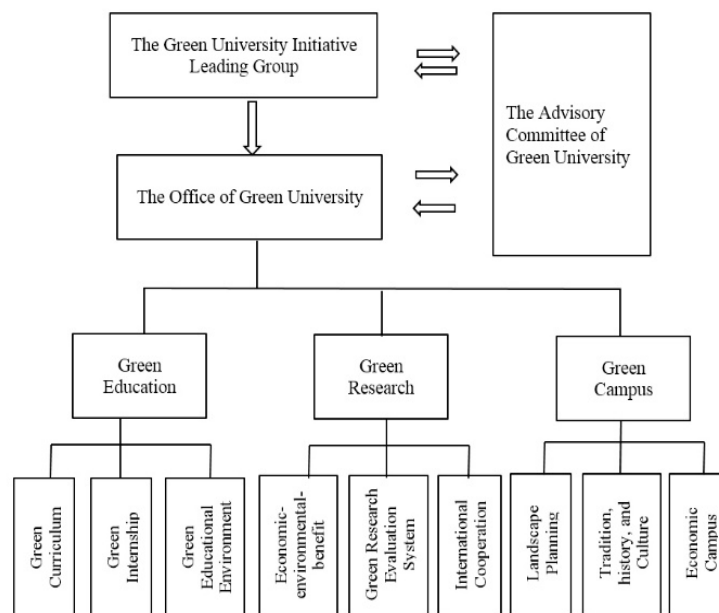

Figure 2. Sustainability organization at Tsinghua University [31].

Though IUB and Tsinghua share some organizational similarities, Tsinghua's sustainability organizational system is more hierarchical. First, in contrast with the diverse membership of IUB's advisory group, the members of Tsinghua's advisory committee are all experts in sustainability-related fields, are generally well-known professors or researchers in positions of considerable authority, and are selected by the university [32]. Therefore, the organization of sustainability activities in Tsinghua lacks the involvement of ordinary faculty, staff, students, and community members. Second, the Office of Green University in Tsinghua leads the development of three dimensions of sustainability, namely green education, green research, and green campus. In contrast with IUB's loosely-defined cooperation with student organizations on a variety of concerns, Tsinghua's Office of Green University has explicit tasks and specific working targets that are regulated by the university. Overall, the framework for sustainability organization at Tsinghua is more rigorous and hierarchical than that at IUB.

3.4. Goals

IUB's sustainability goals involve almost every aspect of academics, operations, and community outreach. In 2010, the IUB Campus Sustainability Advisory Board and its seven working groups proposed the 2020 Vision, which includes general goals and an overarching vision: "Indiana University is an international campus sustainability leader recognized for innovation and excellence in academic programs, research, campus environmental quality, campus operations and community outreach that facilitate and demonstrate the path to a more sustainable future" [33]. The 2020 Vision's goals address seven aspects of campus sustainability:

(1) Seeking to be an international leader in campus sustainability. The 2020 Vision explicitly states that sustainability should be infused into the university culture and core values, and be a part of decision-making processes. The university tries to involve as many participants as it can to extend the scale and effects of campus sustainability. Through these efforts, the university hopes to "achieve the Platinum rating on the AASHE national Sustainability Tracking Assessment and Rating System" and "continuously increase the quantity, quality, and diversity of participation in campus sustainability" [33].

(2) Promoting sustainability in every level of the education process. For instance, IUB plans to provide internationally recognized degree programs in environmental and sustainability studies at the undergraduate, graduate, and doctoral levels, as well as make sustainability engagement a component of the educational experience for graduates [33].

(3) Developing detailed sustainability goals related to university energy management, and the atmospheric and built environments. For instance, the Campus Master Plan includes recommendations for achieving a 20% reduction in greenhouse gas emissions by 2020, primarily by making buildings more energy efficient. Furthermore, the university proposes to develop ways to monitor the progress of sustainability efforts, such as equipping all buildings with smart meters so that utility information will be readily available to users, and also creating an internal audit team that would promote and monitor improvements in energy and resource effectiveness [33].

(4) Requesting a reasonable sustainability goal for campus transportation. Though private cars are widely used by students, faculty, and staff commuters, the university proposes to reduce demand for single occupancy vehicles on campus by 20%, by encouraging alternative transportation modes [33].

(5) Developing sustainability goals in the area of food. For instance, the 2020 Vision includes plans for the university to purchase 20% of its food from producers who embrace sustainable practices [33].

(6) Developing detailed targets for the university environment. The 2020 Vision calls for reducing campus solid waste by 40%, planting 12,000 trees, and providing sufficient resources to maintain the beauty of campus landscapes [33].

(7) Providing funding to support sustainability. Because substantial additional funding is required to achieve sustainability goals, IUB has included detailed goals within the 2020 Vision regarding funding. The university plans to raise $10 million for specific sustainability projects through events, grants, and donations, as well as procure additional funds for Office of

Sustainability programs and internships directed toward meeting the university's sustainability goals [33].

In contrast with IUB, Tsinghua does not list sustainability goals in detail, but instead outlines the three general goals regarding education, research, and the environment. First, promoting the concept of green education, Tsinghua develops sustainability goals for students, who are expected to become the dominant players in sustainable development in the future by internalizing awareness of environmental protection values. Second, with respect to research, Tsinghua develops the concept of green research, the main goal of which is to integrate sustainability thinking into research practice. Tsinghua does not list specific quantitative goals for students or faculty to achieve, but only describes some general goals. For instance, the university mentions that green research should include research into technologies for sustainability, and should also employ sustainability thinking for different levels and aspects of research. Third, Tsinghua promotes the ideal of a green campus. Through providing a more sustainable physical environment, Tsinghua hopes to help students strengthen the notion of sustainable development in their daily lives [30].

Based on the above comparison, we find that there are explicit differences in the ways that the two universities describe their sustainability goals. IUB elucidates its sustainability goals within seven specific areas, while Tsinghua describes its sustainability goals in three general fields. In addition, IUB lists definite goals in different areas, and most of these are specific quantitative goals. In contrast with IUB's detailed goals, Tsinghua's goals are characterized more broadly. Without quantitative goals and specific targets, Tsinghua's goals appear vague, failing to provide clear direction for faculty and students. For instance, Tsinghua makes mention of building an ecological campus, but does not provide detailed goals with respect to the campus environment, transportation, or food system, as IUB does. As a result, it is harder for Tsinghua's faculty and students to interpret its sustainability policies and achieve the sustainability goals established by the university. Overall, because they are specific in a detailed and quantitative form, IUB's sustainability goals are more practical and feasible than those of Tsinghua.

3.5. Strategies

The strategies, or actions, that IUB adopts to achieve its sustainability goals are designed from three perspectives—education, research, and operations. First, in terms of education, IUB makes efforts to expand sustainability courses and degree offerings. The IUB Education and Research Working group is responsible for promoting sustainability courses, which can be classified into two types. One is sustainability-focused courses, which involve social, economic, and environmental dimensions, as well as courses examining a topic using sustainability as a lens. The other type is sustainability-related courses, which incorporate sustainability as a distinct component or concentrate on a single sustainability principle. Both types of sustainability courses are designed to help students develop a better understanding of sustainability [33]. IUB also has set up a fellowship program to encourage faculty to design new sustainability curricula. Every year, the Office of Sustainability awards Sustainability Course Development Fellowships to faculty [34]. Through these efforts, IUB has made great progress in sustainability curriculum provision. By 2010, sustainability had been incorporated into over 200 courses, which are offered by most departments across the university [33]. In addition to

curriculum provision, degree options constitute another strategy for supporting sustainability. IUB offers sustainability-related degrees not only in environment-related colleges and departments, but also in other colleges and departments. For example, the College of Arts and Sciences, Kelly School of Business, and School of Public and Environmental Affairs all offer sustainability related tracks at the undergraduate and graduate levels [34]. IUB also consistently expands new sustainability related degree programs. For instance, a new Ph.D. minor in sustainable energy science was introduced in 2010 [33] and a cross-campus proposed degree program in Environmental and Sustainability Studies has recently been developed [34].

Second, the IUB Office of Sustainability and the Education and Research Working Group collaborate to facilitate research in sustainability-related fields in multiple ways. The Education and Research Working Group created the Sustainability Clearing House, which hosts more than sixty faculty members who conduct sustainability-related research from diverse disciplinary perspectives [34]. The Office of Sustainability also cooperates with different schools to provide Sustainability Research Development Grants, which are designed to "support collaborative efforts of Indiana University graduate students and faculty to develop new, externally funded research programs related to research on sustainability" [35]. Since 2009, these grants have supported more than thirty projects related to sustainability, involving the fields of public policy, biology, anthropology, and psychology [36]. In this manner, IUB effectively promotes cutting-edge sustainability research and facilitates interdisciplinary collaboration among faculty and students [37].

Third, IUB facilitates sustainability in its operations. Corresponding to its specific sustainability goals, IUB promotes sustainability in the field of university operations in the following six areas:

(1) Controlling energy usage of buildings. IUB's utilities team records and monitor both the water and electricity usage of each building weekly. IUB has also set up usage baselines for university buildings [38]. The Energy Challenge Awards program was established to encourage the "small behavior changes" which can collectively decrease environmental impacts [39]. These strategies have been effective in reducing energy consumption—total water usage has decreased by 24% since 2004, even though campus floor space has increased more than 380,000 square feet in this time period [33].

(2) Reducing e-waste produced from computing technology. IUB has been recognized as a global leader in information technology [39]. The university realizes the challenge of e-waste and has worked to establish environmentally friendly e-waste disposal procedures [40]. Students and faculty are trained to deal with computing-related waste in sustainable ways [40].

(3) Exploring effective ways to increase environmental quality through protecting natural resources, including air, land, and water, and then ensuring the longevity of these resources and improving IUB community and environment health [41]. To these ends, IUB has initiated tree-planting and river restoration programs [42].

(4) Supporting locally-produced food. Student groups work with the Food Working Group to support local, sustainable food products by decreasing packaging and reducing transportation needs. The university also has established several campus food gardens [43]. Furthermore, the university hosts the Big Red Eats Green, a fall harvest festival on campus, to encourage consumption of local food.

(5) Diverting waste through reuse, recycling, and composting [44]. IUB has adopted alternative means for dealing with waste and has had encouraging results. The IUB community provides a way to divert truckloads of move-out waste from the landfill while at the same time benefitting local charities, and IUB diverted over 2 million pounds of electronic waste from the landfill in the two years before 2010 [33].

(6) Achieving sustainability in transportation. IUB has developed a well-structured campus bus system. In addition, IUB is known for a famous campus cycling competition, the Little 500, through which the university encourages many students to use bicycles [45]. IUB also encourages car sharing—according to the 2020 Vision, over 2000 individuals have signed up for the Zipcar program on campus, a ride-sharing system that helps reduce individual car ownership, fuel consumption, and traffic congestion [33].

In summary, IUB adopts specific sustainability strategies in the areas of education, research, and operations. Particularly in the operations area, IUB has taken specific, detailed steps to promote campus sustainability. A factor that cannot be ignored is the vast number of sustainability volunteers, including faculty, staff, students, and community members. Over 200 volunteers serve on the Campus Sustainability Advisory Board, which includes seven Working Groups, as well as the 22 Student Sustainability Council organizations, and the 23 Green Teams [32]. Without these volunteers, implementation of sustainability programs might be next to impossible.

Like IUB, Tsinghua also implements sustainability strategies in the three areas of education, research, and operations. First, Tsinghua pursues a strategy of green education, including "green curriculum" and "green practice". Green curriculum is the primary means of achieving the goal of green education. The Department of Environment Science and Engineering at Tsinghua is the department principally responsible for creating the green curriculum system. Since 1998, the department has developed a series of sustainability-related courses; these form the foundation for Tsinghua's university-wide green curriculum. In addition, Tsinghua has transformed its traditional practical education program to green practice by adopting new green practice initiatives, including a green science and technology competition and green student activities [30]. These green practices help students understand sustainable development as a means for resolving real issues in society. Since 2004, more than 40 percent of students have been involved with green practice initiatives every year [46].

Second, Tsinghua supports green research as a means of implementing sustainability. Green research requires scholars to evaluate environmental impacts before they launch a research project. Only when the project is evaluated as being environmentally friendly are investigators allowed to proceed. As projects are carried out, the university continues to evaluate them with respect to their role in advancing sustainability; this sustainability assessment is regarded as a part of project outcomes. Sustainability research projects are placed in three categories: projects that directly seek to solve environmental problems, such as those that address wastewater disposal, air pollution, and solid waste management; projects that develop new technologies to reduce energy use and material waste; and projects that explore new energy technologies. In addition, Tsinghua supports research directed toward addressing environmental issues more broadly, including drafting the nation's Basic Law of Energy. Tsinghua's green research program has produced significant results; since 1998, when the green

university concept was first proposed, Tsinghua has carried out 280 key national-level projects and acquired more than 300 sustainability-related patents [47].

Third, Tsinghua has proposed the green-campus concept as a means for implementing sustainability practices. The green campus has three components: strengthening landscape planning and employing diverse plantings to keep the campus green year round; creating an economically and energy-efficient campus by encouraging conservation in campus operations involving water, electricity, fuel, and materials use; and curtailing pollution, by taking measures to reduce pollutants emitted by the central heating plant and replacing coal with natural gas.

Based on the comparison above, we find that both universities engage in sustainability practices in the three areas of education, research, and operation. For IUB, sustainability means not only environmental issues but also social justice. For Tsinghua, the understanding of sustainability concerns mainly environmental issues. In terms of research, Tsinghua creates policies only for faculty research, while IUB provides opportunities and funding for both faculty and students. In terms of implementation, IUB has put in place more specific and detailed standards and strategies than Tsinghua. In summary, IUB has more detailed and specific strategies, involving a wider community and a broader set of sustainability concerns, than does Tsinghua.

4. Discussion and Summary

Both IUB and Tsinghua's sustainability programs are in accord with broader global concepts of sustainable development. While IUB makes clear that its sustainability programs are influenced by United Nations sustainability agreements and declarations, the sustainability program at Tsinghua, while guided by Agenda 21, also coincides with the trend toward building "world-class" universities [48]. Though the global context is similar, the two universities' national and local contexts are quite different. Divergent political and cultural contexts in considerable part explain differences in definition, mission, organization, strategy, and goals with respect to university implementation of sustainability programs and practices. First, political context influences the organizational structure of the university with respect to implementing sustainability programs and practices. China's political regime is a highly centralized one, within which higher levels of government exercise a great deal of authority over lower-level branches [48–50]. This hierarchical character is embedded in the governance institutions of Chinese universities. Tsinghua's organization is typically hierarchical, and top-down policy procedures govern its sustainability programs and practices. In contrast, the inter-governmental structure in the United States is considerably less hierarchical, even for public institutions such as IUB. While certain requirements and directives do come from the state legislature and the university's state-wide central administration, there is considerable flexibility and autonomy at the level of the individual institution. Still, in the case of IUB and the United States more generally, those policies, procedures, and requirements that have been put into place are quite prescriptive and subject to legal and administrative enforcement. Laws, conditions, and in many instances even guidelines are binding. The Chinese system, however, provides general guidance, allowing for much flexibility in interpretation and implementation. However, high-level administrators make the key decisions—and those decisions generally cannot be fundamentally challenged by lower-level authorities or the general public. Moreover, IUB is required to provide detailed, precise information

about university practices, including sustainability initiatives. Tsinghua is not bound in the same way; the authorities there exercise considerable discretion over what information and avenues of participatory access are open to students, faculty, and the general public. In considerable part, these differing requirements explain the differences in organizational structure between IUB and Tsinghua with respect to promoting sustainability.

Both universities have three-tiered organizational structures that address sustainability, consisting of campus organizations, a sustainability office, and an advisory board. IUB, however, has a more loosely-structured and more inclusive organizational system and Tsinghua has a more hierarchical one. IUB's advisory committee is voluntary and its members consist of ordinary faculty, students, and staff, while Tsinghua's committee is comprised entirely of experts who are selected by the university. Moreover, IUB sets up diverse internships and provides fellowships to encourage students and faculty to participate in sustainability programs. As a result, sustainability programs and practices at IUB have broad influence across the university. At Tsinghua, though, students are encouraged to participate in sustainability internships, and the hierarchical organization of sustainability programs limits the involvement of ordinary students and faculty. Students at Tsinghua seldom volunteer to participate in the university's sustainability efforts.

Second, the national context influences how universities design goals and strategies to implement sustainability programs and practices. Proposed in 1998, Tsinghua's sustainable university scheme is the first one in China, with the purpose of being a model for other universities in promoting sustainability. There was no related experience in China for Tsinghua to follow at that time. IUB implemented significant campus sustainability programs in 2008, much later than Tsinghua, when the notion of university sustainability in the United States had spread and involved many institutions, and had formed a series of understandings, discussions, standards, organizations, and assessment indicators among colleges and universities. For instance, AASHE had announced a series of sustainability assessment indicators by that time. IUB set a goal of being a leader in sustainability, and this goal had models or standards to follow under the AASHE framework. Therefore, IUB developed sustainability in a relatively mature context, while Tsinghua had to initiate sustainability practice largely by itself. Due to the mature context and existing assessment indicators, IUB has been able to develop more detailed and specific sustainability goals and strategies than Tsinghua. From this perspective, the different national contexts have influenced the two universities' respective development of sustainability programs and practices.

Third, cultural context influences how universities define their sustainability missions. IUB and Tsinghua understand the United Nations' three essential sustainability elements (environment, economy and society) differently. Under the STARS framework, which involves environmental protection, economic development, and social equity, detailed indicators for sustainability have been created. IUB gives consideration to all three aspects, and has adopted specific sustainability targets [13]. In China, however, the understanding of sustainability is, generally, more limited. Sustainability in universities chiefly emphasizes environmental issues; this coincides with the national understanding of sustainability. This is not necessarily surprising, given the severity of environmental problems in China. Therefore, sustainable development in China is principally concerned with balancing the country's rapid economic development with conservation of the environment and natural resources [46]. In Tsinghua's case, therefore, it makes sense that environmental education, focusing mainly on physical

environmental concerns, is the central focus. Environmental education strategies are centered on integrating environmental issues into the curriculum, encouraging research on environment-related topics, and building an environment-friendly campus. Tsinghua also stresses creation and dissemination of knowledge and technology that promotes environmental protection, preservation of natural resources, and ecological protection and restoration in its sustainability policies, while social aspects of sustainability are not given much emphasis.

5. Conclusions

Promoting sustainability at the university level is a global trend, within which many universities in the United States and China are active participants. Both IUB and Tsinghua have defined the sustainable university concept, created sustainability missions, and developed sustainability strategies that are in accord with the same overarching global frameworks. These two universities' different national and local contexts, however, have produced different foci, organizational structures, and strategies. IUB has adopted a comprehensive view of sustainability that includes environmental protection, economic development and social justice, and also emphasizes community outreach and volunteer participation. Its organizational system is loosely structured, involving many volunteers in its sustainability efforts. Under the mature U.S. framework for university sustainability, IUB has developed sustainability indictors (STARS), and has established specific and detailed strategies and goals. In contrast, Tsinghua's sustainability structure is more hierarchical and centralized. Tsinghua involves mostly environmental experts in its sustainability activities, rather than a more diverse range of volunteers, ordinary students, and community members. In addition, while Tsinghua has focused successfully on environmental issues and their relationship with economic development, sufficient attention has not paid to social justice issues related to sustainability. Because Tsinghua's initiatives pioneered university sustainability efforts in China, it has not had an established set of protocols and experiences to guide its efforts, as has been the case for IUB; as a consequence, Tsinghua continues, of necessity, to be a leader in exploring new ways of promoting sustainability thinking and practices.

Based on our examination of these two institutions' sustainability definitions, missions, organization, goals, and strategies, we can learn a great deal about their differing sustainability policies and practices. Furthermore, these two cases have transformative value for other institutions in in the U.S. and China. For example, IUB's mature implementation approaches, specific goals, and detailed strategies can help institutions in China improve their concepts of university-level sustainability and design more practical and concrete goals. In addition, IUB's model of less rigid organizational structure and extensive involvement of volunteers in sustainability efforts can be of value to universities in China. At the same time, Tsinghua's hierarchical and authoritative system can inspire universities in the U.S. to find ways to improve the effectiveness and expediency of their own organizational systems. These comparisons help us not only to understand how two specific research universities implement sustainability programs and practices, but also to understand how universities can improve their sustainability efforts by learning from experiences in different political and cultural contexts.

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Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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