RECOMMENDATIONS ON CAMPUS SUSTAINABILITY DEVELOPMENT AT DUKE KUNSHAN UNIVERSITY

by

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Executive Summary

Duke Kunshan University (DKU) is a higher education institution located in the City of Kunshan in the Jiangsu Province of China. It was established under the partnership of Duke University and Wuhan University (WHU) and welcomed its first inaugural class of students in August 2014. DKU has completed its first phase of developing its academic, research, and physical campus infrastructure and is now in the second phase (Phase II) of launching a four-year undergraduate degree program. Although Duke University continues to oversee the development of DKU, it has not yet included this satellite campus into its Climate Action Plan, the guiding document of the university’s strategic plans on sustainable development. As Duke determines the next steps on how best to integrate satellite campuses such as DKU into its sustainability plans, it is important for both institutions to consider how DKU can begin to build a strong foundation for campus sustainability actions.

This study thus seeks to help Duke and DKU better understand the landscape of campus sustainability at Chinese universities through a case study of the Hong Kong University of Science & Technology (HKUST). The objective of this case study is to (1) identify the kinds of sustainability initiatives currently taking place at a Chinese university, (2) to understand the specific challenges to implementing such initiatives, and (3) to discover what recommendations DKU could consider in its beginning stages of sustainable development.

The first section of this report provides a review of literature on existing and proposed definitions and frameworks for campus sustainability and on the development of campus sustainability at Chinese universities. Duke University’s own definitions and frameworks are also discussed through the review of its primary documents regarding campus sustainability. From this review, the research team determines four focus areas that are used as the conceptual framework to conduct on-site interviews for the HKUST case study and to provide a framework for the final recommendations to DKU. These focus areas are administration, operations, education, and research.

In the second section, the research team provides an overview of the methods and materials used for this report. This section first describes the process of conducting on-site interviews at HKUST and outlines the four focus areas of the conceptual framework. It then provides details on the collection of written documents reviewed to gain an understanding of the initiatives taking place at these universities (Duke, DKU, and HKUST). Finally, this section reviews the methodology for data analysis using the qualitative analysis software, NVivo 11.

The third section describes the research findings and results of the case study. It begins with a comparison of DKU and HKUST’s campus, academic programs, and regulatory structures in
place to support campus sustainability development. This is followed by an introduction of HKUST’s Sustainability Unit and the results of the interviews with HKUST faculty and staff. The interview results focus on the prominent challenges and recommendations discussed by the participants on developing a strong campus sustainability program.

In the final section of this report, the research team makes the following key recommendations to Duke Kunshan University under four overarching themes, which were determined from results of the case study and review of initiatives taking place at Duke University, HKUST, and other higher education institutions. As DKU continues to build its physical and academic infrastructure, these recommendations seek to provide the university with a strong foundation to take strategic sustainability actions in the future.

**Student Engagement**
1. Develop project-based sustainability courses that tackle existing campus and community challenges
2. Develop student sustainability networks

**Institutional Commitment**
3. Develop definitions of sustainability specific to DKU
4. Establish faculty and staff sustainability representatives across the institution’s academic and administrative offices

**Sustainable Academic Development**
5. Develop inventory of existing courses and research projects with sustainability elements
6. Provide incentives for faculty to develop new courses and research projects with sustainability elements

**Data-Driven Campus**
7. Develop key sustainability metrics and start tracking to create a baseline for the university’s overall performance
8. Utilize student labor and projects to gather data and evaluate environmental performance
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I. Introduction

Duke Kunshan University (DKU) is a higher education institution located in the City of Kunshan in the Jiangsu Province of China. It was established under the partnership of Duke University and Wuhan University (WHU), and in September 2013, it was given the authority to operate as a non-profit, joint-venture institution by China’s Ministry of Education. There were three motivating factors that led to the establishment of this institution. First, as Duke University’s senior leadership sought to expand its global engagement and strengthen its leadership in global education, DKU presented an opportunity to expand Duke’s international reach and reputation in China. Duke also saw the potential to expand the platform of research for its students and faculty by providing better access to China-based resources and Chinese research funding. Last but not least, China had approved a number of such Sino-American university partnerships due to the increasing recognition of the critical thinking and problem-solving skills tied to western-style, liberal arts education. The City of Kunshan, a city well-known for its investments in innovative technology, welcomed DKU as an opportunity to have continued economic and technological growth in the region.

DKU has recently completed its first phase development (Phase I) to set the foundation for its physical, academic, and research infrastructure. In Phase I, it established four master’s degree programs, an undergraduate study abroad program, two research centers, and a collaborative research institute for the students and faculty of Duke, DKU, and WHU. Phase I also included the construction of its campus that was built and designed according to the safety and environmental expectations set by Duke University. DKU is now undergoing Phase II of development to launch a full four-year undergraduate degree program and to expand its physical campus. Although Duke University continues to oversee the design of DKU’s campus and academic programs, it has not yet included this satellite campus into its strategic plans on campus sustainability. As Duke determines the next steps on how best to integrate satellite campuses into its sustainability plans, it is important for both institutions to consider how DKU can begin to build a strong foundation for campus sustainability development.
This study seeks to help Duke and DKU better understand the landscape of campus sustainability at Chinese higher education institutions through a case study of the Hong Kong University of Science & Technology (HKUST). The objective of this case study is to (1) identify the kinds of sustainability initiatives currently taking place at a Chinese university, (2) to understand the specific challenges to implementing such initiatives, and (3) to discover what DKU itself should consider in its beginning stages of sustainable development. This report begins with a literature review on the definitions and frameworks for campus sustainability and an overview of campus sustainability development in China. Next, the research team discusses the methodology and materials that were used, then reviews the results from the case study interviews. Finally, the team presents its recommendation to DKU.

II. Literature Review

The case study of HKUST first required the research team to gain an understanding of the existing definitions and frameworks surrounding campus sustainability. In addition, as this study is focused on providing recommendations to Duke Kunshan University, the team also reviewed literature on the development of campus sustainability in Chinese higher education institutions. The “Environment Complete” database was used to search for keywords that represented the focus of the literature review, including “sustainability,” “campus,” “frameworks,” and “China” After identifying a few pieces of literature, the search was expanded based on related academic journals, such as the International Journal of Sustainability in Higher Education and the Journal of Cleaner Production.

Defining a Sustainable Campus

Several definitions of campus sustainability were presented in the literature (Brinkhurst et al. 2011; Cole 2003; Creighton 1998; Hopkinson, James, and Van Winsum 2004; Velazquez et al. 2006). Hopkinson et al. (2004) defined a university as sustainable through its impacts: direct impacts through its operational activities, indirect impacts through the knowledge and behavior
of its students, and indirect impacts from research on environmental issues. Velazquez et al. (2006) presented a more systematic definition for a university that “addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles.” Velazquez et al. also suggested that each university define and interpret sustainability based on its own values and mission, and subsequently form a guideline or master plan. Cole (2003) defined a sustainable campus as one that “acts upon its local and global responsibilities to protect and enhance the health and well-being of humans and ecosystems. It actively engages the knowledge of the university community to address the ecological and social challenges that we face now and in the future.” In referring to sustainability in this report, the research team adopted the definition proposed by Velazquez et al as it captured the balance of economic, social, and environmental goals within the context of education, research and partnership, the overarching priorities of higher education institutions.

Frameworks for Campus Sustainability

There were also several frameworks for establishing campus sustainability proposed in the literature (Alshuwaikhat and Abubakar 2008; Beringer 2007; Geng et al. 2013; Mcmillin and Dyball 2009; Newman 2012; Velazquez et al. 2006; Weenen 2000; Zhao and Zou 2015). These frameworks all sought to address the questions of how a university might be best organized to pursue sustainable development and what types of initiatives it could pursue. Velazquez et al. (2006), for example, proposed a hierarchical framework comprised of four key phases of development: (1) establishing a broad vision of sustainability, (2) creating a mission statement that “lays the foundation for future actions and philosophies that underlie those actions,” (3) establishing a committee that sets sustainability policies and objectives, and (4) implementing sustainability strategies under four main categories of education, research, outreach and partnership, and sustainable campus operations.

Another framework focused more generally on three axes of campus sustainability: the “why,”
“what,” and “how” (Weenen 2000). The “why” axis addressed why a university should pursue sustainable development by thinking about the limitations of the world’s resources and the need for social, environmental and economic equity. The “what” axis focused on incorporating sustainability into the different levels of university engagement, from its operational activities to its mission statement. And lastly, the “how” axis focused on a university’s commitment to sustainability through organizational actions such as implementing an environmental management system and creating a network of university stakeholders (Weenen 2000). A framework similar to Weenen’s three-axis model recommended an adoption of three main strategies: “EMS implementation; public participation and social responsibility; and sustainability teaching and research in an integrated way” (Alshuwaikhat and Abubakar 2008). In these examples above and the additional frameworks described in the literature, the research team found that the models generally focused on establishing university-wide strategic plans to then facilitate the launch of specific sustainability-related activities on campus.

Sustainability as Defined by Duke University

As the main institution under which Duke Kunshan University was established, the research team also reviewed the definitions and framework of campus sustainability established by Duke University. In the website of the Trillium workshop on sustainable education development, Duke provided several definitions of sustainability to help its faculty and staff members deepen their knowledge of sustainability (Duke University Trillium Sustainability Workshop 2017). Duke first reviewed the broader principles of sustainable development included in “Our Common Future,” a report on sustainable development for the world by the United Nations World Commission on Environment and Development. In this report, sustainable development was defined as meeting “the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland 1987). Duke also referred to the definition of sustainability provided by Leslie Paul Thiele, who stated that sustainability is “the practice of satisfying current needs without sacrificing future well-being by preserving core values and relationships while managing the scale and speed of change” (Thiele 2013).
With these broader principles in mind, the Education Subcommittee of Duke’s Campus Sustainability Committee approved more specific definitions that connected sustainability to Duke’s commitment as an educational institution. The following definitions were provided under the areas of research, community engagement, and sustainability literacy: (Duke University Trillium Sustainability Workshop 2017)

- **Sustainability research** was defined as the “systematic investigation of social, environmental, and economic solutions towards a more sustainable world.”

- **Sustainability in community engagement** “serves to meet a need identified and agreed on by community stakeholders and assists the community as it moves towards ecological soundness, social justice, and economic viability.”

- **Sustainability literacy** of its students entailed (1) knowledge of the “interconnection and interdependency” of social, environmental, and economic systems, (2) the ability to ask questions and think critically about sustainability in a holistic manner, and (3) the ability to apply this knowledge to solve real-world issues and integrate sustainability into their personal lives and professional careers.

In addition, as a member of the Association for the Advancement of Sustainable Higher Education (AASHE), Duke is supported by AASHE’s own definition of sustainability. AASHE is an organization that brings together higher education institutions in North America to share their experiences and resources on campus sustainability development. This organization was also inspired by the Brundtland report and defined sustainability “in a pluralistic and inclusive way, encompassing human and ecological health, social justice, secure livelihoods, and a better world for all generations” (AASHE 2017).

**Framing Campus Sustainability at Duke University**

Duke University’s principal framework for campus sustainability comes from its Environmental Policy Statement established in 2005. This statement provides three overarching areas of academics, operations, and community for sustainable development as a higher education
institution. Academics encompasses support for interdisciplinary research and education, increased awareness of environmental issues, and improvements on sustainability curriculum. Operations emphasizes the integration of sustainability into campus activities through the assessment of impacts, engagement in pollution prevention activities, and the development and tracking of its progress in reaching its environmental goals. The third area, community, recognizes Duke University as an environmental leader and integral part of the local, national, and global community (Duke Sustainability 2005).

These broader areas are reflected in the focus areas of the Climate Action Plan (CAP), Duke’s strategic guideline that aims towards carbon neutrality by 2024. The CAP was developed by the university’s Campus Sustainability Committee (CSC) in 2009 and includes recommendations on the strategic actions to integrate sustainability under transportation, energy, carbon offsets, education, and communication. The CSC has been working to update the targets and strategic plans of the CAP to include more specific areas from the Sustainability Strategic Plan (SSP) such as water-reductions strategies, targets for waste, procurement, sustainable food, and natural resources (Duke Sustainability 2017a).

Furthermore, an integral part of Duke University’s framework is the Campus Sustainability Committee itself. As a standing committee, the CSC works to provides recommendations on the development of sustainability policies at Duke. Its five subcommittees are dedicated to the focus areas of the Climate Action Plan, and consist of students, faculty, and administrative staff members of the university. Last but not least, the Sustainable Duke office serves as Duke University’s official administrative body on the sustainable development of its campus. It is responsible for overseeing the strategic plans for sustainability, developing programs to reduce campus environmental impacts, and leading education and outreach efforts in the Duke community to promote awareness and positive behavior towards campus sustainability actions. It also provides public access to its sustainability efforts online (Duke Sustainability 2017a).

**Campus Sustainability Landscape in China**

Sustainability education emerged as a noteworthy topic in China in the 1990s as the nation paid
attention to the issues highlighted at the United Nations Conference on Environment and Development in 1992 (Tan et al. 2014). In 1994, China developed its National Agenda 21, a white paper on the strategic guidelines for sustainable development that helped establish the connection between sustainability and social and economic growth. It was used as a guiding document for the pollution control measures of the nation’s 9th Five-Year Plan (FYP) from 1996-2000, and for its long-term objectives on land and water conservation by the year 2010. To work towards these objectives, the document highlighted the need for environmental education to “enhance public consciousness and promote public participation.” Agenda 21 encouraged schools in China to be “mobilized to spread knowledge about sustainable development.” This set the stage for educational institutions to become key players in the nation’s efforts towards sustainability (United Nations 1997).

China has continued to emphasize the need for environmental education and public awareness. In 1996, the Ministry of Education, the State Environmental Protection Administration, and the Propaganda Department of the Communist Party of China Central Committee promoted the “Action Outline of National Environmental Publicity and Education (1996-2010)” that aimed to promote the idea of “green schools” in China (Tan et al. 2014). This effort continued into China’s 12th and 13th five-year periods (2011-2015 and 2016-2020, respectively) as six ministries of the central government came together to issue updated guidelines. The current update includes the major tasks of enhancing public awareness and guiding public opinion towards favoring environmental protection, introducing environmental education into China’s schools, and encouraging public participation in environmental protection efforts (China Environment Media 2016). In promoting environmental education and cultivating awareness of youth, this guideline specifically recommends Chinese universities to strengthen their environmental curriculum through faculty training and improvement of teaching materials, offering of additional environment-related electives and/or online courses, and active support of student bodies in their efforts to promote positive social and environmental practices (Ministry of Environmental Protection 2016).

This guideline is tied to the nation’s prioritization of ‘green growth’ in its 13th FYP (2016-2020).
The major tasks to address this priority include improvements of central and local government access to environmental data through more effective monitoring, evaluation, and enforcement; greater reductions in energy and carbon emissions intensity; prioritization of soil, water, and air pollution; and support of domestic green industries. This current FYP also raises the 12th FYP carbon emissions and energy consumption reduction targets by 18% and 15% respectively (Koleski 2017). These plans continue to set urgency for higher education institutions (HEIs) to catch up to the increasing demand for sustainable development by the central government.

Furthermore, as there has been a rapid expansion of HEIs in China, their ratio of energy use in comparison to the total national energy use continues to increase and thus creates pressure for these institutions to proactively integrate environmental protection measures (Lo 2015; Tan et al. 2014; Geng et al. 2013). Since 2000, the number of HEIs in China has grown at an average annual rate of 6.4%, and the number of students enrolled in these institutions at 9.4% (National Bureau of Statistics of China 2016). Lo (2015) states that “sustainability of HEIs, then, is closely linked to the national sustainability strategy and can be understood as an integral part of China’s national conservation programs.”

Following these national guidelines, there has been a growing desire by HEIs in China to adopt a more holistic approach to campus sustainability. Tsinghua University and Tongji University, for example, are mentioned as prominent leaders who have developed well-rounded models of sustainability (Lu and Zhang 2014; Niu, Jiang, and Li 2010; Tan et al. 2014; Yuan et al. 2013; Zhao and Zou 2015). In 1998, Tsinghua University was the first to propose and launch the “Green Campus Initiative” that promoted sustainability through green curricula, research, and green campus operation. This project was financially supported by the State Environmental Protection Administration and led to the integration of similar actions (e.g. through workshops, conferences, and research projects) into the strategic plans of many other universities (Zhao and Zou 2015; Niu, Jiang, and Li 2010).

In pursuing a campus sustainability, Tongji University was the first to demonstrate energy and resource efficiency projects through improvements in its campus construction and operations in 2007 (Niu, Jiang, and Li 2010). With this achievement, Tongji helped to develop the National
Guidelines on Campus Energy Management Systems (CEMS) in 2009 through a joint effort by the Ministry of Education, the Ministry of Housing and Urban-Rural Development, and American Energy Foundation (GEEP 2016). This system was established to promote “eco-tech application and green education for [an] energy and resource efficient campus” (Tan et al. 2014). Its approach includes three phases, from energy use monitoring and energy auditing to subsequent operational improvements. Tongji has also published several guidelines on energy auditing, campus facilities management, and campus evaluation which were issued by these partnering government agencies mentioned above (Tongji University 2012).

Tongji University also helped to establish the “China Green University Network” (CGUN) with support from the Ministry of Education and the Ministry of Housing and Urban-Rural Development (Zhao and Zou 2015). The mission of CGUN is for its member to share their experiences and knowledge on campus sustainability topics such as education, research projects, and carbon reduction technology, and to offer support to national policy making to advance campus sustainability development (Tan et al. 2014). It currently has eleven subcommittees working on various topics related to campus sustainability such as waste treatment, education development, and monitoring. Each subcommittee is led by one of the network’s member universities. These subcommittee leaders are assigned to summarize members’ experiences and provide case studies related to the subcommittee topic (CGUN 2017), which are then shared with the remaining members of the network. During the 6 years of development, CGUN has been an avenue for member universities to collaborate on sustainable projects and to share experiences of sustainable campus development with both China and international collaborators (Tan et al. 2014). In 2016, CGUN hosted the Asian Conference on Campus Sustainability held in Shandong Province, China, and was attended by members from CGUN, the Campus Sustainability Network in Japan, and the Korean Association for Green Campus Initiative. Representatives from each country shared their opinions and cases studies on sustainable campus development theory and practices, evaluation, technical applications and student activities (CGUN 2017). As of 2013, CGUN has thirty university members. The criteria for a university to join this network include 1) successfully launching the CEMS on campus to obtain approval from the Ministry of Housing and Urban-Rural Development and 2) showing university commitment through the
signature of the university’s president or vice-president within its CGUN membership application (Tan et al. 2014).

Although campus sustainability development has gained a strong foothold in China, there are challenges facing the universities as well. Lo (2015) stated that the availability of financial resources for sustainability-related initiatives relies heavily on support from the government, and that this support significantly depends on the type of HEI in China. The most resourceful type is the central-level HEIs, which are considered the top-tier universities in China. Tsinghua University and Tongji University are examples of central-level HEIs, and are therefore able to receive substantial funding from the government and have great scientific research capability. Provincial-level and private and independent HEIs usually have limited budgets and lack funding from local governments, which adversely impacts their ability to create initiatives on campus. In addition to the efforts of Chinese university leaders, students, faculty, and staff, policy support is critically needed to take a step forward in campus sustainability development (Lu and Zhang 2014).

III. Materials and Methods

To gain a deeper understanding of sustainability at Chinese higher education institutions, the research team conducted an evaluation of campus sustainability at the Hong Kong University of Science and Technology (HKUST). The reasons of choosing HKUST over other Chinese universities were a) as discussed below in the Results section, DKU and HKUST face similar timelines in the development of sustainability within their institutions, and b) the Sustainability Office at Duke University was connected to the Head of the Sustainability Unit at HKUST, which provided an opportunity for the research team to visit HKUST’s campus to conduct on-site interviews with its faculty and staff.

Qualitative data was gathered through on-site interviews and review of material culture, which is the collection of written documents from a variety of primary sources that were reviewed for this
study. The documents reviewed by the research team are outlined below in the “Material Culture” subsection. These data were collected and analyzed using NVivo 11, a qualitative analysis software. This section describes the conceptual framework used to organize and analyze the data, the interview methodology, and the data analysis methodology.

**Conceptual Framework**

After thorough discussion and the review of the literature on existing and proposed sustainability frameworks, four focus areas of campus sustainability were determined to best capture the components of the frameworks found in the literature. These focus areas created the conceptual framework for this study and were used to build the node structure in NVivo 11 to analyze the transcribed interview data. The node structure is explained and detailed in the Data Analysis Methodology subsection.

The research team determined and defined the four focus areas as follows:

(1) **Administration**: This focus area encompasses the strategic plans and actions adopted by a university to promote campus sustainability. These plans and actions include everything from the university’s overarching vision, mission statement and sustainable policies and guidelines to be followed by faculty and staff, to sustainability-focused committees and structural units (such as a sustainability office).

(2) **Operations**: This focus area includes both technical and non-technical activities that seek to improve the sustainable performance of the campus. Operational measures include initiatives such as recycling programs, environmental management systems, energy-efficiency measures, paper conservation, transportation planning, and public awareness campaigns.

(3) **Education**: This focus area includes both formal and informal sustainable education for university students. Formal education captures actions taken to incorporate sustainability into the university’s curriculum and informal education includes alternative learning platforms such as conferences, workshops, and student-led sustainability groups.
Research: The last focus area represents a university’s efforts to encourage scholarly research of topical sustainability issues. Improving access to funding and providing grant opportunities for sustainability-focused research and establishing research centers on sustainability are some examples of plans and actions within this focus area.

HKUST Case Study Interviews

In order to develop the case study of campus sustainability at HKUST, the research team conducted on-site interviews with the university’s faculty and staff members in December 2016 with funding from Duke University’s Green Grant Fund. In selecting interview participants, the research team used a purposive sampling method, which is the selection of “information-rich cases related to the phenomenon of interest” (Palinkas et al. 2016). In the context of this case study, the ‘cases’ were the faculty and staff members who could provide valuable input on the initiatives taking place on campus, the challenges of implementing these initiatives, and the possible recommendations they had on how the university could overcome these challenges. With the help of the Data, Health and Environment Specialist of HKUST’s Sustainability Unit, the research team sent interview invitations via email to four major academic schools and six administrative offices of HKUST in an effort to provide a well-rounded and representative picture of sustainable development.

Ten faculty and staff members and the three members of the Sustainability Unit accepted the invitations which allowed the team to interview a total of thirteen individuals. The table below shows the majority of the interview participants as members of administrative offices, with only two individuals from the School of Science and one from School of Humanities and Social Sciences. It is important to keep in mind that this limited the research team from gaining additional input on campus sustainability development from an educational and research perspective. For any future studies, the team would suggest attempting to reach out to the remaining schools and divisions to create a more robust picture of sustainable campus development.
Table 1. Interview Participants – Role at HKUST

<table>
<thead>
<tr>
<th>Structural Unit</th>
<th>Interview Participant</th>
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<tbody>
<tr>
<td>Entrepreneurship Center</td>
<td>Associate Director</td>
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<tr>
<td>Facilities Management Office</td>
<td>Director</td>
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<tr>
<td>Finance Office</td>
<td>Director</td>
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<tr>
<td>Finance Office</td>
<td>Senior Finance Manager</td>
</tr>
<tr>
<td>Office of Planning &amp; Institutional Research</td>
<td>Planning Manager</td>
</tr>
<tr>
<td>Office of the Executive Vice-President &amp; Provost</td>
<td>Assistant Provost</td>
</tr>
<tr>
<td>School of Humanities &amp; Social Sciences</td>
<td>Research Assistant</td>
</tr>
<tr>
<td>School of Science</td>
<td>Director of Division of Life Sciences</td>
</tr>
<tr>
<td>School of Science - Division of Environment</td>
<td>Professor</td>
</tr>
<tr>
<td>Student Housing Office</td>
<td>Hall Operation Officer</td>
</tr>
<tr>
<td>Sustainability Unit</td>
<td>Head of Sustainability Unit</td>
</tr>
<tr>
<td>Sustainability Unit</td>
<td>Program Manager</td>
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<tr>
<td>Sustainability Unit</td>
<td>Health, Safety, and Environment Specialist</td>
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</table>

To interview these individuals, two slightly varied interview guidelines were used: one for the Sustainability Unit staff members and one for the remaining faculty and staff participants. The guideline for the Sustainability Unit members included more specific questions on the role of each Unit member, as the research team was also interested in learning more about the sustainability office itself. These interview guidelines and verbal consent agreements can be found in Appendix A - D. Each interview was recorded, transcribed, then gathered in NVivo 11 for analysis under the conceptual framework described above.

**Instrumental Case Study**

This study is defined as an instrumental case study, which is an in-depth review of a particular case to acquire further understanding of a real-life issue in its settings (Stake 1995). For the
purpose of offering recommendations to Duke Kunshan University, the research team wanted to study a university in China that had taken great strides to develop a sustainable system on campus. As the Sustainability Office at Duke University was connected to the Head of the Sustainability Unit at HKUST, the research team was able to get in contact with the office to learn about the initiatives taking place at HKUST.

**Materials culture**

Material culture reviewed for this study included annual reports, case studies, memos, and other primary reporting materials. These written documents were acquired from HKUST’s official website, the AASHE online database, DKU’s official website and Duke University’s official website.


**Data Analysis Methodology**

Once the on-site interviews were completed and transcribed, the research team used NVivo 11, a
software that supports qualitative data and mixed methods research, to code the interview data according to the four focus areas of the conceptual framework. Text-search queries and word frequency queries in NVivo were also used to further explore the data and help identify emerging themes.

To code the interview data, the research team first developed nodes, which are places to gather coded qualitative data under the patterns and themes of interest (QSR International 2017). The nodes were set up in a hierarchical manner where the four focus areas of the framework (as mentioned in the Conceptual Framework section) were used at the four parent nodes (Figure 1), under which interview data was coded into the following four sub-topics:

A. **Initiatives**: Description of a past or current campus sustainability initiative including who implemented the program and how

B. **Responses**: Description of the response to these initiatives by the university community (including students, faculty and staff)

C. **Challenges**: Description of the challenges to implementing these initiatives on campus.

D. **Recommendations**: Comments and suggestions by participants on how to improve campus sustainability initiatives/overcome the stated challenges.

In addition to this node structure for the initiatives at HKUST, the team created another node called “Sustainability Unit Role” to gather interview data on the context of the Unit and the role of its staff members.

**IV. Results**

This section outlines the findings from the research team’s interviews with HKUST faculty and staff and review of material culture. It begins with a comparison of HKUST and DKU, next introduces the Sustainability Unit at HKUST, then summarizes the results of the interview
analysis and review of material culture under each area of the conceptual framework.

Campus Comparison – DKU & HKUST

As readers of this report review the following case study of HKUST and the final recommendations made for DKU in the Discussion section, it is important to consider and keep in mind the similarities and differences in the two institutions. The following section provides a brief overview of both universities to provide this baseline comparison.

Campus Comparison -- Duke Kunshan University (DKU)

Once authorized by the Ministry of Education (MOE) to operate as a joint-venture university, DKU opened its doors to the first class of students in the fall of 2014. It has completed Phase I of the development of its physical and academic infrastructure and now offers four master’s degree programs (focused on global health, medical physics, management studies, and environmental policy) along with an undergraduate study abroad program called the “Global Learning Semester” (Duke Kunshan University 2017a). It is also home to the Global Health Research Center, Environmental Research Center, and the WHU-Duke Research institute. In addition to the academic programs, Phase I included the construction of five buildings: the academic building, conference center, student residence, faculty residence, and service building, all located within the 200-acre site in the Kunshan Yangcheng Lake Science Park in the City of Kunshan. (Additional details on the size of the campus and each building can be found in Appendix J, as provided by the Assistant Director at Duke University’s Office of Project Management.)

With authority from the MOE, the partnership and the formal agreements between Duke and DKU are supported by the legislative and regulatory framework of the MOE and the Jiangsu Education Bureau. Jiangsu Province was the first province in China to include cooperation with universities from foreign countries into its education plan. By 2015, there were 333 Sino-foreign education facilities and programs in the Jiangsu Province (Jiangsu Department of Education 2015). And in response to the “Guideline on the management of sustainable campus
construction” proposed by the Ministry of Housing and Urban-Rural Development in 2008, Jiangsu Province set the goal for higher institutions within its jurisdiction to pursue a reduction of 50% on the energy consumption in new buildings, to promote the use of solar heating systems inside the buildings, and to strengthen the management on energy use to enhance its efficiency (Jiangsu Department of Education 2008).

In addition, the Municipality of Kunshan, as one of the principal partners of DKU, sponsored the establishment of the institution as it had “interests that were compatible and not competitive, can tap substantial economic resources, provide an imprimatur of legitimacy, and navigate the various layers of government approval and regulation” (Duke University Office of the Provost 2011). The City of Kunshan provided DKU the 200-acre campus site and construction cost of $260M to establish the university.

In the operations side, DKU’s administrative staff are responsible to the DKU Board and report to senior Duke administrators. The administrative and operational functions of DKU are met through a combination of services providers, including Duke University (senior management, student administrative services, etc.), DKU (financial accounting & purchasing, student housing, etc.) and third-party vendors (facilities maintenance, campus security, etc.) in China.

Following Phase I of development began Phase II in 2016. Phase II is currently working to establish a new four-year undergraduate degree program at DKU and to construct a sixth “Innovation Building” that will house a library, classrooms, and group working rooms (Duke Kunshan University 2017a). The undergraduate program will be implemented over a period of seven years and is expected to host 2,000 students, with its first class of approximately 150-175 students expected to begin in the Fall of 2017 (Provost Kornbluth 2016). In addition, the master’s programs at DKU are expected to expand and house 500 students at maximum capacity. Rather than having traditional departments or majors, the undergraduate program will be divided into three major academic disciplines: natural sciences, social sciences, and arts and humanities (Duke Kunshan University 2017b). Kunshan has partnered with Duke University and DKU to help finance the university’s expanding operations. It has agreed to cover up to $40 million of
the estimated $45 million per year needed to support the undergraduate program, and to provide 20 scholarships for the first three years of the program (Provost Kornbluth 2016). After the first six years since its establishment of having subsidy coming from Duke and Kunshan supplementing to the amount necessary for DKU to reach the estimated expenses, DKU will start operating mostly on its own generated revenue, including tuition, conference center fees, etc. (Duke University Office of the Provost 2011)

**Campus Comparison -- Hong Kong University of Science & Technology (HKUST)**

HKUST is located on a 143-acre site in the Clear Water Bay peninsula in the Sai Kung District, approximately eleven miles from central Hong Kong. It currently includes twenty different academic departments and divisions, thirteen research institutes, and fifty-four research centers across many disciplines. As of December 2016, approximately 14,000 students were enrolled at the university (9,334 undergraduates and 4,874 postgraduates), and as of June 2016, the university had 607 regular faculty members and 3,514 full-time staff members (as of Dec 2015). It is clear that although the physical size of HKUST’s campus is relatively smaller than DKU, HKUST is much more densely populated and has had significantly more time to build its academic capacity. However, HKUST has only recently incorporated campus sustainability into the fabric of the university. The Sustainability Unit, for example, was not established until 2013, and strategic integration of sustainability-related targets did not come into play until 2015 when the university’s Strategic Plan was updated with key objectives for 2020. As such, it seems DKU and HKUST face similar timelines in the development of sustainability within their institutions.

HKUST is one of the eight post-secondary institutions supported by Hong Kong’s Education Bureau, whose role is to oversee the development and implementation of education policies and legislation for the primary, secondary, and post-secondary schools in Hong Kong (Hong Kong Education Bureau 2017a). And as a public institution, a major source of funding for HKUST comes from the Education Bureau’s University Grant Committee (UGC) and its Research Grant Council (RGC). UGC is a body of the Education Bureau that advises the strategic development of and allocates funding to universities in Hong Kong, and under UGC, the Research Grant
Council identifies priority research areas for the Hong Kong government and universities, and provides research grant opportunities funded by its Research Endowment Fund (REF). The REF was established in 2009 with HK$18 billion in available funding (Hong Kong Education Bureau 2017b).

In addition to overseeing policies on education, the Education Bureau has its own Environmental Policy document that commits the Bureau to Hong Kong’s Clean Air Charter. This charter focuses on addressing energy use and air quality issues in Hong Kong through emissions reductions actions by requiring all government bureaus and departments to implement their own environmental policies and energy savings measures. Along with its own measures such as energy and carbon auditing of the Bureau offices, it also requires all Hong Kong schools to establish their own school-based environmental policies and energy savings measures to help improve air quality. The circulars issued to Hong Kong schools stated that their environmental policies should “inter alia, lay down schools’ commitment to improve their environmental performance, schools’ mission and vision towards environmental protection,” and that these schools should “include plans/programmes that work toward their goals set out in the environmental policy in their Annual School Plans and report the progress in their Annual Reports” (Hong Kong Education Bureau 2015).

**Sustainability Unit at HKUST**

The Sustainability Unit was established in August of 2013 and was emphasized as a bridge between the academic and operational goals of HKUST. The Unit is in charge of overseeing the sustainability efforts across the different offices and academic departments of the university.

The Sustainability Unit consists of three staff members: the Head of the Unit, the Program Manager and the Health, Safety and Environment Specialist. The Head of the Sustainability Unit joined HKUST at the establishment of the Sustainability Unit with the initial role of organizing the university’s existing sustainability efforts in a cohesive and strategic manner. In his interview, he stated that when he joined the university, he noticed how disjointed the existing
efforts of HKUST’s campus appeared. In order to learn about the existing system at the university, the Unit conducted an in-depth review of the existing plans and strategies in its first year. This review was then used to build the Unit’s strategic plan in the following year, and in its third year, the Unit began to implement its sustainability plans.

The Head of the Unit is currently responsible for incorporating the Unit’s plans and actions into the Five-Year Strategic Plan 2020 of HKUST and to oversee the Unit’s efforts that coincide with the academic and operational side of the university. At a broader level, he also serves as the Secretary of the Environmental Sustainability Steering Committee (ESSCOM), which is a committee of faculty and staff members who help to shape the university’s policies that assist students, staff, faculty, and alumni to make positive contributions to sustainability and reduce the environmental impact of the university.

The Program Manager coordinates with the major stakeholders who work with the Sustainability Unit. Some of the major responsibilities include supporting students who want to participate in the Unit’s activities or develop their own experimental projects; coordinating staff and faculty who are involved in or want to participate in a sustainable initiative; and taking charge of marketing and outreach efforts to promote sustainability efforts to the campus community. In addition, with the formation of the Green Office Network, a group of representatives from different offices of the university, the Program Manager also provides internal training and holds regular meetings to teach members how to follow sustainability guidelines; incorporate these practices into the operations of their offices; and pass on the sustainability mindset to their colleagues.

Last but not least the Health, Safety and Environment Specialist (who will be referred to as the Environmental Specialist for short) joined the Unit in November 2015 with the growing need to keep track of the university’s environmental impacts. This member of the Unit is currently in charge of collecting and analyzing campus data; developing the university’s greenhouse gas inventory; and assisting the two other Unit members to implement sustainability initiatives on campus.
HKUST Interview Results

As mentioned in the Conceptual Framework, the four focus areas of campus sustainability (administration, operation, education and research) were used as the foundation of the interviews towards HKUST faculty and staff, and formed the analysis structure of the interview results. The following parts present the challenges and recommendations proposed by the interview participants under each focus area on campus sustainability development in HKUST.

The following section reviews the results of the research team’s interviews with the thirteen HKUST faculty and staff participants on the challenges and recommendations they had on developing campus sustainability at their university. These results are organized under the four areas of the conceptual framework: Administration, Operations, Education, and Research, as well as a subsection on any significant overall challenges they faced.

1. Administration

Challenges in Administration – Lack of Manpower and Engagement of Faculty & Staff

In discussing administrative challenges, five interview participants brought up the lack of manpower and engagement of the faculty and staff members at HKUST. First, the Program Manager and Environmental Specialist of the Sustainability Unit, and the Planning Manager of the Office of Planning & Institutional Research discussed the difficulty of the Unit in implementing sustainability-related projects on campus with only three Unit staff members. These participants made the point that, although other faculty and staff members were generally accepting of the idea of sustainability initiatives, it was difficult for the Unit to administer to all of the departments and offices to communicate the ways in which they could actively engage and participate in the sustainability projects related to them. All five participants echoed this challenge of improving faculty and staff participation in sustainability practices when they lacked specific guidelines from the university on exactly how they could engage.
Challenges in Administration -- Senior Management Approval

Secondly, the challenge of obtaining senior management support and approval was brought up by six interview participants. These participants mentioned many factors that were required to obtain this support: there had to be enough consensus and support from the frontline staff of the department or office involved, thorough discussion with the related departments to set achievable yet challenging enough targets to make the initiative worthwhile for the university, specific strategies to achieve the desired targets, and regular meetings required to keep track of progress. Obtaining approval was not only about having an idea for an initiative, but ensuring buy-in and having a comprehensive and convincing plan.

Recommendations for Administration -- Leadership Support Within Structural Units

To address these administrative challenges, our interview participants stressed the need to strengthen leadership support within the departments and offices at HKUST. It was stressed that, when office and department leaders show support and commitment to sustainability initiatives, they positively influence others within their structural unit to buy into the concept of sustainability and thus help improve participation in sustainability initiatives. The university is currently working to strengthen this leadership support through the Sustainable Operations Executive Committee (ExCo). ExCo was formed in 2016 as an administrative committee focused on the university’s energy and waste reduction goals and oversight of “Unit Level Guidelines” that help create more sustainable working environments (HKUST 2016a). The committee is composed of members who represent different operational offices of the university including the Finance Office, Facilities Management, Purchasing, Student Affairs, and Campus Services. By joining this committee, department and office leaders are able to provide their teams with the appropriate guidelines and tools to engage in sustainability actions.
2. Operations

Challenges in Operations -- Student Engagement and Awareness

The first challenge is tied to the mindset and actions from student groups, who are key players in campus sustainability development. Despite the numerous activities taking place on campus, four interview participants mentioned the difficulty of promoting these activities and facilitating student participation. These participants mentioned that, even with proper guidance, some students still did not engage in these activities due to the difficulty of changing their behavior or the perception that these activities were too time-consuming.

The Environmental Specialist of the Sustainability Unit and Student Hall Operation Officer mentioned recycling as an example, that even with the recycling bins placed all over the campus, some students could not tell the difference among the categories or they did not bother to throw trash into the right bin. In addition, it was mentioned by the Student Hall Operation Officer that students in the university were usually very busy with their academic work, and that the organizers of sustainability activities needed to consider how they could make these activities more convenient and provide other incentives for the students to join.

Challenges in Operations -- Lack of Data

The three members of the Sustainability Unit mentioned the lack of data as a challenge in pushing operational initiatives forward. As described by the Head of the Sustainability Unit, when he first came to HKUST, the university had not collected or utilized data on measures such as waste disposal, water use, or energy savings. The lack of data-driven initiatives had led to a system that was fragmented and created challenges in evaluating the baseline of the university’s environmental performance, making it difficult to identify the priority areas and set key measurable targets. The Program Manager stated that there was still a need for more data collection and analysis to create a convincing case for front-line operations staff in order to facilitate buy-in. This concern was reiterated by the Environmental Specialist who stated that without performance data, it was difficult for administrative offices to realize their operational
impacts which led to a lack of participation in sustainability practices.

**Recommendations for Operations — Data-Driven Programs**

The Sustainability Unit staff stressed the need for data availability to track progress, aim towards specific targets and prove the effectiveness of sustainability initiatives launched by the university. Having a record of success through data would enable the university to analyze the performance of the whole campus as well as across different offices and units, and to obtain both high-level and front-line staff support to launch future sustainability projects.

Since the establishment of the Sustainability Unit, the university has been working to collect and analyze sustainability-related data to create a data-driven sustainable campus. The Sustainability Unit currently collects data under energy use, greenhouse gas emissions, water consumption, waste, and printed paper consumption, and has a dedicated role, the Health, Safety, and Environment Specialist, who helps collect and analyze this data. Through improved data collection and analysis, the Sustainability Unit has been able to determine a baseline of HKUST’s environmental performance from the academic year 2013-2014 and has been able set specific reduction goals (10% reduction in energy consumption and carbon emissions, 50% reduction in waste) for the university’s 2020 Sustainability Challenge (HKUST Sustainability 2017a).

**Recommendations for Operations — Incorporating Sustainability into Office Workflow**

Five interview participants mentioned the importance of helping staff members gradually incorporate sustainability practices into their operational working routine. This would allow individuals to better buy into the concept of sustainability and improve engagement in future sustainability actions within their offices. These interview participants stressed the fact that, as this process of buying into the idea of sustainability takes time, it required the Unit and the leaders of these initiatives to slowly introduce and encourage practices that would help the staff members make an easier transition to a more sustainable workflow. As these offices more clearly
understand the role of sustainability within their work, the interview participants mentioned the hope for them to lead and initiate their own sustainability projects.

3. Education

Challenges in Education -- Interdisciplinary Nature of Sustainability Education Programs

Four of the interview participants, three of whom directly support education within their roles, mentioned the challenge of the interdisciplinary nature of sustainability curriculum. They stated that sustainability courses require cooperative action from various academic disciplines, making difficult to identify the appropriate faculty members in the appropriate department or school to take the lead on a sustainability course or program. Once the university finds the right faculty member, there are still many things to consider such as deciding who oversees the design of these specific programs.

These participants also mentioned that this interdisciplinary nature made it difficult to coordinate among all of the disciplines offering sustainability-related courses. With over twenty different departments, the challenge lied in identifying courses within these disciplines that are sustainability-focused then creating better communication and coordination among the disciplines to ensure that there was no excess overlap in course material. The main concern with this lack of coordination was in having fragmented sustainability programs that were less in-depth and offered fewer skill sets to its students.

Recommendations for Education -- Academic High Level Support

Senior management approval and support was emphasized by five interview participants as a solution to strengthen sustainability education programs. Apart from operational leadership support, the support of academic leaders such as the Executive Vice-President & Provost who guide the vision and direction of the university’s academic programs was highlighted as a key factor in building a strong foundation for sustainability education. By providing clear oversight
and improving coordination among the different schools and departments, the university could prevent redundant overlaps in course material and sustainability programs and improve the visibility of sustainability-related courses already being taught at the university. Through this support, academic leaders could improve student access to sustainability curriculum and ensure that the university offers a cohesive group of sustainability courses instead of having fragmented, one-off programs in the different academic disciplines.

4. Research

Challenges in Research -- Proactivity of Faculty

It was brought up by the Assistant Provost in the interview that even if the university could try to frame strategic objectives related to research, the researchers themselves hold the initiative in their hands. That means for them, there are a lot to consider such as funding amount, laboratory settings, interests from the school and the participating students will affect their decisions of undertaking the project or not.

Challenges in Research -- Publishing and Translation

Another concern raised by the professor at the Division of the Environment was specifically related to the sustainability field, which was a relative new academic area and as a result of that, it would be hard for the existing journals to receive and publish an article with interdisciplinary theme and blurry-defined boundaries as it could not fit into any existing category. This difficulty could hinder the research to even start.

Furthermore, even if a researcher publish the article successfully, efforts were still in need to enable plain people to understand what the research was trying to deliver, as was suggested by the Environmental Specialist of the Sustainability Unit that the faculty should try to translate their own language to people for them to learn about and read.
**Recommendations in Research -- External Support & University Promotion**

In discussing how to overcome these research challenges, four of the interview participants made similar remarks on how the solution lied much more heavily on the need for external changes that were above the university’s influence. It was stressed that there would need to be a change in the traditional structure of providing institutional support, and publishing and funding opportunities for research as the current structure limited the opportunity for a highly interdisciplinary topic such as sustainability to make a strong case under one discipline. However, as a starting effort, these interview participants mentioned HKUST’s current efforts to highlight sustainability-related research at the university to help promote the importance of these projects to the university community and thus motivate more incorporation of sustainability elements into both student and faculty projects. For example, the Sustainability Unit currently provides a publicly available list of sustainability-related research projects from HKUST on its website (HKUST Sustainability 2017f). This list is provided not only to promote sustainability-related research ideas, but also to facilitate the translation of research results to coherent sustainability actions.

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**5. Overall Challenges**

After discussing some of the challenges specific to the four areas of sustainability, the research team asked the HKUST faculty and staff members about their views on the overall challenges of introducing these efforts on campus, and found the following significant barriers.

**Overall Challenges -- Engagement from the University Community**

One of the most prominent challenges emphasized by seven of the thirteen interview participants was the difficulty of obtaining buy-in from the university community. It was stated that many individuals had genuine concerns on how much time they could truly invest in sustainability initiatives on campus. Students, faculty and staff tend to have saturated academic and professional work schedules, or would have the tendency to believe that their individual contribution would not create a significant positive impact on the environment. This led to
apprehension on participating in sustainability projects that did not seem related to their respective fields or that appeared as too big of a time commitment.

**Overall Challenges -- Sustainability Definition**

Seven participants also brought up the challenge of clearly defining sustainability. On one hand, sustainability was often pigeonholed as a purely environmental and science-based subject matter. This created concern that sustainability initiatives on campus would lose sight of other important social or economic issues. This type of labeling also led to a lack of engagement by students, faculty, and staff who felt sustainability was not related to their own focus areas at the university. However, in contrast to the labeling of sustainability as purely environmental, our interview participants also mentioned how many individuals held entirely different meanings of sustainability due to its interdisciplinary nature, making it unclear how sustainability is connected to their own work, and where to draw the line on what relates to sustainability education and research and what does not.

**V. Discussion**

Overall, the discussion of recommendations from the HKUST faculty and staff included four overarching themes of student engagement, institutional commitment, a data-driven campus, and sustainable education development. Based on the results of the on-site interviews and the review of material culture, the research team provides recommendations under these four themes on how DKU can begin to incorporate sustainability into its campus within its current stages of expansion and capacity building.

**Recommendations: Student Engagement in Sustainability**

The results of a text frequency query on the discussion of recommendations revealed “students”
to be the most frequently mentioned word by our interview participants. In reviewing the context around this word, it was found that student engagement was seen as the foundational component of sustainable campus development by the interview participants. Without student engagement, the majority of these individuals stressed by the end of their interviews that the recommendations they provided could not be successful without the active awareness and participation of the student body. The need for student engagement is also evidenced in the role of the Sustainability Unit’s Program Manager, who is responsible for supporting students who want to engage in sustainability initiatives at HKUST. As a liaison between the student body and the sustainability initiatives available on campus, the Program Manager is able to make these initiatives more accessible to the students and thus facilitate participation.

With the new undergraduate degree program and the expansion of the existing master’s programs, it will be important for DKU to motivate its growing student body to engage in sustainability efforts. Student engagement could not only address the potential lack of manpower by providing the university with a wider network of individuals interested in making a difference, but it could also indicate to DKU’s senior leadership the need for support and commitment to campus sustainability in the interest of its student body. This study proposes two ways by which DKU could facilitate student engagement in sustainability efforts on campus: through the development of project-based sustainability courses and the support of student sustainability networks.

**Student Engagement Recommendation #1: Develop project based sustainability courses that tackle campus and community challenges**

Our first recommendation under student engagement is for DKU to begin developing project-based sustainability courses that will allow students to connect with real-world sustainability issues within their own campus and surrounding community. These courses could help to address one of the challenges mentioned by our interview participants of obtaining buy-in from students and faculty due to their concern of their saturated work schedules. By offering accredited project-based courses that are built into the curriculum of the undergraduate degree program,
sustainability projects could be perceived as smaller time and commitment burdens. In addition, such courses would allow students to gain critical problem-solving skills and to act as leaders in sustainability by spreading awareness of such projects among their peers.

The Sage Project at San Diego State University (SDSU) is an example of a successful project-based curricular program. In 2015, SDSU partnered with the local government to connect students to real-world community problems through project-based courses at the university (Barlow 2015). By the second year of the program, over 2,000 students across 23 different academic disciplines had engaged in 18 different projects with the local community. Much of the program’s success was attributed to the willing participation and funding from its local government partners (who agreed to fund 10-20 projects per year at a cost of $15,000 to $50,000 per project). Success was also attributed to the appointment of a faculty member to oversee the matchmaking process between projects and faculty and their courses, and to act as a liaison between the university and the local government (Barlow 2015).

As a first step, DKU could consider dedicating a full-time faculty or staff member to work with the university and the City of Kunshan to identify high-priority sustainability projects and funding opportunities. Once these projects are identified, this dedicated faculty/staff member could oversee a matchmaking process between the projects and interested faculty members. Then, in following the footsteps of Duke University, the team would recommend DKU faculty to build courses that are similar in design to the existing course at Duke, called the “Theory and Practice of Sustainability.” This one-credit applied-learning course allows students to use their problem-solving and critical thinking skills to help develop and improve sustainable practices on Duke’s campus. Students enrolled in this course work on various sustainability-related campus practices, such as “building design and operations, utility supply and consumption, carbon offsets design and calculation, transportation, water, sustainability education and communication, behavior change, waste production and recycling, and procurement” (Duke Service-Learning 2017). This course model could be extended to also use the City of Kunshan as a case study along with DKU.
Student Engagement Recommendation #2: Develop student sustainability networks

Through the administrative support of the Operations office at DKU, a student network could be established to gather those who are interested in sustainability issues and who want to make a difference on campus. The research team recommends launching programs that are similar to the existing student groups at Duke University. Students for Sustainable Living (SSL), for example, is a paid internship program of fifteen graduate and undergraduate students who work together on education and outreach efforts on campus. As a team, the students choose an area of campus sustainability for which they help to design and implement a project for the academic year. This internship gives the students an opportunity to apply their creative and critical thinking skills to create real campaigns and to create a stronger network of individuals who would encourage others in the university community through their outreach efforts (Duke Sustainability 2017d). The Duke Green Devils initiative could also be an appropriate program to launch at DKU to gradually build up student engagement as its body of undergraduates expands. This initiative at Duke University is focused on providing undergraduate freshmen the opportunity to become leaders of sustainability by engaging in ‘greening’ activities such as the “Green Dorm Room Certifications” and education and outreach efforts on the undergraduate side of Duke’s campus. These students also have an opportunity to connect and work with the graduate students involved in the SSL initiative, allowing the students to create an even stronger network of student support and collaboration to contribute to campus sustainability development (Duke Sustainability 2017b).

In addition to encouraging others in the campus community by promoting sustainability education and awareness, these students could also provide additional manpower to the often-limited human resources required to take on larger sustainability-related projects such as waste auditing. As with the team’s recommendation on developing project-based sustainability courses at DKU, the dedicated faculty or staff member could also collaborate with a student network to identify campus-based projects that require additional manpower. This could be one of the first steps taken to engage the students at DKU and begin assessing the environmental impacts of its campus.
Recommendations: Institutional Commitment

To address the overall challenge of obtaining buy-in for sustainability initiatives and improving collaboration among the structural units at HKUST, the interview participants stressed the need for high-level support and engagement of faculty and staff members. The research team provides two recommendations for DKU that focus on the initial steps it could take to build a foundation for support and engagement on its campus.

Institutional Commitment Recommendation #1: Develop definitions of sustainability specific to DKU

This recommendation seeks to address the overall challenge brought up by the interview participants of clearly defining sustainability to obtain buy-in from the university community. It seemed members of the HKUST community were not engaging in campus sustainability efforts due to the difficulty in connecting the meaning of sustainability to their individual work. In addition, the interdisciplinary nature of sustainability made it challenging for HKUST to build sustainability curriculum and to identify and strengthen sustainability-related research.

As a newly established institution, DKU’s leadership has the opportunity to strategically define the culture of sustainability on its campus and help bridge this connection. By formally adopting definitions of sustainability, the university could visibly show its support and commitment to prioritize sustainable development. As a first step, the research team recommends DKU to review the definitions and focus areas of sustainability provided by Duke University, which can be found in the Literature Review section of this report. Reviewing the definitions and frameworks established by Duke could help DKU to understand the standards and expectations of this main institution and help align the sustainability objectives of the two universities.

In following Duke University’s example of formally approving specific definitions connected to research, community engagement, and sustainability literacy, DKU could review the areas of its campus in which sustainability is not as clearly defined for its community. As members of
DKU’s leadership, students, faculty, and staff are key stakeholders of the university, considering their perspectives would be an essential component of this defining process. Interviews with these stakeholders (perhaps by utilizing the manpower of future student sustainability networks) could help the university gauge where sustainability can be more strongly integrated and understand how the university community envisions a sustainable campus.

DKU also has the opportunity to adopt a university-wide policy on campus sustainability development. The research team recommends that once it has clearly defined sustainability internally, DKU could then establish a sustainability policy similar to Duke University’s Environmental Policy that set the overarching vision for sustainable development in the areas prioritized by the university and its community. HKUST took a similar action in setting a long term university-wide vision through its 2020 Sustainability Challenge that focused on sustainable education, operations, the HKUST-community, and sustainability-related research (HKUST Sustainability 2017a). This action would further demonstrate leadership commitment to sustainability and provide a foundation for setting more specific sustainability policies and targets in the future.

Institutional Commitment Recommendation #2: Establish sustainability representatives across the institution’s structural units

In addition to high-level support, our interview participants stressed the importance of mid-level support, referring to the need for active faculty and staff engagement. This engagement was seen as a tool to (1) increase participation in and provide more manpower for sustainability initiatives; (2) to improve collaboration across structural units; and (3) to provide support for student engagement in campus sustainability. Furthermore, a study of sustainability at Canadian and U.S. universities found that faculty and staff leadership were often overlooked by universities due to the heavy focus on top-down or bottom-up approaches to campus sustainability (i.e. with strengthened senior leadership and strategic planning or student engagement) (Brinkhurst et al. 2011). Although these two approaches were important, the study demonstrated the significant influence faculty and staff members had on the successful implementation of green efforts and on student engagement and encouragement.
In considering initial approaches to facilitate engagement, the research team recommends that DKU begin by building a network of faculty and staff members to act as ‘sustainability representatives’ of their respective disciplines and administrative offices. This was an approach used by Shenyang University to facilitate implementation of sustainability practices and to allow spreading of sustainable knowledge among these individuals. The university board of Shenyang had required every existing structural unit to have at least one individual in charge of the unit’s environmental issues (Geng et al. 2013). DKU could similarly request voluntary representatives from each unit and hire a dedicated staff member to oversee the network and facilitate discussions on sustainability-related issues within the university. With enhanced awareness and motivation from participating in this network, the sustainability representatives could then support their own faculty and staff members by sharing sustainability knowledge and practices and facilitating discussion on how to better integrate sustainability into the unit’s specific mission and workflow. This type of network could help ensure buy-in for future projects and thus facilitate long-term support from the university’s academic and operational leaders. It could also act as the primary resource and advisory committee for students who want to engage in sustainability projects on campus.

As DKU’s academic programs and administrative offices continue to build faculty and staff capacity with Phase II, it could later establish a formal committee similar to the Environmental Sustainability Steering Committee (ESSCOM) group of HKUST (Details of ESSCOM included in Appendix F) and the Campus Sustainability Committee of Duke University. The network of sustainability representatives could then become an integral decision-making body that contributes to DKU’s strategic plans for sustainable development.

**Recommendations: Sustainable Academic Development**

In the HKUST interviews, 8 out of the 13 participants discussed how sustainability education through related lectures, project-based courses, and research was integral to the successful development of campus sustainability. HKUST has set the goal of establishing a sustainability
education and research framework to ensure that its students gain a concrete understanding of sustainability concepts and gains the capacity to solve real-world problems, both locally and globally (HKUST Sustainability 2017a).

Sustainable Academic Development Recommendation #1: Develop inventory of existing courses and research projects with sustainability elements

The recommendation of improving the visibility of sustainability curriculum was suggested by our interview participants in HKUST. Based on the practices at Duke University and other institutions described below, the research team recommends DKU to develop publicly available inventories of its current and future sustainability-related courses and research projects. This effort would not only enhance the visibility of existing courses to its students, but also improve sustainability curriculum design by helping to identify the course areas where sustainability could be better integrated. Moreover, these active inventories could create collaboration among faculty members looking to design interdisciplinary courses or research projects, and express support from the university to encourage research projects focusing on sustainability topics.

Duke University has been providing an inventory of sustainability-related courses since the fall of 2010, with highlights of courses in which sustainability is the primary focus (Duke Sustainability 2017e). The full course list is presented on the Sustainable Duke website and is updated every semester. HKUST also identifies and provides a list of existing courses with sustainability elements (HKUST 2017a).

This need to enhance visibility can also be seen in the case at San Francisco State University, where faculty members campaigned to have sustainability requirement to be included in the general education requirements, to make sure that all graduates would have a basic understanding of sustainability. Within this campaign, 47 courses from a set of 23 different disciplines across the university were identified to meet the sustainability requirement. These courses were highlighted for students who were interested, and mandatory for graduates to take
to gain a basic knowledge on sustainability (Davidson 2015).

It is recommended that DKU follow in Duke and HKUST’s footsteps in enhancing the visibility of existing courses. In its four-year undergraduate program, DKU demonstrates on its website that there will be interdisciplinary components among its three disciplines (of natural sciences, arts and humanities, and social sciences) featured in the program’s curriculum (Duke Kunshan University 2017b). Though sustainability is not currently specified in the sample study areas, DKU could begin by identifying any planned courses that will include sustainability elements, then highlight these courses on a simple and accessible inventory. The same recommendation could apply to the research projects of the university. DKU has already established research centers for global health and the environment, and a collaborative research institute between Duke, DKU, and WHU. Within these research entities, DKU could begin to recognize past research projects that have incorporated sustainability. Duke University is currently working to find an appropriate method to identify sustainability-related research projects. As of 2013, these projects were identified by searching key sustainability-related terms on the university’s project database. This search allowed Duke to identify over 200 research projects within its various academic departments (Duke Sustainability 2017c). DKU could follow this example by Duke by first determining key indicator words for sustainability to identify both courses and research projects.

*Sustainable Academic Development Recommendation #2: Provide incentives for faculty to develop new courses and research projects with sustainability elements*

Duke University has an annual workshop called the “Trillium Sustainability Workshop” that brings faculty together to think about new course development with sustainability concepts, or to help weave sustainability into their existing classes. In addition, Duke has begun to collaborate with other academic institutions such as North Carolina State University to increase the prevalence of sustainability education (Duke University 2017).
Similar to the Trillium workshop at Duke, an interdisciplinary group of faculty members formed the “Ponderosa Group” at Northern Arizona University (NAU) to develop curriculum and revise syllabi to include environmental content within their courses (Brinkhurst et al. 2011). Through this group, faculty members of NAU were able to create sustainability minors and majors, and more strongly integrate sustainability into the existing curriculum at the university (Barlett and Chase 2012).

Our recommendation for DKU is to hold a similar workshop to create and strengthen its sustainability curriculum. DKU could develop the workshop by consulting Duke through the Sustainable Duke Office and by utilizing the existing resources of the Trillium Workshop, such as its syllabus resources and example workshops from other universities in the U.S. DKU’s own workshop could be developed through the existing Environmental Research Center which has potential funding resources and has held workshops itself involving faculty both from Duke and DKU. DKU could also invite academic professors from other nearby universities in China, such as Tongji University in Shanghai which has established a strong sustainability curriculum with 42 and 49 sustainability development courses (approximately 40% of the total courses offered) respectively for undergraduate and graduate programs (Tongji University 2012), to participate in the discussion.

Most importantly, since DKU has already established a tight collaboration with multiple disciplines at Duke through its Environmental Research Center, educational and research resources could potentially be transferred between the two universities and to help DKU in its sustainability academic development.

In addition, DKU could take advantage of regional opportunities such as the International Training Program on Education for Sustainable Development in Higher Education (ITP ESD-HE) organized by United Nations Environmental Programme (UNEP)-Tongji Institute of Environment for Sustainable Development. This training program enables its participant to build a Change Project, which is to either create or revise a sustainability-related course, in consultation with his/her mother institution and get feedback from professionals in their field.
(UNEP-Tongji Institute of Environment for Sustainable Development 2017). This could facilitate the faculty at DKU to design courses tailored to their own academic priorities as connected to sustainability. Moreover, working with counterparts from other institutions around the world could further motivate the faculty to devote their time and energy into building up sustainability courses for their students.

Another opportunity on developing its sustainability academics for DKU is to apply for a membership in the China Green Campus Network (CGUN) mentioned in the Literature Review section of this report, after meeting the conditions to join. As one of CGUN’s sub-committees on campus sustainability development in China focuses specifically on education program development. The resources provided under this program include the shared experiences and information on establishing sustainability courses at universities across China (CGUN 2017). The CGUN could be a great platform for DKU to learn from the best in the field and have access to these resources.

**Recommendations: Data-Driven Campus**

As mentioned in the introduction of HKUST’s Sustainability Unit, the establishment of the Unit was motivated by a general lack of systematic methods to organize what sustainability-related data the university had to begin with. There had been some sustainable features at the university such as green roofs and solar panels on some of the residential dorm buildings. However, there existed a need to evaluate how these existing elements could fit into a more cohesive and strategic picture of sustainable development at the university. This is where data came in to connect the dots, by first allowing HKUST to evaluate its campus performance and create a baseline for future assessment of its environmental impacts. The Sustainability Unit was then able to launch more campus-based initiatives to promote sustainability on campus.

As discussed in the HKUST interviews, when the university cannot be convinced of the importance or need of sustainability projects on campus, providing data on true environmental impacts could clearly illustrate this need to obtain high-level support and drive these projects
forward. Data would also make a stronger case by helping to address other challenges brought up in the interviews, for example, to increase the community’s awareness and engagement of sustainability issues and to facilitate cooperation between different units and offices at the university to share and buy in to sustainability practices. The following two recommendations for DKU directly address the challenge of the lack of data mentioned under the Operation theme from the interviews.

Data-driven Campus Recommendation #1: Develop key sustainability metrics and start tracking to create a baseline for the university’s overall performance

As data could motivate changes and provide baseline for further analysis, this study recommends the Operation Office at DKU to begin developing key sustainability metrics to create a baseline for the university’s environmental performance benchmarking. The following examples highlight the importance of establishing metrics and a baseline of environmental impacts to motivate the launch of sustainability actions and the establishment of measurable targets.

Duke University’s effort to track data from the start of its commitment to sustainability highlights the importance of identifying key metrics that motivate strategic sustainability actions. Over the past ten years, Duke has been using sustainability metrics to benchmark its emissions reduction progress, working towards the goal of carbon neutrality by 2024 (Duke University 2009). Through these metrics, Duke has been able to measure an overall emissions reduction of 23% in 2016 from its 2007 baseline (Duke Sustainability 2016a) and to continually evaluate the strategic plans within the five focus areas of its Climate Action Plan. Duke has been evaluating its performance through measures of carbon emissions and offsets; infrastructure (energy use in buildings, water reduction, construction); campus operations (food, transportation, procurement, waste and recycling); and education and engagement (courses and communication within the community). As of 2016, Duke’s energy emissions has gone down by 37% and transportation emissions rose by 27% from the 2007 baseline (Duke Sustainability 2016a). This update on progress helped to validate Duke’s efforts in reducing carbon emissions while acknowledging the
difficulty of changing individual commuting behavior.

When the Head of the Sustainability Unit first came to HKUST, there were no complete sets of sustainability-related data across the institution, and any campus data being collected were not being utilized to motivate sustainability actions. For example, data from meters measuring energy consumption of its dining caterers were only being used for financial reimbursement purposes. As a result, the university was unaware of its waste generation, water consumption or energy usage on campus, which left no entry point for a sustainability management system. Once the Unit began to gain an in-depth understanding of the existing plans and strategies of HKUST, it was able to establish key measures of sustainability performance. The Sustainability Unit is now tracking and analyzing data on energy consumption, carbon emissions, water consumption, waste, and printed paper consumption (HKUST Sustainability 2017a). These sustainability metrics have allowed the Unit to measure a 2013-2014 baseline and to set operational targets of 10% energy and carbon emissions reductions and 50% waste reduction by 2020 (HKUST Sustainability 2017b).

A case study of Mohawk College from AASHE highlighted a similar situation. After forming its sustainability office, the university aimed to build a comprehensive environmental management plan and to set carbon emissions reduction targets. However, before building this plan, the university first commissioned a third party company to complete a greenhouse gas inventory for the 2007 calendar year. The results of this inventory enabled the university to establish a measurable baseline and to begin the development process of the environmental management plan. With baseline data set in place, Mohawk College then set a 2020 target to reduce its carbon emissions by 20% using the measured baseline. The university was able to surpass this target, and was able to achieve a 24% reduction by 2014 (Griffiths and Baynes 2016).

DKU has established a welcoming setting for campus sustainability development through its LEED-certified buildings and sustainable campus design features (such as pedestrian friendly infrastructure and a 40-acre community garden site) (Duke Kunshan University 2017a). In addition, the Operations Manager of DKU informed the research team via email in April 2017
that the university has begun keeping track of electricity use on campus and for each building, water consumption of the campus as a whole, steam consumption as a campus, and the natural gas use in two of its campus kitchens. This could motivate DKU to adopt Duke University’s metrics by tracking additional sustainability-related data to motivate sustainable education and positive behavioral change programs. As is in China, water conservation has been a long-lasting policy challenge due to the constraints on water-supply and poor water quality. Some provinces, including Jiangsu, have command and control programs that require public institutions (including schools, hospitals, and government departments) to reduce water consumption (Lo 2015). In an effort to contribute to water consumption reduction, DKU could establish water consumption data as one of its tracking priorities, and by doing so, help raise student awareness and connection to the real-world environmental problems faced by the nation. Similar actions were taken by Western University (WU), which installed water meter and made its water consumption data open to the public. Through this initiative, WU was able to reduce water use by 18% from 2012 to 2015, with 2-5% reductions per building attributed to increased awareness and engagement (Cano and Lopez 2016).

Furthermore, with the development of DKU’s undergraduate degree program and expansion of its existing programs, there is likely a substantial and growing amount of travel by the students, faculty, and staff between DKU and Duke University. As this could significantly contribute to the environmental impact of DKU’s campus, the research team also recommends DKU to begin tracking air travel information along with basic facilities data as a first step to collecting sustainability-related data on campus. Duke University has been including faculty and staff air travel in its greenhouse gas inventory by air travel cost and an estimate of the dollars per mile from a major airline to obtain actual mileage (Duke Sustainability 2016b).

As the next step for DKU to follow Duke’s efforts in measuring the full spectrum of its campus environmental impacts, it could consider tracking additional data such as on food procurement and waste auditing, to eventually be able to assess its holistic environmental impact as its capacity of operation staff expands. In following the Environmental Specialist role established within HKUST’s Sustainability Unit, the Operations office could hire a dedicated staff member
to begin managing this set of data, conduct further analysis to track the university’s overall environmental performance, and provide the performance results to the university community.

In collecting and analyzing sustainability-related data, DKU could utilize existing resources provided by organizations in China who focus on helping Chinese universities become more sustainable through data-driven initiatives. For example, the university could refer to existing guidelines such as the “Campus Carbon Accounting Strategies” guidebook (CYCAN 2017). This guidebook was developed by an environmental nonprofit organization called the China Youth Climate Action Network (CYCAN) and was created for its “Low Impact Campus Project” that encourages college students to help calculate the carbon footprint and propose carbon emission tactics for their universities (CYCAN 2017). The guidebook is designed specifically for Chinese universities and provides step-by-step instructions on how students can obtain university support, collect data, calculate emissions and analyze the results. It has been successfully running in 165 universities across the country.

Another tool for data management refers back to the Campus Energy Management System (CEMS) developed by Tongji University (as mentioned in the Literature Review section). This tool helps monitor energy, power, and water consumption data at university campuses, and has already been expanded to 200 universities in China with financial support from the Chinese Ministry of Finance (Tan et al. 2014). CEMS could help DKU to evaluate performance in terms of monitoring energy usage, conducting historical data analysis on energy efficiency, managing equipment systems, as well as predicting consumption trends (Tongji University 2012). In using the CEMS successfully, DKU has the opportunity to join the China Green University Network (CGUN) by passing CGUN’s national acceptance test with the agreement of the university board. In joining the network, DKU could get accessed to its database of energy data collected from its members and guidance on building green campus evaluation standards, this may further help DKU to learn from other universities’ practices on how to collect and analyze the data (CGUN 2017).

Apart from the guidebook and the system, DKU could collaborate with Sustainable Duke staff to
utilize their greenhouse gas accounting tool adapted from an online software called “Clean Air-Cool Planet” (Carbon Map 2017), which was developed by the University of New Hampshire to help manage and analyze campus-wide carbon emission data. Sustainable Duke has also added additional emission indicators such as methane produced from natural gas in the 2017 update to the CAP. Although these emissions indicators are U.S. based (i.e. from the EPA and EGRID), this inventory tool could help DKU get an idea of the types of data measured by Duke to evaluate its carbon emissions and consider developing a similar set of data to track, making the results of their inventory more comparable and compatible to that of Duke University. This could also streamline the possible integration of DKU’s performance into Duke’s emissions reduction tracking and evaluation.

Data-driven Campus Recommendation #2: Utilize student labor and projects to gather data and evaluate environmental performance

This recommendation relies on the first theme of student engagement, where project-based learning courses or participation in student sustainability networks could contribute to building a data-driven campus. It is recommended that DKU first identify sustainability-related areas of its campus that lack data and that may be difficult or time-consuming for the Operations staff to collect themselves. The operations office could then create data collection teams by recruiting students who are interested in contributing to the university’s efforts to reduce its environmental impacts.

The research team recommends DKU to first consider the metrics included in Duke University’s Strategic Sustainability Plan (SSP) and identify which measures would require more manpower for data collection at DKU. The SSP metrics are specific to reducing the university’s environmental impact and creating a more sustainable learning and living space for its community. Some ideas of data-collection projects from these metrics include: conducting surveys on commuting modes with the DKU community to help evaluate its transportation impact, conducting waste auditing to identify the pounds of landfill per person at DKU, and
working with individual dining services on campus to identify how and where the campus food is grown (Duke Sustainability 2016a).

HKUST has conducted similar projects with the help of its students. Led by the Sustainability Unit, students came together in 2014 to conduct a waste audit. This project enabled the dining hall caterers at HKUST to realize their true environmental impact as the students discovered that approximately 83% of the university’s total waste came from food waste of the caterers’ kitchens. This audit paved the way to further discussion on the potential solutions on food waste reduction.

VI. Limitations

The results and recommendations of this study are based on a limited set of perspectives from the interview participants from HKUST and a review of literature and other material culture. Any further research should continue compiling interview and survey data that will contribute to the robustness of this case study. This could be done through additional interviews with faculty and staff members, and even with students, to study the observed challenges and recommendations of implementing a strong campus sustainability program. In addition, due to timing and the current transitional nature of the campus, the team did not have the opportunity to work with DKU’s own university community. Further studies should include an in-depth look into DKU community’s vision and unique perspectives on campus sustainability development.

One of the initial objectives of this project was to conduct a full inventory of Duke Kunshan University’s carbon emissions to identify the major environmental impacts of its campus and to estimate its future emissions based on this baseline data and the university’s plan to expand. However, after much discussion with DKU staff, the research team agreed not to calculate an inventory. It proved to be quite difficult to compile the necessary data due to the time constraint of the university’s faculty and staff, who are currently focused on the successful launch of DKU’s undergraduate degree program. Moving forward, the research team believes that a
greenhouse gas inventory will be a valuable and necessary tool for DKU in setting a strong foundation for sustainability initiatives on campus. An emissions inventory would not only help the university learn about its major impacts, but also provide a starting point and motivation for emissions reduction actions on campus.

VII. Conclusion

Based on a case study of Hong Kong University of Science and Technology’s sustainability program, and a review of supporting literature and material culture, this study provides recommendations to Duke Kunshan University in its initial steps of developing a campus sustainability strategy. The following eight recommendations are based under the themes of student engagement, institutional commitment, a data-driven campus, and sustainable education development:

Student Engagement
1. Develop project based sustainability courses that tackle campus and community challenges
2. Develop student sustainability networks

Institutional Commitment
3. Develop definitions of sustainability specific to DKU.
4. Establish sustainability representatives across the institution’s structural units

Sustainable Academic Development
5. Develop inventory of existing courses and research projects with sustainability elements
6. Provide incentives for faculty to develop new courses and research projects with sustainability elements

Data-Driven Campus
7. Develop key sustainability metrics and start tracking to create a baseline for the university’s overall performance
8. Utilize student labor and projects to gather data and evaluate environmental performance

As DKU continues to build its physical and academic infrastructure, these recommendations will
be important considerations to make when strategically deciding on key sustainability actions. The hope is for this study to serve as a starting point for further studies on sustainable development at DKU and other higher education institutions looking to develop a resilient and sustainable campus.

VIII. Acknowledgements

We want to express our gratitude to the Sustainability Unit at HKUST for hosting us in Hong Kong and for connecting us with our interview participants, and we greatly appreciate the time and insight provided by our interview participants, the HKUST faculty and staff. We also want to say thank you to Dr. Prasad Kasibhatla, our master’s project advisor, and Tavey Capps, the Director of Sustainable Duke, who walked us through this project and offered us invaluable help.
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IX. Appendix

Appendix A. Verbal Consent Agreement for Sustainability Unit Staff

Hello, thank you again for agreeing to participate in an interview with us. As you know, we are both master’s students from Duke University here to conduct interviews for a case study on HKUST’s sustainability program. The purpose of this research is to learn more about the program and your role as a sustainability unit staff member. Your participation is completely voluntary. You can skip any question you do not want to answer to stop the interview at any time for any reason. With your permission, we would like to identify you by your name and your official role in our case study and final master’s project. However, it is not essential for us to have your name for the purposes of our project, so please let us know if you prefer that we do not use your name or title. Participating in this interview will not include any foreseeable risks or result in any direct benefits to you. We will be sharing data in our master’s project in the form of a presentation at Duke University, a final report, and a website, all of which will be available to the public. The interview should take about 20-30 minutes to complete, and if you have any questions about our study afterwards, please feel free to contact us at helena.rhim@duke.edu or handi.ma@duke.edu. You can also contact our advisor, Dr. Prasad Kasibhatla, at psk9@duke.edu with any questions or concerns. Do I have permission to audio-record the interview so that we can keep track of what you said afterwards? We plan on creating a transcript with the recording to accurately keep track of the content of this interview. The transcript and the recording will be kept indefinitely. If you prefer that we not, that is perfectly fine.

Appendix B. Sustainability Unit Staff Interview Guide

1. Could you tell us about your role within the Sustainability Unit?
   a. How long have you had this role?
   b. What are your key responsibilities?
   c. How has the position changed since you started?
2. What does campus sustainability mean to you?
3. Do you have any previous experience related to sustainability?
4. We are interested in learning more about HKUST’s efforts under these four areas of sustainability: operations, administration, education, and research. Could you tell us about any current initiatives under these four areas?
   a. Who initiated these efforts and how were these individuals motivated?
   b. What were some of the challenges in advancing these efforts?
c. How has the HKUST community reacted to and engaged with these initiatives?
   i. Have these reactions and perceptions of campus sustainability changed over time?

d. How do you evaluate the progress on these efforts?

e. Would you say these efforts have been successful so far?

f. How are these efforts being funded?

g. In what area(s) do you see the biggest room for growth and improvement?

5. How do you evaluate the program as a whole?
   a. What would you say are the biggest challenges to introducing sustainability efforts at UST?
   b. Have there been any impacts from the program on the local community outside the campus?

6. How has HKUST’s relationships with other departments within the university and other institutions (e.g. other universities, the local government) impacted the development of these efforts/campus sustainability as a whole?

7. What are the short-term and long-term priorities for the Sustainability Unit?

8. What are your thoughts on bringing sustainability projects to universities in China?
   a. Do you know of any campus sustainability initiatives happening at other Chinese universities?
   b. What would you say are the biggest challenges to introducing sustainability efforts to Chinese universities?
   c. Do you have any suggestions or advice on how to better implement sustainability initiatives at other Chinese universities?

9. Is there anything else you would like to share with us?

Appendix C. Verbal Consent Agreement for General Faculty/Staff

Hello, thank you again for agreeing to participate in an interview with us. As you know, we are both master’s students from Duke University here to conduct interviews for a case study on HKUST’s sustainability program. The purpose of this research is to learn more about the existing sustainability efforts at the university and about your views on these efforts. Your participation is completely voluntary. You can skip any question you do not want to answer to stop the interview at any time for any reason. With your permission, we would like to identify you by your name and your official role in our case study and final master’s project. However, it is not essential for us to have your name for the purposes of our project, so please let us know if you prefer that we do not use your name or title. We will be sharing data through our master’s project in the form of a presentation at Duke University, a report, and a website, all of which will be available to the public. The interview should take about 20-30 minutes to complete, and if you have any
questions about our study afterwards, please feel free to contact us at helena.rhim@duke.edu or handi.ma@duke.edu. You can also contact our advisor, Dr. Prasad Kasibhatla, at psk9@duke.edu with any questions or concerns. Do I have your permission to audio-record the interview so that we can keep track of what you said afterwards? We plan on creating a transcript with the recording to accurately keep track of the content of this interview. The transcript and the recording will be kept indefinitely. If you prefer that we not, that is perfectly fine.

Appendix D. General Faculty & Staff Interview Guide

1. Could you tell us about your role here?
   a. Could you briefly introduce your office?
   b. What are your key responsibilities?

2. Have you incorporated sustainability into any of your [courses, research and/or projects in your department]?
   a. Who initiated these efforts?
   b. How were these efforts implemented?
   c. Were there any significant costs or barriers to implement these efforts?
   d. How would you measure the success of these efforts?
      i. How have students/faculty/staff engaged in and responded to these initiatives?
   e. Do you have any plans on adding or expanding such efforts in the future?

3. We are interested in learning more about UST’s efforts under these four areas of sustainability: operations, administration, education, and research. (Your work would fall into ____.) Do you know of any sustainability initiatives happening on campus within these areas, outside of your own work? If so...
   a. Who initiated these efforts?
   b. How were they implemented?
   c. Were there any significant costs or barriers to these efforts?
   d. What are your thoughts on these initiatives?
   e. How have you engaged in these efforts?
   f. What other initiatives would you like to see happen on campus?

4. What would you say are the biggest challenges to introducing sustainability efforts at UST?

5. What are your thoughts on bringing sustainability projects to Chinese universities?
   a. Do you know of the campus sustainability initiatives happening in other universities? If so, would you care to elaborate?
   b. Do you have any suggestions or advice on how to better implement sustainability initiatives at other Chinese universities?
6. Is there anything else you would like to share with us?

Appendix E. Node Structure for Data Analysis on NVivo 11

Appendix F. HKUST’s Campus Sustainability Initiatives Under Administration

5-Year Strategic Plan 2020
The 5-Year Strategic Plan 2020 outlines five strategic objectives aimed to improve HKUST’s administrative support system. One of the five key objectives is to be “an exemplar of best-in-class standards, practices, and operations, as an agile and effective organization.” (HKUST 2015a) This strategy seeks to develop a sustainable campus through its education system, operations, and community work both within the university and with the wider community. The plan embeds sustainability into the university’s long-term vision of being a global leader in education, research, and innovation and entrepreneurship.

2020 Sustainability Challenge
The 2020 Sustainability Challenge includes the university’s short-term priorities that will contribute to its long-term vision of having a carbon-neutral and zero-waste campus with a net positive environmental impact as a “living laboratory” for experiential learning. By 2020, HKUST seeks to reduce its greenhouse gas emissions by 10% and waste by 50%, using AY2013-2014 as the baseline. To achieve these targets, the challenge involves four areas of focus: an education goal, operations goal, demonstration goal, and community goal (HKUST Sustainability 2017a).
(1) **Education goal**: HKUST seeks to set up an education and research framework for sustainability by 2020. Some of the strategies to reach this goal include improving support networks for faculty to build sustainability curriculum, promoting existing sustainability-related courses, and hiring faculty who focus on sustainable education and research.

(2) **Operations goal**: The University’s main priority is to reduce its GHG emissions and waste.

(3) **Demonstration goal**: To facilitate showcasing of sustainability research projects at HKUST

(4) **Community goal**: To work as a “social backbone” to support and facilitate sustainability initiatives within the campus.

**Hong Kong Sustainable Campus Consortium (HKSCC)**
HKUST is a member of the HKSCC, a consortium that was established in 2010 as group of eight publicly-funded Hong Kong universities that work together towards sustainable development in the higher education sector (HKSCC 2017). Members of HKSCC meet regularly to share and discuss ideas on sustainable practices, and are able to use their combined decision-making power to improve, for example, the terms and requirements of purchasing agreements. The consortium also works with the Hong Kong government to receive feedback and comments on the initiatives of these universities and for the government to share its own sustainable development strategies.

**Sustainability Policies and Guidelines**
HKUST has a strong set of university policies and guidelines to support sustainable development on campus. As of the release of this report, the ESSCOM committee has been working to update university policies and guidelines to facilitate active involvement in reaching agreed upon sustainability targets. Four key sustainability policies and guidelines include: the Sustainability Guidelines, Mobility Policies, High Performance Building Standards, Sustainable Catering Policy, and the Task Force Report on Sustainability Purchasing. In addition to these policies and guidelines, ESSCOM is currently developing a policy on green building renovation and green labs policies.

- **The HKUST Sustainability Guidelines** was developed by the Sustainable Operations Executive Committee (ExCo) to provide students, faculty, and staff with instructions on sustainable operations measures on campus. This guideline focuses on instructing offices on how to best integrate sustainable practices, principles and guidelines for green office purchasing, and guidelines for waste reduction from campus events (HKUST Sustainability 2017c).

- **The Mobility Policies** document is a simple set of four major priorities of the university. HKUST seeks to improve the pedestrian access, commits to convert campus fleet to electric vehicles, improve accessibility for those with disabilities or limited mobility, and to sustainable transportation (HKUST Sustainability 2017d).

- To contribute to the targets for greenhouse gas emissions and energy reduction (by 10% below 2013-14 levels by 2020), the **High Performance Building Standards** identifies the “minimum level of design and requirements for all capital projects” that should also be included in the requirements of any new building projects (HKUST Sustainability...
- The **Sustainable Catering Policy** is currently in draft form. Once completed, it will be enforced by the HKUST Campus Service Office and will apply to all regular caterers and caterers who service events on campus. The current draft of this policy organizes specific requirements under three main emphasis points: (1) healthy and sustainable lifestyles, (2) waste and energy reduction, and (3) student learning experiences (HKUST Sustainability 2016).

### Appendix G. HKUST’s Campus Sustainability Initiatives Under Operations

HKUST has various operational activities currently in place, and the existing sustainability initiatives on campus can be divided into two categories: technical and non-technical. Technical initiatives involve upgrading technologies (e.g. installing solar panels) and non-technical initiatives focus on the change of human behaviors (e.g. rideshare scheme, reusable containers). Technical changes are mostly implemented by the Facility Management Office (FMO) and typical activities include actions such as installing motion-sensitive devices inside buildings to control the air conditioner and lighting systems, running seawater inside the pipes to cool down the air, purchasing recycled paper. Non-technical activities are more common on campus, such as doing food waste auditing, recycling and gardening, most of which are projects initiated by the Sustainability Unit, some with the help of the Green Team (detailed below). Signature initiatives are as follows.

#### The Sustainability Network

The Sustainability Network was formed under the 2020 Sustainability Challenge Community Goal (HKUST Sustainability 2017a), this community-oriented network was built to support and advance sustainability efforts across campus. It includes a Green Team to work on group projects, a Gardening Club to help beautify the campus, and a Sustainability Lunch & Learn series for staff to get the news on best practices.

The Green Team is a voluntary group of over 100 students, faculty, staff and community members who have interest in building the campus in a more environmental-friendly, sustainable way. They organized several projects on campus that could involve the whole community into living the sustainable way, such as promoting people to use reusable containers to cut down the consumption of disposable material. They also offered a small reward for people who use that containers in the canteen, as an incentive for people to take part in the activity and aim at slowly changing their habits in a natural way. The projects were facing challenges and further improvement but those demonstrated the University’s determination on converting sustainable ideas into actions.

#### Waste Auditing

Led by the Sustainability Unit, together with the help of students and caterers, HKUST did a thorough waste auditing on the total solid waste generation from kitchen and post-consumption
areas, including food waste, recyclable materials and general trash. They found out that around 83% of the total waste generated come from food waste (HKUST Sustainability 2015).

**Recycling**
In 2014, a student group conducted a project on campus recycling habits. From this experience, students got the idea of the most important influencers for recycling: “belief that recycling makes a difference to the environment” and “awareness of recycling bins on campus.” And the team made recommendations that included increasing the number of recycling bins, developing signage to improve their visibility and posting campaign-style messages on campus to promote students’ action to recycle. The university was able to recycle 99 tons in total from 2014 to 2015, which accounted for almost 4% of total waste generated (HKUST Sustainability 2015).

**Student Hall Check Out Campaign**
In the student hall, a hall checkout campaign is held to enable the check-out students to give away their useful stuff to each other or to the newcomers. What’s left would go to charity or to landfill depending on their ability to be used again. Initiated by the Student Housing and Residential Life Office, this event has reduced the amount of waste by collecting 200 kg of clothing, 500 items of stationeries, 100 items of electrical appliances and 1000 books in total during 2014-15 (HKUST Sustainability 2015).

**Greening the Buildings**
All the current buildings inside HKUST campus have achieve the Hong Kong BEAM (Building Environmental Assessment Method) Gold certification. Technical initiations installed inside each building include occupancy/vacancy sensors for lighting system, greater centralization A/C systems, infra-red operating water taps, dual flush cisterns, energy meters, etc. Implemented and supervised by the FMO. The new incoming buildings are pursuing a higher standard – BEAM platinum certificate. In addition, what comes as a natural advantage for the university is the ability to use the surrounding seawater to cool the air circulating inside the buildings, a way to decrease the electricity consumption.

In the student residence hall, green roof was built on top of Student Hall VIII and IX to absorb heat, thus lowering the incoming heat temperature. Solar panels were also installed on these newer buildings to absorb solar heat to preheat incoming city water for the use of student shower, meanwhile reducing the use of electricity. Students also proposed to turn off half of the lighting during daytime when less residence are inside the buildings.

In addition to all the above major sustainability initiatives on campus, the interview participants have also mentioned several others, such as ride-sharing scheme which aims at reducing the greenhouse gas emission on campus; promoting the use of reusable containers, which subsidize the user group in order to cut down the disposable waste that would be generated otherwise.

Students were also engaged in efforts outside the university wall. There was once a program called “Green Ambassador” which initiated students joining sustainability activities in other communities outside Hong Kong. Student teams have gone out to Taiwan and South Africa to learn about their sustainability environment, conservations efforts and even worked with local
government and NGOs, which broadened the eyesight and injected more passion into the participants to build a sustainable campus for themselves. This program came to an end after the sponsorship stopped.

Also, small daily actions such as printing on both sides, using recycled printing paper, turning off lights and computers when people are absent, those are the things one cannot ignore that help shape the overall sustainability landscape in the HKUST community.

Appendix H. HKUST’s Campus Sustainability Initiatives Under Research

As an international research university, HKUST has got top-notch researchers to develop their projects in diverse fields. Just in AY 2014-2015, 69 environment-related research projects were conducted at HKUST, gaining over HK$50 million in funding (total research projects funding was HK$21.8 million) (HKUST 2015b). Campus sustainability topics such as food waste management, green building, green transportation, and green communications were included in those projects. And another two proposals led by HKUST researchers were granted HK$33 million each by Hong Kong’s Research Grants Council (HKUST 2016b), showing the University’s endeavor towards research on sustainability. And the partnership with Ford Motor Company provided environmental sustainability research grants for 20 master students.

In focusing on the sustainability research and education in HKUST, the University have founded five strategic research areas – sustainability being one of them (HKUST 2015a), was facilitated by the cluster hiring of faculty as well as a substantial knowledge transfer system to enlarge its impact in the community.

The University is also dedicated the campus to being a “living lab” for its community, through sustainable practices and experiential learning. Green practices initiated by students are reported online and sent to the community through SafetyWise newsletters. Topics including paper saving, laboratory decommissioning, vehicle emissions tests, etc. (HKUST 2016c)

Also, according to the sustainability report from 2014 to 2015 (HKUST Sustainability 2015), highlight researches were conducted such as the development of low-cost and environmentally-friendly solar cells, a mini pulsed electric field device which could reduce more than 90% of bacteria in tap water, an aluminum composite that can be applied to safer and more energy-efficient construction. All those achievements got great potential in being transferred into reality and solving real-world sustainable problems. And according to the director of FMO, some students were working on computer modeling of the potential application with solar panel, which might be used in one of the new buildings underway.

Student teams led by their professors have gone beyond the campus as well. As was shared by a research assistant in the Social Science School, one of their research projects was to help third parties such as the Ocean Park to incorporate sustainability messages into their programs towards tourists. This is a case that reflects the influence HKUST community could have on other sectors.
Appendix I. HKUST’s Campus Sustainability Initiatives Under Education

Sustainability education framework
In AY 2015-2016, HKUST set the goal to establish educational and research framework in sustainability education by 2020. It has taken a first step by establishing an undergraduate course called “Introduction to Sustainability” which was launched in Fall 2016 and is offered jointly by the different schools at the university. This course provides a broad overview of issues related to sustainability and review the “contributions of science, engineering, business management, the social sciences, and humanities to understanding and resolving these issues” (HKUST 2017b).

Blended Learning
As a part of the university’s Center for Education Innovation (CEI), HKUST has begun to introduce credit bearing “blended learning” courses that combine online teaching and face to face discussions (HKUST Center for Education Innovation 2017). Blended learning courses allow students to learn the fundamental materials online, then apply it through interactive in-class activities and discussion. These courses were designed to enhance students’ learning experience by allowing flexibility of time, location, and speed of learning. As of Feb 2017, HKUST offers four blended learning courses within the Division of the Environment that pertain to sustainability: “Green Buildings and Energy Management,” “The Sustainable Citizens,” “ESG Management and Reporting,” and “Climate Change, Sustainability and Big History.”

Cluster Hiring
Tied to establishing both the education and research framework, the university is beginning to hire faculty in clusters under the five established strategic areas: Data Science, Sustainability, Autonomous Systems and Robotics, Public Policy, and Design Thinking and Entrepreneurship (HKUST 2015a). These five strategic areas were agreed upon through a consultative exercise across all 20 academic departments and divisions, and hiring faculty members in clusters under these areas is a way for the university to strengthen its research and education capability and to emphasize the importance of cross-disciplinary initiatives and research.
## Appendix J. DKU General Campus Facts

Provided by the Assistant Director at Duke University’s Office of Project Management

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<tr>
<th>Description</th>
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<tr>
<td>Population of Shanghai</td>
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**ACADEMIC BUILDING**
- 300-seat auditorium with green room
- Four 90-seat classrooms
  - two “U” shaped
  - two “semi-circle” (one with TelePresence capability)
- Four 36-seat seminar rooms
- 42 six-seat team rooms
- Three eight-seat conference rooms
- Library (temporary)
- One Executive Board Meeting Room (24 seat)
- Student Dining Area (134 seats)
- Executive Dining Area (184 seats)

**CONFERENCE CENTER**
- 182,000 sq ft
- 197 guestrooms and 20 suites
- Two conference rooms (30-50 people)
- Eight team rooms (8 - 12 people)
- Dining–dining room, coffee shops, bar, etc.
- Six Lounges Meeting spaces
- Fitness center & locker rooms
- Outdoor Terrace

**STUDENT DORMITORY**
- 200 Beds
  - 12 ADA Equipped beds
  - 38 Double Room beds
  - 149 Single room beds
  - 1 Resident Assistant Apartment
- Café and 3 Student Lounges
- 8 Team Room Spaces
- Laundry
Bicycle Storage rooms

**FACULTY RESIDENCE**
16 Apartment Units
- 8 - One Bedroom Units (one level)
- 4 - Two Bedroom Units (two level)
- 4 - Two Bedroom Units (two level)
Faculty Lounge
Fitness Center
Main Office
Landscaped Courtyard

**SERVICE BUILDING**
Utility Services (HVAC, Fire Sprinkler, Fine Water)
Data Center and Command Center
Mail Room
Student Clinic
Mechanic’s and Landscaping Shops
Facility Manager’s Office
Security Office

**INNOVATION BUILDING  (coming in 2017)**
Laboratory Space
Faculty Offices
Library (permanent)