



# Making university and curricular sustainable entrepreneurship: a case study of Tsinghua University

Zhou Zhong<sup>1</sup> · Fan Feng<sup>2</sup> · Jizhen Li<sup>3</sup> · Xin Liu<sup>4</sup> · Yue Cao<sup>5</sup> · Ying Liao<sup>6</sup>

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## Abstract

Making the university and its teachers and students alike as sustainable entrepreneurs are central endeavours in this age of sustainable development today. This paper presents an in-depth case study to examine the development of sustainable entrepreneurship of Tsinghua University of China at institutional and curricular levels. The paper first proposes an analytical model of the sustainable university as the alignment of six elements based on three interrelated propositions. The paper then applies the model to study Tsinghua's culture of sustainability and entrepreneurship and its strategies from green university to sustainable university. Next the paper discusses five cases courses in sustainability education from diverse disciplines with shared goal to foster sustainability competence as global competence and shared pedagogies for experiential learning. The paper concludes with theoretical discussions of institutional-level sustainable entrepreneurship and also practical discussions of shared characteristics and challenges of curricular-level sustainable entrepreneurship with special references of pedagogical and digital opportunities and challenges. The paper presents findings from a self-reflective practitioner-as-researcher action research jointly conducted by the instructors of case courses. The paper used a mixed-method approach with participatory observation, interview, focus-group, survey, and curricular development experiments.

**Keywords** Sustainability university · Sustainability education · Entrepreneurship · Green university · Global competence · Tsinghua University

## The sustainable university vision

### The sustainable entrepreneurship of the university

Making the sustainable university is a central entrepreneurial endeavour of our age. Such a university registers the latest university model after the three respective models of the teaching university, the teaching-research university, and the

entrepreneurial university. The evolution of these models is not linear, instead since the second model each of them has come into being by integrating the previous one(s) while creating new missions and functions, and operates alongside the previous models in higher education system. The fourth and latest one focuses on the mission of sustainability, which broadly refers to vitality and wellbeing, but may also refers specifically to achieving Sustainable Development Goals

✉ Zhou Zhong  
zhongzhou@tsinghua.edu.cn

Fan Feng  
fengfan83@tsinghua.edu.cn

Jizhen Li  
lijzh@sem.tsinghua.edu.cn

Xin Liu  
xinl@tsinghua.edu.cn

Yue Cao  
caoyue@tsinghua.edu.cn

Ying Liao  
liaoying@tsinghua.edu.cn

<sup>1</sup> Institute of Education, Tsinghua University, Beijing, China

<sup>2</sup> Department of Painting, Academy of Arts and Design, Tsinghua University, Beijing, China

<sup>3</sup> School of Economics and Management, Tsinghua University, Beijing, China

<sup>4</sup> Department of Industry Design, Academy of Arts and Design, Tsinghua University, Beijing, China

<sup>5</sup> Department of Landscape Architecture, School of Architecture, Tsinghua University, Beijing, China

<sup>6</sup> Centre for Global Competence Development, Tsinghua University, Beijing, China

(SDGs). The rise of the sustainable university vision can be observed from a recent study finding that 37 out of the top 50 universities in the Times World University Rankings 2022 have officially published the university's sustainability strategies, action plans, or reports by 2021 (Yuan & Zhong, 2022). Moreover, the general aspiration for sustainable entrepreneurship can be seen from many universities across the world (Fabregà, 2018; Filho, 2021; Kimanzi, 2020).

This paper presents an in-depth case study to examine the development of sustainable entrepreneurship of Tsinghua University of China at institutional and curricular levels. The paper proposes to understand making the sustainable university as an entrepreneurial endeavour driven by dynamic capabilities to align six elements based on three propositions. The Schumpeterian concept of entrepreneurship is new combinations of productive factors (Schumpeter, 1934, p. 76). Drawing on findings from recent studies, this paper considers entrepreneurship as new combinations of orientations with opportunities through by an organiser, such as an individual or an organisation. Inspired by Clark's five-element model of the entrepreneurial university (1998), making the sustainable university can be seen as an entrepreneurial process of aligning six key elements: a stimulated academic heartland with core strength in the arts and sciences of sustainability, an expanded developmental periphery, a diversified funding base for sustainability engagement, and a dynamic ecotone of sustainable education.

In particular, sustainable education as the sixth element highlights the importance of education for sustainable development (ESD). As an integral element of SDG 4 on quality education, ESD is a key enabler of all other SDGs by empowering the learners with knowledge, skills, values and attitudes to take informed decisions and make responsible actions for environmental integrity, economic viability and a just society (UNESCO, 2020). ESD in the university sector embraces the mission to transform individuals, institutions and societies together in order to strengthen their sustainability competences and realise their full potentials (Fisher, 2016; Price et al., 2021; Scherak & Rieckmann, 2020). Moreover, the faculties as scholars of sustainability research and designer and instructors of sustainability curricular can be seen as sustainability-driven entrepreneurs or sustainable entrepreneurs who also aim to cultivate their students into such entrepreneurs (Bauman, 2021; Biberhofer et al., 2019; Cincera et al., 2018). While this new type of entrepreneurs are experts of sustainable innovations for social and ecological objectives, they also share the basic characteristics of entrepreneurs. Furthermore, inspired by Etzkowitz's mode of the entrepreneurial university (2016), the present study proposes three interrelated propositions of reciprocity, dynamism and resilience to explain how the six-element alignment enables a fusion of academic values, administrative capability, and outreach proactiveness to build a focused

university capable of overcoming demand overload from wider society.

### Proposition 1: Reciprocity

The sustainable university defines excellence as sustainability which entails triple-helix goals of the university of sustainability, by sustainability, and for sustainability. First, the vision aims to transform the university and its members and the society sustainably together towards holistic development with environmental integrity, economic viability and social justice. Secondly, the university aims to achieve the sustainable vision by making the university itself as a living lab to design, test, and incubate local-to-global innovations for tackling big challenges to humankind. That is, making the sustainable university is the intentional process of integrating the sustainable development dimension into the university's purpose, functions and delivery, so that the university maintaining its own surviving and thriving as a community, an organisation, and a campus or more campuses, while contributing to the sustainability of the society and the Earth at large. Thirdly, the sustainable university shoulders two responsibilities: the inter-generational responsibility of "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987), and the co-development responsibility of a development that meets the needs of one group without compromising the ability of the others to meet their own needs (UN, 2015). These triple-helix goals were evident in many university declarations for sustainability (Lozano et al., 2013; ULSF, 1990). Altogether, the sustainable university vision embraces an all-embracing value of "topophilia" as "the affective bond between people and place or setting" that prepares us to understand ourselves (Tuan, 1990, pp. 1–4). Such a bond as an engagement is multifaceted and multivalent, such as being simultaneously educational, academic, cultural, and empirically applicable for sustainable development (McCowan, 2019; Steele & Rickards, 2021).

### Proposition 2: Dynamism

The sustainable university thrives on interactions between development opportunity and sustainability orientation. Opportunity denotes favourable or advantageous circumstances for achieving goals. Orientation denotes both values as aforementioned the first Proposition and traits. The sustainable university makes new combinations of orientations and opportunities by developing and deploying traits, also known as dynamic capabilities, to combine and recombine all the resources that the university can mobilise and allocate from both within and outside the university. While ordinary capabilities refer to organisational routines

as repeated action sequence, dynamic capabilities refer to transformative actions to sense and seize opportunities to capture value through mobilising and allocating resources from both inside and outside an organisation. Dynamic capabilities refer to the ability to “integrate, build, and reconfigure internal and external resources/competences to address, and possibly shape, rapidly changing environments” (Teece, 2007). The three main groups of dynamic capabilities: creative capabilities such as being unique, proactive, experimental, or adaptive; venturing capabilities such as being goal-driven, fast-learning, and coping with uncertainty, ambiguity and complexity; and relational capabilities such as multi-stakeholder commitment, networking, and collaborative enquiry (Teece, 2018). The sustainable university shares the traits of the entrepreneurial organisation as being visionary, goal-driven, risk-taking, innovative and proactive (Covin et al., 2020). Such a university uses dynamic capabilities to orchestrate key resources and efforts to create value throughout both its internal and external networks, encompassing teaching and learning, research and innovation, campus development and management, international cooperation, and measuring and reporting of institutional sustainability.

### Proposition 3: Resilience

The resilience of the sustainable university can be viewed as the three-fold sustainability consisting of survival, stability, and development in terms of being respectively reactive concerning events, responsive concerning patterns of behaviour, and generative concerning systemic structure, therefore seeing new possibilities for shaping the future. This three-fold understanding is inspired by Brock’s model of education in temporal scale (Brock, 2016, p. 176), Senge’s model of systems thinking and learning organisation (Senge, 1990), and Sternberg’s concept of intelligence as resilience through adaptability to the environment (Sternberg & Sternberg, 2017). The sustainable university builds its independence in terms of resilience of the campus, the community, and the whole of organisation. The outbreak of Covid-19 pandemic since 2020 has highlighted the crucial importance of the campus resilience in making a safe and healthy place and space physically, spiritually, and financially for the university community and the organisation alike while maintaining educational and academic quality during public crisis, especially during temporary campus lockdown. Sustainable stability for campus means accelerated campus digitalisation for effective learning and efficient communication for the university community both on-campus and off-campus. In the long-term view, the sustainable development of the whole of the campus, the community and organisation as climate change agency.

## Research methods

This paper presents an embedded in-depth case study of the making of Tsinghua University of China as a sustainable university. At the institutional-case level, the paper examines Tsinghua’s green university strategy as a sustainability strategy developed since the 1990s in the context of China’s growing commitment to sustainable development as green development. Then at the curriculum level, the paper compares the innovative pedagogical characteristics of five sets of courses concerning sustainable development. This paper also discusses the interaction between faculties’ grassroot efforts as a community of practice and university strategies and support. Through such interaction they have engaged with each other in mutual learning in sustainability education, pedagogical innovations, and sustainability research. The paper concludes with theoretical and practical discussions about key issues in the entrepreneurial characteristics of making the sustainable university.

The paper employed several qualitative research methods including literature review, archive study, participatory observation in curriculum development and classroom observation, interview, and focus-group. All five present authors are practitioners-as-researchers, since they are the course instructors of the embedded curricular cases in the present Tsinghua case study. They took an initiative to undertake an interdisciplinary action-research project in 2020–2022 to enable joint engagement in innovations in teaching sustainability. This paper is part of the research findings from this research project. In fieldwork research, this paper has been informed by the following key ongoing processes: internal meetings and international conferences for exchanges of experiences in sustainability teaching and research about sustainability education, co-teaching in several courses, and also joint design and delivery of the annual Tsinghua Global Summer School on Sustainable Development since 2020. In this context, this study is part of a systematic enquiry collaboratively conducted by the present authors as one of practitioners in the real-world environment to gather information with the goals of gaining insight, developing reflective practice, effecting positive changes in practice (Mills, 2014, p. 8). Such participatory research is conducive to generating knowledge that contributing to personal and professional development as well as academic, pedagogical, and institutional development (Tolman & Brydon-Miller, 2001).

## Institutional study: The Sustainable entrepreneurship of Tsinghua

### An integrated culture for sustainability and entrepreneurship

Many of Tsinghua's characteristics today can be observed from those formed at its founding years. Tsinghua campus itself is an epitome of the culture of sustainability and entrepreneurship as developing dynamic equilibrium between tradition and innovation, nature and culture, body and mind, individuality and commonality, efficiency and effectiveness, etc. These characteristics all enrich sustainability education at Tsinghua today in dynamic ways, then with education they together contribute to the sustainability of the University and its community.

Tsinghua was founded in 1911 as a modern school and then became a university in 1928 with the goal to sustain its support to China's educational modernization. Tsinghua campus was built on the site of a 300-year-old traditional Chinese garden surrounded by paddy field in the outskirts of northwestern Beijing. The campus site of was specially chosen in 1909 for being spacious, leafy, refreshing, serene and secluded hence conducive for developing the youth's body and mind, yet also convenient for the staff for being accessible to the city with a train line nearby (Tsinghua, 1991, pp. 3–4). Today the campus has remained to be an academic grove on a land of 4.63 square kilometers covered by over 200,000 trees of 1280 types with 55% of green coverage ratio. And the campus has well preserved its original landscape characteristics: borrowing from natural conditions, utilising plants colors and space, organic integration of Chinese and Western landscape elements, and increasing consciousness of cultural preservation (Liu, 2015). The campus today is also one of the most densely populated campuses in China, hosting about 57,000 students and 16,000 staff including 3700 faculty in 2021 (Tsinghua, 2022). Moreover, Tsinghua's surrounding area since the late 1980s has become one of most concentrated area of leading high-technology research institutions and enterprises known as the Zhongguancun Science Park, or China's Silicon Valley.

As a community, Tsinghua has developed a strong sustainability culture rooted in athletics and cultural diversity. The value for athletic excellence of the individuals is rooted in the transfer value of athletics in morality and character building first developed by John Mo (1926, p. 1), who has served as a teacher and professor in physical education at Tsinghua for 52 years in 1914–1966. Such a value has fostered a Tsinghua culture of excellence not only in high-performance sport but also in high-performance education, scholarship and service. The phrase that has made

both inspirational and imperative for all Tsinghua members since the 1950s is “serving the nation healthily for at least 50 years”. Moreover, Tsinghua has also embraced a strong culture of management because it believes that industrialisation.

As an organisation, Tsinghua has developed a strong entrepreneurial culture based on several factors. First, Tsinghua is a “born-global” that has engaged in internationalisation since its founding (Zhong, 2021). Tsinghua has developed a niche in fostering high-caliber talent with international outlook through continuous cross-national and cross-cultural engagement while overcoming resource constraints. Secondly, Tsinghua has developed a strong culture of mutual empowerment among people, technology and funding. This is rooted in the Tsinghua belief that modernisation not only depends on technology but also the talent in technology and resource management (Mei & Pan, 1943). Tsinghua has thrived in its early years on sound financial stability through well-endowed Tsinghua Foundation during four decades of continuous wars in China. Since the 1980s Tsinghua has become a Chinese pioneer in entrepreneurial university underpinned by its core strength in science, engineering, and management (Zhang et al., 2021).

Thirdly, ongoing pressure to maintain an efficient campus with a vibrant culture has spurred Tsinghua to make the best use of its resources. For almost a century Tsinghua has remained to be the largest single-site campus in China. Tsinghua has experienced a major expansion in students and staff over the past three decades hence making the campus one of the most densely populated place in China. Typical for many established universities in China, Tsinghua campus functions as a mini-city. It provides all students and staff with a full range of infrastructure and services including accommodation, dining, sports and cultural recreation, medical care, grocery, post, banking, police office, and fire protection offices. Similar to many comprehensive universities, Tsinghua has made the campus a living lab for its own academic disciplines.

### A stimulated academic heartland

Tsinghua has been a leading university of China over the past century through developing a stimulated academic heartland in a wide spectrum of academic disciplines and fields with a core strength in science and engineering. The university was made into a polytechnical institution in 1952 during China's Soviet restructuring of the entire higher education system. Then since China's major educational reform in 1985 Tsinghua adopted a long-term world-class university strategy through building a comprehensive research university open to the world and wider society. The key measures involved increased international exchange and collaboration across the world, increased engagement in research



and development, and gradually restoring and building new academic disciplines in arts and sciences while broadening and strengthening engineering.

A key measure is to pioneer education and research in the field of environment. Tsinghua developed China's first bachelor and master degree programmes in environmental engineering in 1977–1978, Department of Civil and Environment Engineering in 1980, Institute of Environmental Engineering in 1981 by incorporating Tsinghua's academic strength in environment, chemistry, chemical engineering, nuclear technology, thermal energy, hydraulic engineering, engineering physics, and motor vehicles, Department of Environment Engineering and doctoral degree programme in environmental engineering in 1984. Since then, Tsinghua has developed an expanding network of environment-related academic centres and entrepreneurial spin-offs in green technology, policy, and management. Tsinghua's recent academic strategy has prioritised sustainability science development. In 2010–2011, Tsinghua established the Research Institute in Earth Science System, the Research Institute in Global Change, the master programme in atmospheric science, and doctoral programme in ecology, then in 2016 Tsinghua established the Department of Earth Science System by incorporating all of the research institute and educational programmes above. In this way, Tsinghua has restored its earth science discipline first developed in 1928 but was moved to other universities in 1952.

### A strengthened steering core

Inspired by the United Nations Conference on Environment and Development in 1992, several Tsinghua environmental engineering professors put forward China's first Green Campus Plan in 1992. Tsinghua University soon adopted this Plan and integrated the notion of green development into Tsinghua's world-class university strategies. Tsinghua published its first Green University Plan in 1996 with three strategies of green education, green research, and green campus, and set up the Green University Office led by a vice-president for institutional-wide coordination (Wang, 1998). Tsinghua's overall green university development goal is to incorporate the principles of sustainable development and environment protection into all of Tsinghua's activities and processes, making Tsinghua a centre of excellence in education and research in environmental protection and sustainable development in China, and promoting those principles in society. Since 1996 Tsinghua has incorporated green development strategies into all of its five-year institutional strategic plans and some special strategic plans.

First, Tsinghua's green education goal aimed at cultivating the talent with sustainability competence so that they can become the seeds to promote green development in service of the nation and the world. Over the past two decades in

1998–2019, Tsinghua has developed an expansive network of learning resources for all Tsinghua students, including about 240 courses and 200 other learning activities about green development each year. Secondly, the green research goal aimed at making all Tsinghua research environmentally sound, and achieving a number of academic breakthroughs in environment and sustainable development. By 2019, Tsinghua has developed 55 interdisciplinary research centres and undertaken about 3,000 research projects in environmental protection and sustainable development. Thirdly, the green campus goal aimed at making Tsinghua an exemplar of incorporating the built and the natural environment to sustain an aesthetic, efficient, and inclusive university. Tsinghua has continued to serve as a national demonstration of resource-efficient and environmental-friendly campus, with outstanding progress in energy and water efficiency, as well as natural and cultural environment protection (Liang & Liu, 2015).

Over the past three decades, Tsinghua's green university culture are strengthened by serving as a national think tank and demonstration living lab for green university development. Several Tsinghua academics in environment engineering first advocated the notion of green university in China in 1992 and initiated its practice in Tsinghua. Then the Chinese government endorsed Tsinghua initiative as a national demonstration and launched the National Green University Project through the first and second National Action Plan for Promoting Environmental Education in 1996–2010. Moreover, Tsinghua academics and alumni have played an active role in making policies such as the National Energy-Conservation Society Initiative in 2005 and the National Energy-Conservation School Initiative in 2006 and regulations such as the National Technical Guidelines for Energy-Saving Campus Construction and Management in Universities and Colleges in 2008 and the National Green Campus Evaluation Standard in 2013 and its revision in 2019. Moreover, in 2007 China adopted the national goal to build eco-civilisations based on both inheriting traditional Chinese culture and innovating green development. In 2015 China adopted the Five-Development National Vision for Innovative, Coordinated, Green, Open and Shared development. Then all universities and other educational institutions adopted green development as a guiding principle educational and institutional development in their strategic planning.

In summary, the culture of “green university” and “green campus” has a long history in Tsinghua and over the past decades it has made dynamic interactions with China's national strategies in “eco-civilisation” and “green development”. In comparison, the notion of sustainable development has shared a deep root with green development, and the term “sustainable development” has obtained worldwide and society-wide commitment through the UN 2030 Agenda for Sustainable Development. In this context, the terms of

“green development” and “green university” have already obtained wide social recognition policy endorsement in China.

### **An expanded developmental periphery and a diversified funding base**

There are several recent milestones in Tsinghua’s green university development in connection with sustainable development. Tsinghua established the Institute for Sustainable Development Goals (SDGs) in 2017 and published Tsinghua’s first SDGs Report in 2021 (Tsinghua, 2021). The Tsinghua Education Foundation established a special funding for Global Climate Change and Green Development in 2017, the University established the Institute of Climate Change and Sustainable Development in 2018, and initiated the Global Alliance of Universities on Climate with eleven universities in nine countries in 2019. Moreover, Tsinghua established the Institute for Carbon Neutrality in 2021 after China announced its goal in 2020 to peak CO<sub>2</sub> emissions by 2030 and carbon neutrality by 2060.

These research institutes are agile academic units integrating research and innovation, education and training, and think tank for policy consultation and public advocacy. For example, Tsinghua has developed a series of certificate programmes open to all Tsinghua postgraduate students in order to promote interdisciplinary studies which focus on national priorities and global challenges. The latest one is the Certificate in Carbon Neutrality developed in 2021. The programme orchestrates courses and learning activities jointly provided by a dozen schools and departments ranging from architecture, environment, civil engineering, energy and power engineering, vehicle and mobility, electrical engineering, chemical engineering, material science and engineering, nuclear engineering, economics and management, and public policy.

### **Curricular study: sustainable education as a dynamic ecotone**

Sustainable education refers to engaging students with internationally informed research and diverse cultural practices in order to purposefully develop their values, attitudes, knowledge and skills in order to transform oneself and society together for sustainable development. While Tsinghua engages in all aspects of the teaching and learning situation in promoting sustainable education, the two main spheres of course development: specialised education provided by individual academic discipline-based departments, and general education coordinated by the University and designed and delivered by individual or clusters of departments. Then innovations emerged as an ecotone connecting those two

spheres. An ecotone is a porous boundary environment that connects two adjoining ecosystems by pooling and interchanging actors and resources between the two into the shared space, hence creating unique environment with new combinations of actors and resources.

Such an ecotone for sustainability education at Tsinghua has emerged out of the “global competence for all students” initiative supported by the Tsinghua Global Strategy put forward in 2016 (Tsinghua, 2016). Tsinghua conceptualised global competence as the ability to learn, work and live sustainably together in global, international, and intercultural contexts. Tsinghua established the Centre for Student Global Competence Development in 2018 as a nexus to develop an extensive network of courses, co-curricular and extracurricular activities by mobilising and coordinating resources across the University and beyond. This Centre has prioritised intercultural, interdisciplinary, and sustainability competencies as mutually reinforcing and as indispensable for global competence development. The next session presented five case studies of innovative elective courses to promote sustainable development with global competence supported by the Tsinghua University Teaching Innovation Fund.

### **Course 1: Global change and sustainable development**

The undergraduate course *Global Change and Sustainable Development* was opened in 2018 by the dean of the Department of Earth System Sciences and co-delivered by a multidisciplinary team of faculties in sciences and arts. The course had the broad goal to develop global competence by developing a scientific understanding of human-nature interactions in global change and its effect on sustainable development, and enhance the ability to analyse global issues through both independent and collaborative enquiry. The course had specific goals to promote the value for global sustainable development, investigate the complex relationship between natural and human systems and the main processes and causes of global changes and their effects, assess the interdependence of human activities and global environment through analyze and evaluate different social sustainable development goals and strategies. The course syllabus on the structure and function of earth systems encompassed topics such as climate change, life and biodiversity, ecological environment, water resources, agriculture and land use, population, cities, energy, economy, health, and natural disasters, etc. Moreover, the course also discussed traditional versus modern views on ecology and sustainability and also national and global strategies adopted or to be developed under current and future global environmental changes.

The course adopted various pedagogies to support learning by students of diverse disciplinary background. Each week the course had a two-hour all-class lecture for about

100–150 students complemented by one-hour small-group discussion. Each group had eight to ten students of mixed academic disciplines led by a graduate teaching assistant. The group discussions were based on homework reading frontier academic journal papers as well as watching and reflecting documentaries about topics of ecology and global change. Some homework also engaged the students to experiment themselves with data and models from frontier research from the Department of Earth Science Systems. The course was supported by the Tsinghua Rain Classroom, a digital learning environment to provide computer-mediated synchronous and asynchronous interaction in on-site, hybrid, or online teaching, logistic management of teaching and learning processes and resources, and automated learner analytics. Moreover, each year the course also made two field trips in order to help the students to integrate their learning in investigating real-world issues of global change. Mid-course domestic field trips to the UNESCO World Heritage sites, while the end of the course international field trips to investigate regions such as north California for understanding the local to global development dynamics. Both types of field trips were co-led by Tsinghua faculties, regional scholars, and local experts. All field trips are free for course students. While domestic field trips had open enrollment, international ones selected the students according to their research proposals and course performance.

## Course 2: Design for sustainability

The postgraduate course *Theory and Practice of Design for Sustainability* (DfS) opened by the Department of Industrial Design of Tsinghua Academy of Arts and Design discussed key concepts, theories, and operating methods and tools of DfS. The course advocated DfS as a way to tackle local to global sustainable development challenges by creating solutions that are equally beneficial to society, economy, and the natural environment. The course conceptualised design as coordinating the relationship between people, artifact and environment (functional, aesthetics, physiological, psychological, social, ecological, brand, etc.) in order to generate creative solutions (product, system, and service). The course taught the general principles of systems thinking and future-oriented responsibility: Collective analysis of complex systems across different domains and scales while considering systemic features such as structure, key components, dynamics, and future scenario analysis such as the state of the art, development trends, and alternative possible intergenerational outcomes and consequence. Moreover, the course also taught design-thinking principles such as human-centered, systematic and integrated solutions, cross-disciplinary collaboration, visualization, ecological inspirations, prototyping, innovative experiment, and rationality and intuition.

The course drew students in art and design, architecture, mechanical engineering, and other departments related to design innovation. The course guided the students to identify real-world problems from selected areas and design innovative solutions according to the principles and methods of DfS. The course employed situated learning, also known as “learning by doing” to engage the students to participate in research projects from the Department’s DfS research centres. For example, the “Lettuce House” as a Sustainable Lifestyle Lab that attracted visits from over ten million people online and on-site, the ecological Public Toilet Project which could be adapted to suit diverse ecological and socio-economic needs across China, an Integrated Squatting/Sitting Dual-use Toilet and Waterless Disposal System for Rural Areas which successfully went into mass production, the Sunshine School Toilet Project for Rural Children which also served as an innovative public health education site loved by local children and teachers, and the frontier Wave-Power Nearshore Floating Garbage Collection Equipment. Those projects illustrated local realisations of multiple SDG goals, and many of them received national and international DfS award. Moreover, the course conducted various domestic and international field trips to visit partner design schools and observed the DfS in different societies.

## Course 3: Introduction of ecological art practice

An experimental undergraduate course *Introduction of Ecological Art Practice* was opened by the Department of Painting of Tsinghua Academy of Arts and Design to promote understanding bio-diversified ecosystem through walking as both artistic and scientific enquiry. This innovative pedagogy was inspired by the concept of Legitimate Peripheral Participation (LPP) as a special form of situated learning (Lave & Wenger, 1991). Moreover, the course also paid tribute to peripatetic traditions from both Chinese and western cultures. The course instructor carefully selected a target *locale*, then engaged the students to ‘drift’ over any straightforward pedestrian paths on site to explore the continuum between the classroom and its surrounding community and environment. The course attracted the students from both art majors and others of diverse academic background across the University. In this context, both artists and non-artists formed small study groups to take the role of designers and researchers.

During the class, the students in small groups took ‘city hunt’ or ‘campus hunt’ in a certain area of the city or campus, where they could wander about, guided by random environmental signals and cues. During the walks, the students took notes and made quick drawings in order to complete a mind map. This mind map presented all the ideas, data, and incidents that occurred during the walk. All the collected information was processed through brainstorming, divided

responsibilities, and spending time together. The students collected information using scientific methods of desktop research and field enquiry, as well as using all palpable and pressing personal perceptions collected through all faculties of hearing, sight, smell, touch, taste, and equilibrium during their walking encounters. Each student presented information to the class about various aspects of the natural and built environment one traversed and experienced outdoors, and then the whole class as a multi-disciplinary community discussed and developed creative solutions for shared ecological concerns.

The course walks stimulated the students to develop an immediate and local awareness, multiple and flexible structures, and a sense of peripheral identity yet with intensive observation, documentation, and reflection. The walks highlighted the hidden senses which our learning relies on but are difficult to be fully represented and reflected upon when simply writing a report. The walks engage the learners in direct contact with the people who are knowledgeable across disciplines such as art, design, biology, psychology and management and through involving people who actually experienced the problem and its consequences. Moreover, some of student final-term group projects led to sustainability actions.

#### **Course 4: National Parks and Protected Areas of China**

The Department of Landscape Architecture, Department of Earth System Science and School of Environment jointly opened the course *National Parks and Protected Areas of China* in 2021 as one of the first Tsinghua Global Open courses taught in English and accessible to the world both online and offline. The course opened soon after China established the first group of five national parks in 2021. The course teaching team consists of scholars and experts who had worked passionately in advocating, researching and designing the policy for preserving and maintaining national parks and protected areas in China for many years. The course explored human-nature co-existence with theoretical knowledge, cutting-edge research and Chinese practice in national parks, nature reserves, scenic areas and other types of protected areas, and also in nature conservation in all land spaces including wilderness areas, agricultural areas and urban areas. In particular, the course discussed the role of protected areas as a cornerstone of biodiversity in sustainable development, including as a potential contributor to all SDGs. The course advocated that the universities should not aim to train professionals to exploit the Earth, but to guide students to establish an intimate relationship with the Earth.

The course employed lectures, seminars, field trips, and also workshops. For example, the course held a workshop called “the university of wilderness and sustainable

development”. It introduced the wilderness as the natural areas with the least level of human impact and also a core of many national parks and protected areas. The workshop provided guided virtual tours into China’s wilderness curated by an international and interdisciplinary panel of guest speakers in geography, landscape architecture, art and photography, zoology and ecological conservation, and educational studies. The workshop advocated the learners to go out of the traditional campus and urban areas and into the wilderness in order to learn from the nature about something which could never be learned from a conventional university campus.

#### **Course 5: Creativity, innovation, and entrepreneurship**

The Department of Innovation, Entrepreneurship and Strategy of School of Economics and Management (SEM) opened a first-year undergraduate course *Creativity, Innovation, and Entrepreneurship: From Idea to Impact* in 2021 to promote entrepreneurship for sustainable development. The course was co-delivered with the Tsinghua X-Lab, a university-wide entrepreneurship platform co-developed by a dozen academic departments.

The course started with a ‘big idea’: the course teaching team said that the Tsinghua students were usually much better at solving problems than identifying problems and raising good questions, and they were usually knowledgeable and skillful in their own fields of specialty but not familiar with other fields. Hence the course is designed to help the undergraduates in SEM to team with students from across the University to explore together basic concepts, processes, and tools of creativity, innovation, and entrepreneurship. The course itself took the form of an entrepreneurship competition to engage the students to develop skills to identify critical sustainability challenges, then employed teamwork-based design thinking for creative and impactful solutions. The course had four learning tasks in sequence to represent the full cycle from creativity to innovation, entrepreneurship, then impact. Each task consisted of lectures, discussions, hack marathons, training camps, and other activities under the tutors’ guidance. The concepts and case studies of sustainability and SDGs were discussed during each task. Moreover, the course developed its own mobile phone application and website in order to facilitate student communication and collaboration.

As the course progressed midway into its first semester, some student teams successfully attracted serious business interest while the course as a whole has also received venturing fund from the University. The course team was invited to develop the course into the Tsinghua Global Summer School (GSS) embedded with an SDG Open Hack Marathon for Sustainable Development and a certificate of completion for global competence development. The Summer School was



opened in July 2021 with joint efforts from 22 Tsinghua academic units including academic schools and departments, overseas educational centres, and international university alliances and partner universities and international organisations, and attracted over 1,000 students from 151 universities in 93 countries and regions. GSS incorporated many of Tsinghua's SDG-related frontier research and innovation findings into open lectures and inspirational talks. Many Tsinghua scholars, students, alumni, and domestic and international partners engaged in SDGs projects served as GSS speakers and tutors. Moreover, all course leaders of the five course cases discussed in this paper joined in co-designing and co-delivering the GSS activities to showcase their sustainability competence education. In this context, all five cases and the GSS were themselves successful educational entrepreneurship. Moreover, the courses all received enthusiastic feedbacks from most of the students, instructors, and observers through course surveys and interviews.

## Discussions and conclusions

The rise of sustainable university as a “global imaginary” manifested the importance for universities and all its members across the world to promote sustainability efforts together. The term global imaginary as coined by Steger (2008) refers to the consciousness of belonging to a global community in the context of rapid development of communication technologies and mounting global challenges such as the climate change. As the term “sustainable development” is both an analytical and normative concept (Sachs, 2015), so is the term “sustainable university”. Analytically speaking, sustainable university refers to a way to understand the university and its role in the world and a method for tackling the university's own challenges and also local to global challenges. Normatively speaking, as sustainable development inspires an ideal world of environmental integrity, economic viability and social justice through good governance, sustainable university refers to enabling the goals and functions of the university for mutual empowerment between its own sustainability and that of society and the Earth.

In theory, this paper adopted both analytical and normative approach to propose a sustainable university model with six elements and three propositions from basic theoretical lens of entrepreneurship and of entrepreneurial university. The sustainable university is made through aligning the abiding orientations of the university as a combination of organisation, community and campus with real-world opportunities sensed and seized when the time comes or when the time is created by the university members. Such an alignment has the means of actor and resource orchestration across the six elements of the university, and such orchestration is driven by unleashing the

capabilities to solve problems in sustainable development in a systematic way with effectiveness, efficiency, foresightedness, responsibility and responsiveness. Moreover, such an alignment has the end of the strengthened sustainability of the university and society together achieved as sustainable development which is based on reciprocity, as sustainable stability yet based on dynamism, and sustainable survival based on resilience. Toward this end, the sustainable university is similar to the entrepreneurial university as being capable of overcoming demand overload from wider society, while the sustainable university being a focused organisation on contributing to achieving the SDGs. The paper discussed on sustainable education as the sixth element in the proposed sustainable university model. Serving as a dynamic ecotone, sustainable education interacts closely with the stimulated academic heartland because the course leaders are themselves frontier researchers in the rapidly expanding and diversifying scholarship of sustainability. Moreover, sustainable education also interacts with all other four elements of integrated culture, strengthened steering core, developmental periphery, and diversified funding base.

In practice, this paper applied the proposed theoretical model to examine the Tsinghua University of China as an innovative and impactful case of sustainable university development. In retrospect, Tsinghua has well aligned sustainable university development into its green university development since the 1990s. Tsinghua has aligned its green university development into the national movement of green university development which Tsinghua had pioneered. In the meanwhile, Tsinghua has also well incorporated green university development into its world-class university strategy. Tsinghua's green university strategy encompassed mutually reinforcing strategies of green education, green research, and green campus.

With regard to innovating green education into sustainable education, the paper presented five case studies of innovative courses in sustainability competence development in earth systems, art and design, landscape architecture, and management studies. The courses illustrated the reciprocity and dynamics of proactive grassroot approaches to developing sustainability curricula through new combinations of various tangible and intangible as well as multi- and inter-disciplinary resources. Such resources encompassed academic strength in particular disciplines and departments, distinctive institutional culture, strategic coordination and funding from administrative units, external resources mobilised from alumni and partners, and stimulated students across disciplines and nationalities to join the effort in future blue-printing. In particular, at the core of those courses were dedicated faculties working collaboratively to support each other by informing frontier research findings, identifying common themes, pooling resources, experimenting new

pedagogies, and engaging in joint educational evaluation and research.

To a different extent, all courses adopted experiential learning pedagogies with an emphasis on learning-by-doing to connect theory with practice through both self-reflection and collaborative enquiry. Through performance tasks the courses engaged the students in discovering or creating, enacting, evaluating, and exploiting opportunities to achieve SDG goals. Those course tasks employed mixed methods for problem-based, project-based, research-oriented and action-oriented learning, and stimulated the students to integrate all their knowledge and experience to blue-print the future using design thinking. While the students undertook their academic tasks, the courses intended to foster entrepreneur's traits such as being daring, creative, critical, proactive, foresighted, team-minded and good at systems thinking. Moreover, the courses also shared the goals to guide the students to develop responsible styles in learning, being, doing, and living sustainably together. To this end, the case of Tsinghua and its various sustainability courses reflected the university sector's commitment to promoting sustainable entrepreneurship for individuals, institutions and societies.

With regard to resilience, Tsinghua moved to synchronous and interactive online education during the campus lockdown at Tsinghua in spring and summer term 2020 due to the COVID-19 pandemic. Since autumn term 2020 till the present, Tsinghua has moved to hybrid education with instructors and students both online and offline on campus and from a distance. Tsinghua has mainly used the Rain Classroom, a digital teaching and learning platform invented by Tsinghua faculties and staff since 2015 to support all of its courses since spring 2020. The platform enables interactive teaching and learning, on-cloud management of the entire course process and its digital resources, and also automatic learning analytics for performance in teaching sessions and examination sessions. Thanks to intensive uses, since 2020 the Rain Classroom have gone through rapid iterations for enhanced stability and user convenience with improved interactivity, and more functions such as integrated online conferences.

While online education technologies provided timely alternatives in difficult times such as the campus lockdown, the cases courses all found it difficult to recreate the action-oriented pedagogies online, especially the hand-and-mind workshops and walking-as-a-learning-method fieldtrips. Instead, the course instructors and students together worked out many new ways to enhance teaching and learning, such as more individualised learning tasks, more virtual fieldtrips, and also more joint classes with industry and international partners. Moreover, the case courses also explore new topics and new processes and procedures, such as new future scenario research and more health and safety topics and more interdisciplinary learning. Such new educational contents

and pedagogies might well not be possible without the unprecedented constraints forced by the pandemic. As a new paradigm is emerging for sustainability, accelerated digitalisation has come to the forefront of sustainable survival. In prospect, the future of sustainable university has closely intertwined with digital sustainable entrepreneurship. Meanwhile, digitalization has also made meeting face-to-face and working hand-in-hand all the more valuable for the sustainable university to ensure and enhance.

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