



Educating for Sustainability

2017 SUSTAINABLE CAMPUS BEST PRACTICES
FROM ISCN AND GULF UNIVERSITIES

THE INTERNATIONAL SUSTAINABLE CAMPUS
NETWORK (ISCN) IN COLLABORATION WITH
THE GLOBAL UNIVERSITY LEADERS FORUM
(GULF) OF THE WORLD ECONOMIC FORUM



ISCN
International Sustainable Campus Network

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Foreword



ISCN
International Sustainable Campus Network



*René Schwarzenbach, President of the Board of the International Sustainable Campus Network (ISCN), and
Guido Schmidt-Traub, Executive Director of the UN Sustainable Development Solutions Network (SDSN)*

The top universities of the world—many of them members of global networks such as ISCN, SDSN, Global University Leaders Forum (GULF), or International Alliance of Research Universities (IARU)—urgently need to strengthen their efforts to solve the pressing problems of this planet. These challenges are laid out succinctly in the 17 Sustainable Development Goals (SDGs) that were recently adopted by all 193 member states of the United Nations.

The global higher education sector has a tremendous opportunity to lead the world in sustainable development research, promotion of solutions, and support for implementation. To mobilize universities in furthering the SDGs, the ISCN and SDSN plan to work more closely together. While the ISCN focuses on promoting sustainability at universities themselves, the SDSN works at the interface between academia and society. Both networks put significant effort into promoting sustainable development in higher education and can thus strengthen their efforts in unison.

In our opinion, it is time for the academic community to seriously rethink and redefine its role in society and in sustainable development efforts. This may require changes in how universities conduct operations, teaching, and research with a stronger emphasis on contributing to the aims of the SDGs.

To date, universities' support for sustainable development has primarily focused on campus design and operations. Less attention has been given to solutions-oriented research, related policy challenges, or practice-focused education of students. More than ever, holistic and cross-disciplinary initiatives are needed to link academic and operational excellence into a truly sustainable learning environment and experience.

Solutions-oriented sustainability research will require more inter- and transdisciplinary approaches. This presents a challenge to today's academic system, which does not tend to favor such endeavors. Scientists and academic institutions are still primarily evaluated, valued, and ranked based on simple quantitative bibliometric indicators that emphasize individual, mostly disciplinary, productivity. We need a cultural change to reward, not punish, academics engaged in inter- and transdisciplinary research, particularly young scientists. This does not infer by any means that disciplinary research should become less valued, but it requires that universities expand and broaden their evaluation and incentive system. However, this can only be accomplished when the top universities in the world jointly agree to foster this cultural change.

By including sustainable development in the strategic goals for all their activities, universities can create an environment that promotes holistic education of all students. To complement professional and disciplinary education, they can expose students to the practical problems that must be solved in order to achieve the SDGs. They can foster the acquisition of critical, systems-oriented thinking as well as the ability to communicate with various stakeholders within and outside academia. Included in this report are the results of a corporate-university dialogue conducted by ISCN members, which shows how important such personal skills are for large firms hiring young academics.

This 2017 WEF ISCN-GULF report describes the initiatives of member universities to educate all their students on sustainability issues. The approaches highlighted vary in scope from the whole institute, a research focus, integration into the curriculum, and collaborations to address global issues. We hope the case studies in this report inspire other universities to adopt the SDGs and sustainable development as central themes of their mission. Our networks look forward to working with you as you embark on this exciting journey.

René Schwarzenbach

Guido Schmidt-Traub

Executive Summary

Zena Harris, Executive Director, International Sustainable Campus Network (ISCN)

“Educating for Sustainability” is the focus of this year’s ISCN-GULF report. The work of both the International Sustainable Campus Network (ISCN) and the Sustainable Development Solutions Network (SDSN) has made it apparent that education underpins the transformation of our society toward a more sustainable future. This is reflected in the transdisciplinary studies that universities are introducing to break down silos and educate students to handle the challenges we face as a global society.

The World Economic Forum outlines five priorities for the 2017 meeting including preparing for the convergence of technology and humanity (or the “fourth revolution”), strengthening governance in our global systems, revitalizing global economic growth, reforming market capitalism, and inspiring optimism and trust through positive narratives.¹ As all sectors and society consider and embrace these priorities and adapt to our shifting global economic, social, political, and environmental climate, the higher education sector serves as the catalyst to prepare students to strengthen and contribute to a sustainable future.

Our higher education institutions must keep pace. The ISCN working group focused on university-corporate dialogue provides a synthesis of interviews with corporate leaders on the skills needed for graduates to excel in their next phase of life, whether it be public or private sector.

This report hosts a collection of case studies from members of ISCN and the World Economic Forum’s Global University Leader’s Forum, all focused on ensuring that students are exposed to the concept of sustainability during their time on campus. The institutional approaches highlighted vary in scope and are addressed in chapters on whole-institute integration, research for sustainability, sustainable development across the curriculum, and collaborations to address global issues. The breadth of the case studies demonstrates the complexity in approach and effectiveness of educational models both in the classroom and through experiences on campus to shape young leaders for a sustainable future.

Whole-institution approach to educating for sustainability

Engaging the whole institution maximizes the impact of not only educating students on sustainability but also faculty and staff, and shows how this subject can be cross-cutting, immersive, and in line with the institution’s mission.

At **Anglia Ruskin University**, sustainability is a required part of every degree program and is integrated into library resources, student art exhibitions, and volunteer programs. Similarly, **De La Salle University – Dasmariñas** firmly believes that educating for sustainability should not be confined to the classrooms or the curriculum. By integrating sustainability into the school’s practices and processes, it reinforces to the students that sustainable development is feasible and achievable through participation and collaboration.

At the **University of Edinburgh**, the whole institution is engaged through sustainable infrastructure developments, volunteering opportunities, sustainability awards, seed funding for sustainability projects, academic initiatives, internships, and more.

Demonstrating the breadth of sustainability, the **University of Gothenburg** hosts the SDSN Northern Europe post-grad course “Music College” (an orchestra with refugees), offers a master’s program in global health, provides a toolbox to integrate sustainable development into courses and faculty activities, and features a Student Sustainability Office.

Monterrey IT redesigned their education model to prepare students for next generation skills through immersive learning. Extracurricular learning and living lab approach links academic learning to campus operations and sustainability in 110 courses at **Princeton University**. Additionally, Princeton piloted a student-initiated seminar in 2015-2016 called “Investigating an Ethos of Sustainability at Princeton” a first course of its kind.

As a statement on campus, **Stuttgart University of Applied Sciences** has created a center for sustainable development that works in five focus areas: teaching, research, operations, transfer, and governance to empower students as change agents. To raise awareness and touch students from multiple angles, **Thammasat University** has added new courses

¹ World Economic Forum, “These are our 5 priorities for Davos 2017. Here’s how you can have your say” (<https://www.weforum.org/agenda/2016/12/davos-world-leaders-get-involved>).

related to Sustainable Development Goals, created campus initiatives such as solar panel installation, bike sharing, and a recycle shop to integrate sustainability through both passive and active learning.

At **Yale University**, the Yale Sustainability Plan 2025 highlights several ambitions including Leadership, Empowerment, Health and Wellbeing, Climate Action, Stewardship, Built Environment, Mobility, Materials, and Technology. These ambitions strongly support the university's mission statement of "improving the world today and for future generations through outstanding research and scholarship, education, preservation, and practice," and uphold President Salovey's commitment to a more unified and inclusive Yale.

Research for sustainability

Research and experimentation are fundamental to learning and universities are creating and providing space and programs for thought and exploration to flourish.

At the **University of British Columbia**, the SEEDS (Social Ecological Economic Development Studies) Sustainability Program has created partnerships between 6,500 students, faculty, and staff to enable hundreds of innovative and impactful sustainability projects. These projects address university sustainability priorities by engaging the Campus as a Living Lab, and supporting the integration of academic and operational work on sustainability.

Chalmers University of Technology has created "Challenge Lab," a transformative and integrative space for students to conduct sustainability-driven research with support from multidisciplinary staff. The **University of Campinas (UNICAMP)** utilizes a student-driven mapping workshop on campus to identify locations as being "potentially sustainable" versus "environmentally negative" in order to improve living space.

Since 2011, **KTH Royal Institute of Technology** has been integrating sustainable development into engineering and architecture programs by using a self-assessment survey tool and providing support for all program directors and teaching staff to achieve the set goal.

To integrate sustainability into financing, **McGill University** has developed the Sustainability Projects Fund (SPF), which provides seed-funding and advice to interdisciplinary projects at McGill in order to build a culture of campus sustainability that contributes to the university-wide sustainability strategy.

Engaging staff and students is one approach the **University of Oxford** uses to identify projects that could reduce carbon emissions across campus and support the university's Carbon Management Strategy. Ideas are proposed to a panel of experts and several are chosen to undergo further development.

The **University of Siena** has developed the SANTA CHIARA LAB, an innovation hub based on the spirit of multidisciplinary and transdisciplinary intellectual inquiry to explore new perspectives at the frontiers of knowledge.

Sustainability across the curriculum

Integrating sustainability across the curriculum provides numerous channels through which to influence students directly. Universities are capitalizing on these opportunities by focusing integration both through specific disciplines and through broader whole-degree programs.

New at **Ecole Polytechnique Fédérale de Lausanne (EPFL)**, the Global Issues course for first-year science and engineering students covers topics such as health, food, mobility, energy, climate, and communication derived from reports produced by the United Nations and the World Bank.

Focusing on education for the built environment, the **Pontifical Catholic University of Peru** has created the LEED lab course, a multidisciplinary immersion course that utilizes the built environment to educate and prepare students to become green building leaders and sustainability-focused citizens.

The **Hong Kong University of Science and Technology** has developed Introduction to Sustainability (SUST1000), integrating the principal contributions of science, engineering, business management, social sciences, and the humanities to sustainability, a truly broad perspective that crosses all disciplines.

Furthermore, **The University of Hong Kong** is committed to responding purposefully to the challenges identified by the United Nations through the Sustainable Development Goals (SDGs) and to play an active part in addressing the issues of inequality, health, education, disaster prevention, poverty, environment, and well-being through its teaching and learning experiences. To achieve this, their Common Core courses are mapped against the 17 SDGs.

All students at **Nanyang Technological University** must take a mandatory class on sustainability in their first year and are exposed to the concept in subsequent years through each department's curriculum. Furthermore, NTU has created the Interdisciplinary Graduate School (IGS), the first of its kind in Asia, which focuses on three thematic research programs: Sustainable Earth, Secure Community, and Healthy Society.

The **University of Geneva** has created a master's degree program in urban and regional development that brings together expertise in geography, architecture, landscape architecture, sociology, urban and regional economics, law, and geographical information systems. All these allow students to get a ready-to-use set of skills and competencies for their working life.

Embedded in its School of Design and Environment, **National University of Singapore** offers master's degree programs focused on architecture, industrial design, and building and real estate, with tailored curricula to equip students with a broad and multi-disciplinary understanding of sustainability in the built environment.

Recognizing that business is focusing more on sustainability, **Ozyegin University** has created an education program on "sustainability for business" through a course open to all students, a certificate program, and private sector training.

With a sector focus on agriculture, the **Università degli Studi di Torino** has developed a master's program on sustainable agriculture and agro-food networks with a focus on access to food in sufficient quantity and quality and reduction of ecological impact through a redesign of the agricultural sectors—a challenge for the coming decades.

Furthermore, **Leuphana University of Lüneburg** is addressing real-world problems in its "glocal" curriculum, which combines local learning with global engagement through a Global Classroom project. Undergraduate students from Germany and the United States work together on urban sustainability issues by bringing together local learning, engagement, and impact with global communication, collaboration, and knowledge production.

Collaborations to address global challenges

Sustainable development collaborations strengthen and expand sustainability perspectives and education, and offer the opportunity to increase the sphere of influence that students and universities have on global issues.

Carnegie Mellon University demonstrated the importance of bringing stakeholders together by hosting a student-led Sustainability Weekend Conference to spark conversations between CMU students and stakeholders on a breadth of sustainability issues such as resiliency, activism, public art, women's health, and environmental justice.

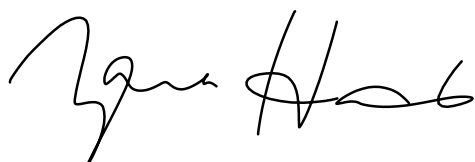
Additionally, the **Korea Advanced Institute of Science and Technology (KAIST)** hosted events related to their Energy, Environment, Water, and Sustainability interdisciplinary programs and their KAIST Graduate School of Green Growth (GSGG) to address the important issues for sustainable society students and world-renowned climate and energy policy makers and scholars.

As part of ETH's transdisciplinary studies, students at the **Swiss Federal Institute of Technology (ETH Zurich)** worked on solutions to the urgent waste problem in the Seychelles, along with their counterparts from the University of Seychelles and representatives from the local authorities, businesses, NGOs, civil society, and government.

To punctuate the dynamics of sustainability collaboration is the collaborative design and development of the Innovation and Technology for Development Centre at the **Technical University of Madrid (itdUPM)** in Spain, an example of an inter-disciplinary, multi-actor working space that is underpinned by the principles of transdisciplinary, co-generation, and community involvement.

The ISCN-GULF Sustainable Campus Charter was ratified in 2010 at the GULF meeting at the WEF. Since 2011, ISCN has contributed exceptional case studies to this group as part of our mission to provide a global forum for the exchange of information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability into research and teaching.

The 30 cases within this report serve as inspiration to demonstrate the action-oriented approach to educating for sustainability at institutions around the world. The ISCN will continue this knowledge exchange at our annual meeting, ISCN 2017 *Climate. City. Campus*, co-hosted by the University of British Columbia and City of Vancouver, June 26–28, 2017.



Zena Harris

Corporate-University Dialogue on Sustainable Development in Education

*Göran Finnveden, Vice President for Sustainable Development, KTH Royal Institute of Technology, and
André Schneider, CEO, Geneva Airport and former Vice President, Resources and Infrastructures, EPFL*

The International Sustainable Campus Network (ISCN) work group on corporate-university dialogue is dedicated to pinpointing the sustainability-related skills general management leaders need to ensure that their decisions are based on integrated and holistic thinking and support the sustainable development of their companies. Our hypothesis is that while the skills needed by sustainability professionals and sustainability technical experts are well supported by higher education offerings, there are significantly fewer resources available to develop the sustainability skills of the broader cohort of future leaders.

In this project, 13 interviews were conducted with executives in different parts of two major international companies, Ericsson and Nestlé. These included leaders of business units, sustainability, research and development, human resources, global affairs and sourcing. A workshop was also organized with sustainability directors (or equivalents) from major companies and organizations in Sweden.

In our interviews and workshop, two main issues were addressed:

- What skillset do managers/leaders need to make sustainable, holistic decisions?
- How can we support this skillset and fill the gaps in our universities' education programs?

Although there were varied nuances in the answers given by different stakeholders, a consistent general picture emerged. There is a need for sustainability professionals, but there is an equal need for sustainability skills amongst the general managers and leaders at different positions in companies. Hence, there is a strong wish to see our universities provide students with a more holistic education that incorporates sustainability training. A special point was also made on the need to include more soft skills, such as how to articulate and think critically about complex issues in the sustainability domain.

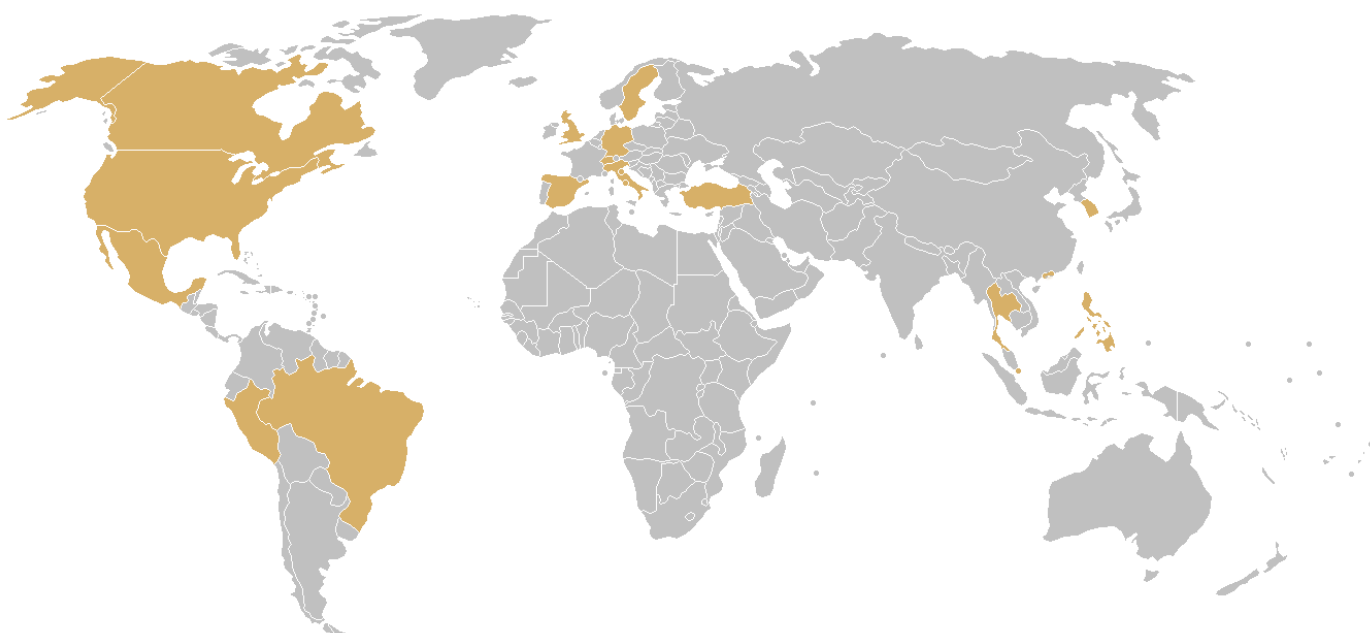
Four major groups of necessary sustainability skills emerged:

1. Critical thinking on complex issues (including system dynamics): understanding sustainability as a complex issue in interlinked systems (for example, different supply chain elements, differing interests by partner, multiple time horizons, business opportunities and threats related to sustainability, opportunities for innovation related to sustainability)
2. Articulating sustainability issues: communicating in an effective and engaging manner with partners inside and outside of the company about options to solve complex issues linked to sustainability
3. Understanding megatrends and global drivers: impacts of demographic shifts, climate change, food availability, and other global change issues on the company's value chain and operations
4. Literacy on key qualitative and quantitative sustainability issues: energy and greenhouse gas management, ecosystem services, community and stakeholder engagement, social infrastructure development, life-cycle management, sustainable supply chains, resource/capital flows, etc.

The relative importance of these four skillsets differed among different interviewees. Interestingly however, personal engagement on sustainability issues was generally ranked low.

When asked about how these topics should be taught, there was an emphasis on enhancing the integration of such topics into the existing curricula at the universities, but also co-developing classes between universities, companies, and NGOs and using such co-developed programs to concentrate on real-world problems—assuring that these classes transmit not only an academic point of view on these topics but also the viewpoint of companies and NGOs.

ISCN and GULF Universities Educating for Sustainability



30 cases | **18** countries | **750,000 +** students

Contributing to this report:

ISCN Members Only

Anglia Ruskin University, *United Kingdom*
Chalmers University of Technology, *Sweden*
De La Salle University – Dasmariñas, *Philippines*
KTH Royal Institute of Technology, *Sweden*
Leuphana University of Lüneburg, *Germany*
Monterrey Institute for Technology and Higher Education, *Mexico*
Nanyang Technological University, *Singapore*
Özyeğin University, *Turkey*
Pontifical Catholic University of Peru, *Peru*
Stuttgart University of Applied Sciences, *Germany*
Technical University of Madrid, *Spain*
Thammasat University, *Thailand*
The University of British Columbia, *Canada*
The University of Hong Kong, *Hong Kong*
Università degli Studi di Siena, *Italy*
Università degli Studi di Torino (UNITO), *Italy*
University of Campinas, *Brazil*
University of Edinburgh, *United Kingdom*
University of Geneva, *Switzerland*
University of Gothenburg, *Sweden*

Both ISCN and GULF Members

Carnegie Mellon University, *United States of America*
Ecole Polytechnique Fédérale de Lausanne (EPFL), *Switzerland*
National University of Singapore, *Singapore*
Princeton University, *United States of America*
Swiss Federal Institute of Technology in Zurich, *Switzerland*
University of Oxford, *United Kingdom*
Yale University, *United States of America*

GULF Members Only

McGill University, *Canada*
The Hong Kong University of Science and Technology, *Hong Kong*
The Korea Advanced Institute of Science and Technology, *South Korea*



Chapter One:

Whole-Institution Approach to Educating for Sustainability





Anglia Ruskin University

A Whole Institution Approach to Sustainability

Project Description: At Anglia Ruskin University we are acutely aware that our students are the leaders and decision makers of tomorrow. We believe we have a responsibility to equip them with the knowledge, skills and values they need to create a better and more sustainable future. Furthermore we believe that our students should be given the opportunity to experience and practice sustainability during the time they are with us. Sustainability therefore features significantly in our Corporate Plan and we have made a commitment to incorporate sustainability in every aspect of our students' university experience - from the formal and informal curriculum, to student life and activities. We also aim to be leaders in education for sustainability (EfS) in Higher Education, using our research to help drive innovation and change throughout our faculties and curriculum, and into other higher education institutions.

The paragraphs below outline some of the broad range of university-wide initiatives we have been engaged in during 2016, as part of our long term strategy for sustainability to be an integral part of students learning at Anglia Ruskin University.

Sustainability learning within and across subject disciplines.

Since 2014 our academic regulations have required sustainability to be part of every Anglia Ruskin undergraduate and postgraduate degree program. Our approach has been that this should not be as a 'stand-alone' topic but should be integrated within each discipline's core curriculum. We realize that there is an educational imperative for staff here too, who may not be aware of how their subject-specific expertise

intersects with sustainability or who do not feel confident in covering these connections in their teaching.

In order to support staff in embedding sustainability within their particular area of expertise and to ensure links between discipline content and sustainability are explicit to students, in 2016 we launched our 'e-library' of curriculum resources. These resources allow staff and students easy access to learning resources and materials which relate specifically to their own discipline and degree course. These resources are being included as case studies within lectures, as themes for tutorial discussions and as topics for student research.

We have also implemented a series of grants, prizes and paid internships to help support the development of student and staff awareness and knowledge of how their discipline intersects with sustainability. This year our Art Degree students have once again created a number of inspiring but also controversial pieces which provide a striking demonstration of how our students are applying their disciplinary expertise in a sustainability context. The 2016 winner of our Sustainability Art prize was 'Scar Tissue' a thought-provoking and powerful indictment of the harm inflicted on the environment through warfare. The piece is made up of a number of publicly available European Space Agency images which include evidence of bombing in the Syrian city of Aleppo. 'Scar Tissue' follows in the footsteps of our 2015 winner 'Lest we Forget Those Who Denied', whose 2m tall oil embalmed tombstone received national media attention.

Beyond the classroom we hosted 'Whole Earth?' an outdoor exhibition created by Mark Edwards in collaboration with the UK's National Union Students (NUS) and Students Organizing for Sustainability (SOS) aimed at teaching students and young people about the problems facing our planet and illustrate how they can become part of the solution. The exhibition also aims to provoke reaction, inviting students to challenge their University tutors to address sustainability as part of their teaching and account for their generation's guardianship of the planet. Student responses to the exhibition are currently being analyzed as part of a PhD thesis on sustainability leadership in UK Higher Education.

2016 at Anglia Ruskin University also saw the publication of the 'Gender Inequality' edition of our popular So What? Magazine. This publication showcases the University's sustainability and education for sustainability research in short easy-to-read articles. The e-magazine and 2000 print copies are widely distributed and read within the University and beyond and help students and others appreciate how sustainability research and education relates to their degree and their lives.

Practicing sustainability.

For over two decades our University's Chaplaincy has led our International Community Experience Initiative (ICE) which has taken teams of student volunteers to disadvantaged communities in Croatia, Ukraine and Botswana. These students have, for example, helped build and renovate orphanages and hospitals, spent time with their residents and helped enrich the lives of local children and adults. In 2016, and in collaboration with the University's Global Sustainability Research Institute we added a new initiative, Sustainable Sainji, which aims to make better use of students existing degree knowledge to help local communities. In August 2016 a team of students with a teaching or 'health' background spent two weeks in north-west India helping to improve the competence of local school teachers and the health and nutrition of children and adults in the community. Projects included showing teachers how to write lesson plans, delivering first aid training and encouraging the children and their parents to 'wash their hands with soap' as part of the UNESCO Global Handwashing Program. It was clear that, as well as providing practical help for the host community the trip was a transformational learning experience for all the students who took part. They told us they learned a

huge amount which was relevant to their future careers, gained a much better understanding of sustainability and how they could use their degree knowledge and experience to help create a better world.

Project Objectives: To make Sustainability part of all our students learning.

Learning Outcomes: Education about sustainability: students will understand the founding principles of sustainability as including environmental, social and economic aspects and be aware of how it relates to their chosen degree course.

Education for sustainability: students will understand and be able to critically reflect on how the knowledge and skills they develop within their chosen degree course can help them become responsible global citizens.

Education as sustainability: students will become sustainability literate making them more resilient and able to prosper in an uncertain future.

How did you define success? What can other institutions learn from your experience with this project? We will succeed when all our students, regardless of their degree course are able to appreciate how their subject intersects with sustainability and how they can use this knowledge to create a better world through their chosen career. That is, when they are consistently using the World of Work to Work for the World.

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Others involved with the project: Whole University



De La Salle University - Dasmaringas

BLACK OUT! GREEN IN! Educating for Sustainability Through Practice

BLACK OUT! GREEN IN! is an 10-year carbon emission reduction program of De La Salle University – Dasmaringas (DLSU-D) that was launched in 2011. The program is a response of the University to the impacts of climate change where the Philippines is considered to be one of the most vulnerable in the world. DLSU-D firmly believes that educating for sustainability should not only be confined in the classrooms or to the curriculum but should be vis-à-vis with its integration to the school's practices and processes thereby reinforcing to the students that sustainable development is feasible and can be done through participation and collaboration.

The program is two-fold – reduction of carbon-emitting practices and replacing it with green or sustainable habits. This is done in two stages. First is measurement of the University's carbon footprint coming from three sectors: Energy usage, transportation and waste production. This will be followed by carbon emission mitigation by sequestration (offsets) and by direct reduction by adopting green practices using four approaches (1) policy formulation and implementation, (2) process or engineering changes, (3) research and evaluation and (4) education.

In the past five years since the launching of the program, DLSU-D was able to:

1. Contribute to the national government's reforestation program by being able to plant more than 180,000 native Philippine trees in declared protected areas (carbon sequestration);
2. Adopt use of renewable energy in selected University areas and gradually replace lightings with more efficient systems reducing the carbon footprint in these areas by more than 50%;

3. Increase waste recovery from 42% in 2011 to 63% in 2015 and implemented measures that will adopt purchase of environmentally – preferable products;
4. Encourage use of bicycles and electric vehicles together with designating road networks only for pedestrians;
5. Conserve the University's biodiversity that contributed to the lessening of energy cost from ventilation systems;
6. Develop monitoring programs that encourage students and student organizations to practice sustainable lifestyle;
7. Increase frequency in the integration of sustainability in courses from various disciplines;
8. Raise awareness in environmental accountability of stakeholders by adopting schemes that promote "polluter's pay" principle.

For more details, information can be downloaded from <http://www.dlsud.edu.ph/PCN/index.html>

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University of Edinburgh

Supporting the student experience through social responsibility and sustainability

Project Description: The Department for Social Responsibility and Sustainability (SRS) supports the University in working towards this objective by providing students with a range of opportunities to enhance their experience. This paper sets out the department's current student engagement initiatives and highlights opportunities to further support the student experience.

Since the department was created in 2014, student engagement has been an important thread across all the department's strategic themes, this is reflected in the range of student engagement initiatives, including extra-curricular initiatives and those linked with the academic curriculum.

Supporting the delivery of a sustainable estate

Working in collaboration with colleagues from a range of support groups, the department works towards the strategic objective of delivering a sustainable estate which supports world-class research and the learning experience for students. By working with Estates Development, the department has been able to support new builds and refurbishments that are sustainable and inspiring to learn in, contributing towards health and wellbeing of students. The department continues to work with Estates to revise the sustainable estate design guidance, ensuring campus sites are environments that positively support the student experience.

Extra-curricular initiatives

Students have been offered a range of practical volunteering opportunities through the department, focusing on event delivery and management,

journalism, environmental and waste auditing. The department also promotes volunteering opportunities in student-led and local community organisation, including the SHRUB student-led cooperative.

The Sustainability Awards, since 2010, has provided opportunities for students to participate in efforts through their academic schools and student societies to make the University more socially responsible and gain recognition. In 2015-16, a total of 11 awards were received by students and highlighted the increasing number of students participating in the awards, including those from student residences. This is one of a number of programmes that the department works directly with the National Union of Students (NUS), further collaborations include Responsible Futures and the Erasmus+ funded project Certificate in University Social Responsibility Auditing.

Launched in 2014, the department in collaboration with the Edinburgh University Students' Association (EUSA), set up the Student Project Grant, which provides small amounts of funding (up to £500) for student groups or societies looking to develop and implement projects. A total of 13 projects have been supported through the scheme, with the projects sharing over £5,000 worth of grants.

To inspire action, share ideas and encourage collaboration on SRS issues between students, the Student Forum was established in partnership with EUSA in 2014. The forum is student-led and has discussed a range of issues such as sustainable food, social enterprise and project management. One of the aims of the forum is to identify resources and support to empower students to create change.

Students have regularly attended the department's program of events, including the event series Our Changing World and Visions of Change. Students are encouraged to critically think about the topics that are discussed at these events. Over 3,000 students are signed up to the department's monthly newsletter, receiving updates on SRS issues across the University.

Academic initiatives

Increasingly the department is working with academic programs and courses, supporting students who are undertaking dissertations, projects and course work on SRS issues. The department aims to promote a living lab approach, using the University's academic and student research capabilities to solve social SRS issues relating to our infrastructure and practices.

Partnerships with academic degree programs and courses have been developed to provide students with an opportunity to research a range of sustainability issues at the University, producing presentations, feasibility studies and briefing notes which include recommendations to further progress these issues. In 2015-16, the department engaged with over approximately 120 students through these partnerships. Staff from across the department provide limited supervision.

Work-based placements with the department have been established for students on certain courses, such as the MSc Science Communication and Public Engagement. Over the last three years 11 students from this degree program were supported to undertake an eight-week placement within the department.

There has been a good level of interest from students to focus on SRS issues for their dissertation research. To help facilitate this, the department annually creates a range of suggested research proposals, sharing these to students through the Making the Most of Masters Network, through academic schools and relevant networks. The outreach of the department is further extended through supporting the Global Academies and contributing towards a range of events for students, including dissertation research mixers.

Through the School of Social and Political Science (SPS), students can undertake a work based placement with our department during the summer, focusing on issues which links to their dissertation. The department, in collaboration with the Business School, supported a placement for two students to Malawi in summer 2015.

Over the last two years the department has provided opportunities for students and recent graduates to develop their knowledge and employability skills in paid internship roles. Through Bright Green Placements and the University's "Employ.ed" scheme, the department has supported six internships, with plans to provide further internship opportunities. Short-term paid research projects have also been undertaken by MSc and PhD students for the department.

Project Objectives:

- Enhance the student experience
- Provide students with opportunities to develop their individual Graduate Attributes
- Establish opportunities for students to actively contribute towards the sustainability of the University
- Link operations with learning and teaching, and research to develop 'Living Lab' projects.

Learning Outcomes:

- Students are very eager to develop their skills and knowledge in a work based setting
- Provide opportunity for students to develop ownership of a project, this will likely improve the impact of the project
- There are opportunities for professional or operational departments to link with academic degree programs and courses
- Student add value to addressing campus wide problems or issues through 'Living Lab' projects.

How did you define success? What can other institutions learn from your experience with this project?

Success is defined very much around two key areas – the experience of the student undertaking the activity and the positive impact of the project. The student experience is often captured through feedback surveys, whilst impact is captured through more qualitative feedback. We have shared our experience of student engagement activities with the wider sector through the UK Green Gown Awards and the Environmental Association of Universities and Colleges (EAUC).

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University of Gothenburg

Examples on Educating for Sustainability

University of Gothenburg has a long tradition of education and research in sustainability. Through the principles of global engagement and social responsibility expressed in the Vision 2020, the university is to promote sustainable development as embodied in the environmental policy of the university's action plan for environment and sustainable development. One objective in the university action plan, in the environmental management system (EMS), is that the University shall increase the integration of sustainable development in education.

Sustainable Development Solutions Network Northern Europe (SDSN-NE)

To promote research, education and collaboration in sustainable development, the Centre for Environment and Sustainability (GMV), which is operated together with Chalmers, is an important player. GMV is hosting the Sustainable Development Solutions Network Northern Europe (SDSN-NE) as of the beginning of the year; officially launched at a two-day event. The network is strongly linked to the United Nations and brings together the knowledge, experience and capacity in academia, business and civil society, and strive to promote development in Northern Europe, as well as the region's efforts towards sustainable development worldwide. At the inauguration, scholars debated how SDSN NE can become an engine for research on "Science-based transformation in 2030" and help fulfill the Agenda 2030 and the UN Global goals for sustainable development.

Post-graduate course Sustainability Opportunities

The university gave for the first time the post-graduate course Sustainability Opportunities that focus on identifying solutions to the major sustainability challenges. The course is a collaboration between the University and Chalmers and was given by the Centre for Environment and Sustainability (GMV). In the course there was conducted projects related to social

dilemmas, justice and the global targets in five areas: transportation, water, food, energy and reproductive health. Sustainability Opportunities were conducted with teachers from twelve different departments at both Chalmers and University of Gothenburg, from practical philosophy to energy technologies. Students participating were representing 13 different disciplines.

Sustainable development at the Academy of Music and Drama (HSM)

Sustainable development in education and research is well integrated at the Academy of Music and Drama (HSM). HSM is working in close cooperation with its stakeholders, such as the folk high school in Angered where HSM operates the music course "Music College" and a course in acting together with the Angered Theatre. HSM has cooperated for many years with El Sistema, "the music as a tool for social development". During the year, the HSM and El Sistema has supported the establishment of the Dream Orchestra, an orchestra of unaccompanied refugees. Students are very involved and a common course in fundamental values was arranged. During the year HSM hosted a conference with 350 participants from 55 countries, with the theme of "Diversity, Identity, Inclusion".

The interdisciplinary master's program in global health

The University has several educational programs that are relevant to the implementation of global sustainable development goals. One example is the interdisciplinary master's program in global health that started during the year. Teachers from four faculties involved in the program, which meets the health sciences social sciences, economics and humanities. The meeting between students of different backgrounds is one of the strengths, students representing nine different nationalities. The program describes health challenges from a global perspective and focuses on complex social structures that are important for the development of public health.

Sustainability labeling of courses and study programs

University of Gothenburg uses sustainability labeling of courses and study programs to highlight the courses and programs that deal with issues related to sustainable development. The label is communicated to students through the printed course catalog, university website and is now visible in the curriculum.

Toolboxes for teachers

The GMV, together with the faculties, has developed faculty-adapted web-based tool boxes to help teachers implement sustainable development in first-cycle courses and study programs. This was then followed by faculty-adaptation work. GMV held three university-wide workshops for teachers to try out using the toolbox under supervision to integrate sustainable development in their own courses and study programs. The opportunity to have discussions with colleagues from their own area and from other subject areas was emphasized as being very positive.

Faculties work with integration of sustainable development

Work on the faculties of the integration of sustainability into education has continued to evolve during the year. The Faculty of Science has charted the respective institution's sustainable development programs and durability marked courses and programs. Education Science and Social Science faculties have worked on the adaptation of toolkits for integration of sustainable development into education to their own faculties' activities.

The School of Economic, Business and Law organizes annual student days as part of its strategy to integrate sustainability in all educational programs. The days are mandatory for all program students and given during the first, second and third year of the Bachelor programs. The theme of the first day focuses on social, economic, and environmental and resource challenges facing humanity. The second year students day focuses on responsibility and accountability. The third and last sustainability day has its focus on ways towards solutions.

The Green humanities network at the Faculty of Arts arranged education initiatives within the area. For example, an internal initiative is being pursued at the Department of Literature, History of Ideas and Religion to build up courses with a link to humanistic environmental research. The activities are supported with faculty reserved strategic funds.

The Special Subjects Teacher Program has implemented a special sustainability component with the human in focus, to be completed by all students in the program. An important aspect of the initiative is that alternative learning environments are used, such as the Universeum Science Centre and the Museum of World Culture, and included in the form of teaching sessions scheduled.

The Gothenburg Centre for Marine Research organizes an interdisciplinary graduate school in marine environmental research. The doctoral students and their supervisor work in cross-disciplinary paired projects designed to promote sustainable management of marine resources.

Student commitment and Student Sustainability Office

In August, the University of Gothenburg initiated the Student Sustainability Office. Two students from the Business School and the School of Global Studies, have been hired. They work alongside their studies on the University's sustainability work from a student perspective. The students will include working with education issues, procurement and support university student in sustainable development.

University's students committed in sustainable development, collaborating via Gothenburg Students for Sustainability Alliance (GSSA) arranged together with GMV two student days that were open to all students at the university. One of the sustainability days, Act Sustainable!, attracted more than 300 participants. On the program was a breadth of activities, including a panel discussion on integration, lecture on the garment industry in Bangladesh and speed-dating with sustainability professionals.

Reflections/Conclusions

To integrate sustainability in education is of great importance. If the work is systematic and goal directed it supports the processes. A great need for cooperation in the university as a whole, in different faculties and between faculties, and as well as inside departments and between departments. To manage, support and coordinate the processes a combination of "bottom-up" and "top-down" processes are crucial.

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MODELO EDUCATIVO TEC21

Monterrey Institute for Technology and Higher Education Tec 21 Education Model

Project Description: Tecnológico de Monterrey was founded in 1984 by Eugenio Garza Sada and a group of Mexican business leaders. They accomplished their dream of creating an advanced educative institution that would remain over time and grow as one of the best universities. The first Campus was established at Monterrey, Mexico, and started operation with 350 students and 14 professors. This year in January 2016 Tecnológico de Monterrey had 83,137 enrolled students with 9,614 professors working for the transformation of the education model.

Since its foundation, Tecnológico de Monterrey has redesigned its education model a few times in order to meet the actual vision of the institution which is to grow leaders with entrepreneur spirit, human sense and globally competitive. Our vision and reality conducted us to rethink our educative model because universities around the globe have XIX century infrastructure, XX century professors and XXI century students, that's why in 2013 we released our new education model named "Modelo Tec 21".

Project Objectives: The objective of Tec 21 Education Model is to offer a holistic formation and improve students competitiveness in their professional field through the maximization of the next generation skills in order to develop the required competences that will let them be the leaders that will meet the challenges and opportunities of the XXI century. The hearth of Tec 21 Education Model is learning based on challenges. It is a connection between the academic knowledge and the development of innovative solutions for real world problems. It integrates ethic and citizen competences, based on a multidisciplinary approach of experience and immersive learning through a process that

challenges the student to meet the future problems as a leader. Finally, students may submit a resolution that meets invariably a technical and an ethical criteria.

Learning Outcomes: During the last period, there were some projects running on this new education model. Below is the description and the outputs of two of them:

- Challenge: Development of an ecotourism route in an ecologic reservation named "El triunfo". Nowadays this community located in the state of Chiapas offers ecotourism services in an undeveloped mode. Coffee production, the main economic activity of the area, remains limited because of its current location in the reservation. Leaving coffee production as a limited activity, ecotourism represents a good opportunity to promote regional economic development. The challenge of this project is to identify and redesign the new ecotourism services offer. The new services offer intend is to locate "El triunfo" as a reference destination of sustainable development based on its engagement with natural resources defense. One of the final contributions of this project is the economic growth of the involved families at this community.
- Challenge: Transformation of Bread Waste. Mexico currently wastes 37% of its agricultural production (Grupo Técnico Pérdidas y Mermas de Alimentos de la Cruzada Natural contra el hambre, 2013), this means that 10 million kilograms of food is wasted that could represent 100 thousand million MXN pesos each year.

- The specific objective of this challenge is to transform the food waste through an innovative focus in new products with the application of process and product variables in the food industry. This considering several technical criteria like logistics, food biochemistry, technology, production, feasibility, environment, legal, health and ethics related to the optimum exploitation of available resources.

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Princeton University

Princeton's Sustainability Education Landscape

Project Description: Since 2012, Princeton University has offered more than 110 courses that have either focused on or incorporated sustainability content. Some of these courses have specifically integrated campus environs or infrastructure into the curriculum in response to increasing student interest in hands-on learning, and research that documents the educational benefits of applied experiences. The University's Campus as Living Lab (CAL) Program, spearheaded by its Office of Sustainability, reflects the growing demand for intentional links between academic learning and campus-scale problem-solving. The CAL program supports faculty and students by linking operational and planning opportunities with ongoing academic inquiry across all disciplines, through coursework, independent study, and research.

In addition to the existing robust curriculum, Princeton University is offering two new Environmental Studies courses that represent evolving ways of thinking about preparing students for today's global challenges.

One is a 300-level seminar called "Investigating an Ethos of Sustainability at Princeton" which was first piloted as a student-initiated seminar in the 2015-2016 academic year. It draws students from a wide variety of disciplines, from engineering to the visual arts, who engage with faculty and staff with diverse expertise to examine global issues and explore how those issues manifest locally on the Princeton campus. Students are then challenged to propose evidence-based solutions that can strengthen the sustainability ethos on the Princeton University campus while also demonstrating scalable or repeatable solutions.

The other is a reimagining of the 200-level introductory environmental studies course with a renewed focus and unique multidisciplinary structure. Starting in 2017, the University will move forward with an unprecedented effort to prepare a generation to manage the "environmental nexus," or the intersection of four global environmental problems involving climate, food, biodiversity, and water – all issues that will reach their peak at the same time as the careers of the current student body.

This new "Environmental Nexus" course, designed to accommodate a large number of students, will address multiple dimensions of the issues, including scientific, political, social and ethical aspects, and will be accessible to all majors and classes. All students who enroll in the class will attend two weekly lectures and one of several sections, each of which will explore the environmental nexus through the disciplinary lens of the student's choice. This freedom and flexibility in course structure will help engage a high number of students from multiple disciplinary backgrounds, allowing the faculty to create the largest possible conversation within the University community about climate change and other pressing environmental challenges. At the same time the course will prepare students with the necessary knowledge to make decisions about their own responsibility for addressing upcoming sustainability challenges.

In addition to curricular and co-curricular endeavors, Princeton also offers a wide range of extra-curricular sustainability engagement and learning opportunities through the Office of Sustainability, the Pace Center for Civic Engagement, Outdoor Action, the Community

Based Learning Initiative, and other University programs.

Project Objectives: The primary objective of these multi-faceted educational endeavors is to meaningfully prepare current and future generations of students with the skill sets to address the world's converging environmental challenges.

Learning Outcomes: The desired learning outcomes associated with these educational initiatives include the development of a personal sense of responsibility for addressing the full spectrum of challenges facing humanity, and the evidence-based knowledge to act on that sense of responsibility.

How did you define success? What can other institutions learn from your experience with this project? The success of this diversified educational approach to sustainability is best assessed through the life-long actions of our graduates and the ongoing level of faculty research and teaching engagement. If successful, students will leave Princeton with a strong sense of agency and ability to affect human practices on behalf of human and environmental vitality.

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Stuttgart University of Applied Sciences

Sustainable Development at Stuttgart University of Applied Sciences

Project Description: Teaching transition via Center for Sustainable and real-world lab. How to enable students, faculty and staff members to become change agents.

Project Objectives: Integrating Sustainable Development into five focal areas; define pathways for a climate neutral inner-city.

Learning Outcomes: A cultural changes takes time. Involving all stakeholders in this process is also very time consuming and needs a lot of efforts.

How did you define success? What can other institutions learn from your experience with this project? Since the integration process works iterative, the definition of success is not easy. But one could boil it down to: The activation and involvement of as many stakeholders as possible.

The Hochschule für Technik Stuttgart (HFT)/ Stuttgart University of Applied Sciences has been focusing on the subject of Sustainable Development (SD) for several years now. As one of the first universities in the country, the university has given itself a mission statement, developed a sustainability strategy (incl. a set of measurable goals as part of the university's overall strategic plan for the years 2012-17), and implemented an organizational structure based on this strategy. The HFT Stuttgart's Center for Sustainable Development (CSD) is the department responsible for all campus related sustainability matters. The CSD works in five focal areas: teaching, research, operations/institution, transfer and governance. These five SD design fields were identified and recommended by the platform "Hochschulen für Nachhaltige Entwicklung" (HNE) for a sustainable transition of a university. The nature of sustainability problems is a wicked one, therefore, we argue that a teaching transition should not only focus on students, but also on faculty and staff.

Since 2013 the CSD has been funded with one project by the State Ministry of Baden-Wuerttemberg for Sciences, Research and Arts (MWK) in order to integrate a three pillar model in all fields of study. The aim of this model was not only to teach students to think outside the box and to practice critical reflection but also to enable them to discrete thinking and to research independently. Or to put it differently: to enable students to become change agents for SD. The university has been offering courses on said subjects long before this project, but all these courses were extracurricular and voluntary – and only taken by students that were already advanced in these fields. The idea of the three pillar model was to make these courses mandatory for all students. That meant a change of all curricula. Unfortunately most fields of study were accredited shortly before the project started, so only three out of 40 fields of study took part in this project. In order to meet the objective of this project, the CSD developed a new concept called "Studium Integrale" which is the name of a program as well as of a diploma-supplement.

Sterling (2004) argues the Education for Sustainable Development (ESD) should not be simply tacked onto existing curricula and structures. Students should become immersed in the system complexity. Based on this, the three pillar model was the first new learning opportunity that has been developed, the Studium Integrale the second. The Studium Integrale was launched by the CSD and in cooperation with the universities' didactics HFT Stuttgart is one of approx. 20 universities in Germany having an Environmental Management System (EMS) according to the European EMAS-directive. Following the installation of the CSD as well as the successful introduction of a university-wide EMS the university received another external funding program: The institute for Applied Research (IAF) won, in joint effort with the CSD, a competition and got the possibility to create a "real-world laboratory" ("Reallabor") named "EnSign" also funded

by the MWK. The aim of this project is to define pathways for a climate neutral inner-city campus. The innovative aspect of this new research process is the integration of civil society and the co-production of research topics and questions, and the bidirectional transfer of knowledge.

Students, faculty and staff shall be enabled to become change agents for SD. So since the beginning the real-world lab and the Studium Integrale are deeply intertwined: So far, all courses on interdisciplinary work have been connected to the real-world lab. At the beginning of the semester students get familiarized with topics such as inter- and transdisciplinary work, academic writing and the real-world lab. Afterwards they work in small interdisciplinary groups on research assignments. They are supported and supervised by the researcher of the EnSign-Project. The idea of letting students actively take part in the transdisciplinary process makes them feel more related not only to the project itself but also the topic of SD. The assumption behind this approach is that students get a better grasp of the complexity of SD when being a part of the research team compared with "only" writing a thesis on this topic. Nevertheless, in some cases the related bachelor-/master-theses lead to extraordinary outcomes. E.g. in one thesis the respective student developed in cooperation with the CSD, one business- and two IT-professors an app for smartphones that can be used by companies and organizations for their EMS and/or energy management systems. The app makes the audit processes leaner, leads to significant cost reductions and fewer errors. In addition the app can be used by companies that will have – starting 2017 – to publish sustainability reports according to the Directive 2014/95/EU of the European Parliament and of the Council: In order to develop a business model for the "EMAS-app" HFT received three start-up-scholarships from the German Federal Ministry for Economic Affairs and Energy.

One credit point for the study concept of Studium Integrale could also be awarded through designated courses of the bachelor's program economic psychology. The psychologists are collaborating in the above-mentioned EnSign-Project, thereby mainly focusing on the user behavior as an impact on the campus' energy consumption. Altogether, there were twelve student groups (containing a total of about 75 students) working on the topic of "Sustainable user behavior for a climate neutral city campus". For this purpose, the students applied various qualitative and quantitative research methods such as guided

interviews and questionnaire studies, as well as projects in the experimental field.

A cultural change within the university is already noticeable: The CSD had an advisory role in the process of developing the curricula of two Master's programs (M.Sc. in Business Psychology, M.Sc. in Green Logistics). As a consequence, for the first time in HFT's history these two Master's programs introduced mandatory courses in business ethics and corporate social responsibility (CSR), including an online CSR-simulation as an integral part of the respective lectures.

Teaching transition at the HFT works not only top-down, but also bottom-up: Greening HFT is a student-led sustainable campus initiative. Greening is nurtured and supported by the CSD and also works closely with the EnSign project team. Greening developed and launched a Campus Engagement Campaign at the Global Climate University Forum presented at the United Nations Framework Convention on Climate Change Conference of Paris (COP 21) in 2015. Greening was the only student group from a German university invited to COP 21. Due to the engagement by the EnSign team, Greening HFT has grown in membership and presence, integrating SD into everyday campus life. Teaching transition does of course not only concern students, but also faculty and staff. Therefore, the CSD has offered advanced training in ethics and sustainable development for professors. In the course of the introduction of the Eco-Management and Audit Scheme EMAS all interested faculty and staff members were being offered courses on a method called Eco-Mapping. To sum up: „Teaching Transition“ is an iterative process that takes time. As a recent survey shows: More and more students, faculty and staff members are aware of the universities sustainability efforts – a cultural change is already noticeable within the university.

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Thammasat University

Raising Awareness: The Key to Success of Sustainability

Thammasat University has given utmost importance to the quality of education as well as to create an environment conducive to learning. One key area has been to educate students both directly and indirectly about sustainability.

Sustainable Development Goals which were adopted by United Nations members at the General Assembly meeting in 2015 have been taken seriously by the University, particularly fourth goal, Quality Education, which directly relates to all educational institutions. In fact, Thammasat University has long undertaken a number of actions and measures before the SDGs were officially announced in 2015. Green and Sustainability has been key to the University's value and content in a number of aspects, including in classrooms and elsewhere.

Project Objectives: Prior to the announcement of SDGs, the University had launched its brand new series of education called "GREATS" which aimed to create graduates fit for the 21st century "GREATS" stands for Global mindset, Responsibility, Eloquence, Aesthetic appreciation, Team leader, and the University's Spirit "Thammasat for the people." Six new courses were introduced on top of ongoing teaching and training schemes such as active learning and service learning. These new courses have been designed to prepare students, among other things, with knowledge and skills that would enable them to be analytical, creative,

and able to contribute positively to the society in their professions. The courses are TU101: Thailand, ASEAN, and the World, TU 102: Social Life Skills, TU 103: Life and Sustainability, TU104: Critical Thinking, Reading, and Writing, TU 105: Communication Skills in English, and TU 106: Creativity and Communication. These new courses are also taught by way of active learning techniques.

Apart from classroom teachings and seminars, the University has also done a great deal to create and promote sustainability in campus. These include its projects on clean transportation, waste management, and to apply energy and environmental conservation policy for the new buildings.

Learning Outcomes: On energy conservation, Thammasat University has installed the first phase solar roof panel for providing 6 MWh electricity this year. The second phase will be continued to meet the total of 15 MWh electricity production within 2017.

On clean transportation, Thammasat has introduced NGV shuttle buses and also provided students with the use of bicycles under the project called Bikes Sharing, both are free of charge. Some of NGV buses will be replaced with 24 seat electric buses in early 2017.

On waste management, Thammasat has launched an outstanding project, the Garbage Recycle Bank, since 2006, where recyclable items can be turned into cash. To extend this recycle scheme, in 2015, the University



set up a special shop called Zero Baht Shop (Baht is a local Thai Currency) where students and staffs can bring their plastic bottles and other recyclable items to the shop and get household products in return. The shop has been so popular and successful that this year (2016), the second branch was opened at private dormitory close to the University and has been operated by Thammasat students.

Moreover, the University has also integrated the energy and environmental conservation policy for the new buildings, built in the campus since 2014. This year, six new buildings were awarded the “Building Design for Energy Conservation of 2016” by Ministry of Energy. The building “100 Year Puey Learning Resort Building” got the Excellent reward for more than 70% energy reduction design, while the other two and three buildings have got the Very Good and Good rewards for 50-70% and 30-50% energy reduction design, respectively.

Projects and activities such as these greatly help to raise awareness of the students and staffs about what they could do to contribute to sustainability of the campus and the community at large.

How did you define success? What can other institutions learn from your experience with this project? The success of the projects mentioned above mainly comes from the participatory of students and staffs, which stimulated by their concern and awareness.

The increasing number of recyclable items brought to the Garbage Recycle Bank in the last three years is an example. It can reduce the releasing of CO₂ to the atmosphere up to 1,124.13 Metric Ton CO₂ eq.

In 2015, the University has requested students and staffs to join the zero plastic bags program by not to take plastic bags from 12 branches of 7-11 shop in the University. It was later found that within 6 months, the shops could save plastic bags more than 800,000 bags.

Another success case was from the activity done in the class of TU 103: Life and Sustainability, when the students were asked for calculating the amount of CO₂ release from their activities each day, especially the activity related to their transportation in the campus. It could be seen that that many students have changed the choices of transportation from using motorcycle taxi to NGV bus services or biking, and even walking.

These experiences can be found in the Thammasat University Sustainable website,
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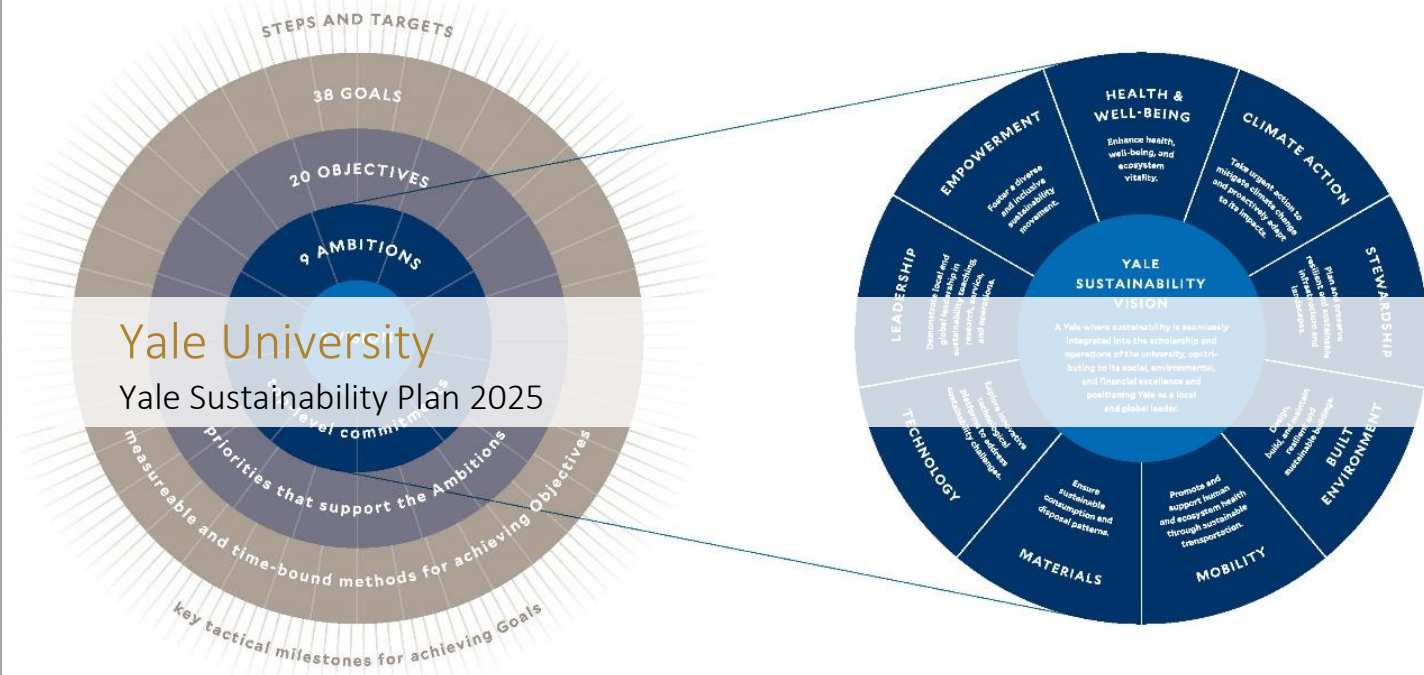
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In October 2016 Yale announced its third sustainability plan. Were this plan simply the next chapter in Yale’s operational sustainability journey, this would hardly be a major milestone. However, in 2014 President Peter Salovey challenged the Yale community to evaluate the second sustainability plan and determine whether Yale’s sustainability commitments were ambitious enough. This sparked a set of assessments including a review by the World Business Council for Sustainable Development, a Masters-level course where student teams conducted topical research, and recommendations from faculty. These activities revealed five significant weaknesses in the form and function of the 2013 – 2016 Yale sustainability plan:

1. The goals were entirely operational and did not reflect the institution’s priorities – scholarship and the student experience.
2. The social commitments were weak and the some of the other indicators, such as recycling diversion rates, were dated.
3. It lacked connection to global context for sustainability or to local priorities in the city of New Haven.
4. The three-year timeline limited aspirational goals.
5. The process to develop the plan lacked transparency and stakeholder engagement.

These outcomes offered an outstanding roadmap for the Office of Sustainability to develop the new plan. The 18-month process to create the new plan started with a small working group of faculty and administrators to help shape the framework, then interviews with university leadership, topical workshops with diverse sets of community members,

focus groups, and presentations to key groups such as administrators and alumni. Throughout the development of the plan the Office of Sustainability shared drafts with key stakeholders, and toward the end external reviewers and city officials were invited to provide feedback.

Creating the plan in such an inclusive and iterative manner was time-consuming, intensive and rewarding, resulting in a document that reflects the values and priorities expressed by the university leadership, faculty, students, alumni, staff, as well as city officials. It also resulted in buy-in from these groups even before the plan was launched, so the transition to implementation was energetic.

Structured around a vision of “a Yale where sustainability is seamlessly integrated into the scholarship and operations of the university, contributing to its social, environmental, and financial excellence, and positioning Yale as a local and global leader,” the objectives and goals of the plan are organized into nine ambitions:

- **Leadership:** Demonstrate local and global leadership in sustainability teaching, research, service, and operations.
- **Empowerment:** Foster a diverse and inclusive sustainability movement.
- **Health and Well-Being:** Enhance health, well-being, and ecosystem vitality.
- **Climate Action:** Take urgent action to mitigate climate change and proactively adapt to its impacts.

- Stewardship: Plan and preserve resilient and sustainable infrastructure and landscapes.
- Built Environment: Design, build, and maintain resilient and sustainable buildings.
- Mobility: Promote and support human and ecosystem health through sustainable transportation.
- Materials: Ensure sustainable consumption and disposal patterns.
- Technology: Explore innovative technological platforms to address sustainability challenges.

These ambitions well-support the university's mission statement of "improving the world today and for future generations through outstanding research and scholarship, education, preservation, and practice" and President Salovey's commitment to a more unified and inclusive Yale. The new plan also contains language that reflects global imperatives and connects to local priorities. It has a nine-year timeline with express mention of experimentation, and there are more opportunities for qualitative assessments of progress. There is a diminished focus on traditional indicators such as waste diversion rates and percent of food sustainably sourced, and along with that, a shift to systems thinking and Yale's overarching influence. The boundaries of metrics and deadlines were intentionally relegated to the goal-level with the specific expectation that the 38 goals that undergird the 20 objectives will be realized, refined, and replaced over the course of the plan.

Perhaps the most significant departure from the old sustainability planning model, however, was that each of the nine ambitions of the plan was deliberately crafted to invite academic exploration as well as operational commitments, as were most of the objectives. Along these lines, scholarship is woven into the objectives and goals throughout the document, including commitments such as developing new green IT technology standards with leadership from faculty.

In terms of education and sustainability, the most intriguing commitments may be under Leadership. The objectives and goals under that ambition include creating multidisciplinary topical working groups of faculty and staff, assessing current experiential scholarship and "campus as a living laboratory" activities, setting shared priorities across various external network groups, and establishing an association of Yale alumni and friends who want to play an active role in Yale's sustainability excellence. These elements are all connected to a larger campus-

wide effort that is also referenced under Leadership to create a Sustainability Network that will support interdisciplinary relationships, connections between the scholarly and operational sides of the university, and collaborative initiatives with institutional peer groups and in the City of New Haven.

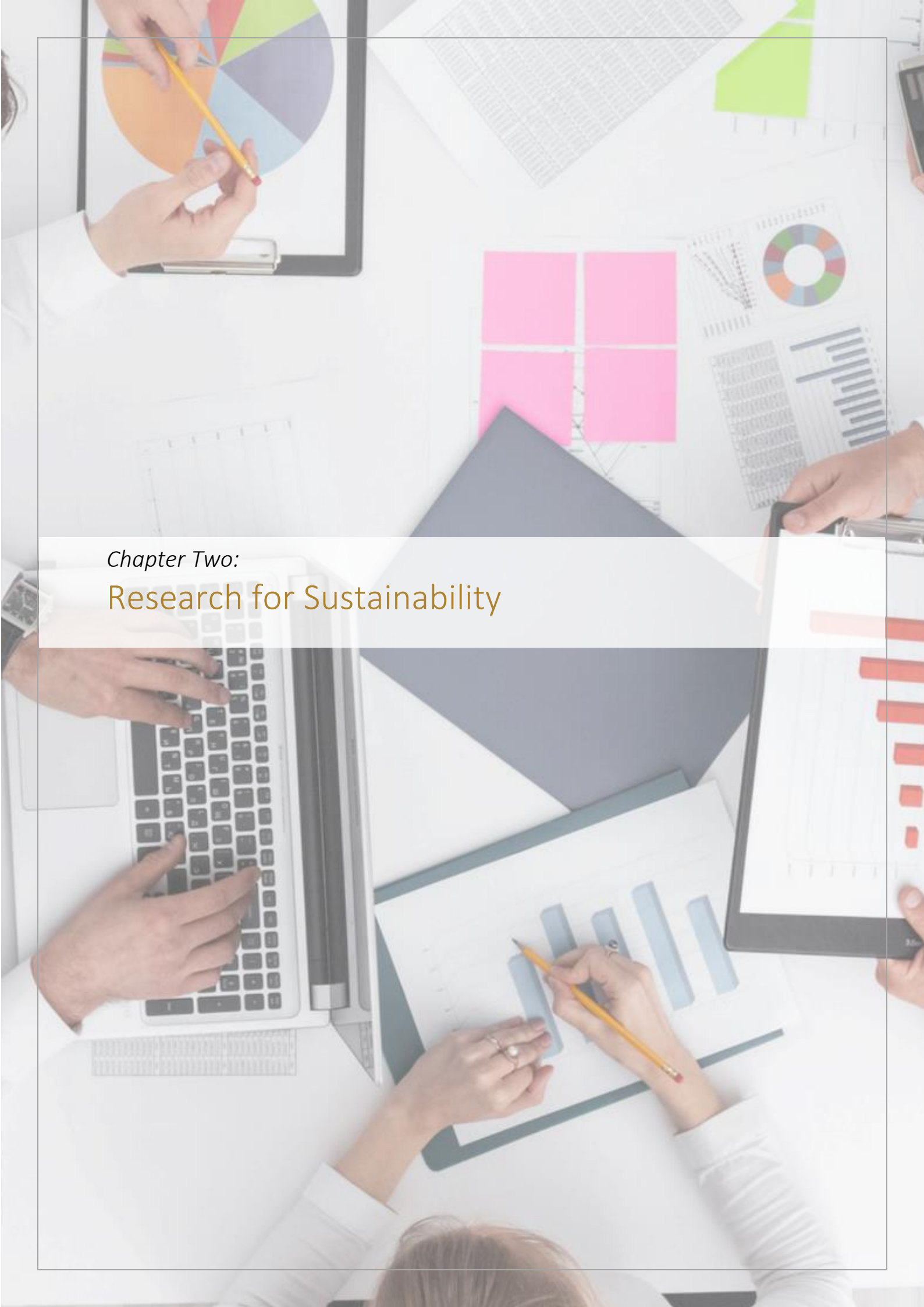
Also in support of this Network, the Office of Sustainability is reaching the end of an intensive process to compare all 4,400+ faculty member biographies to the UN Sustainable Development Goals (SDGs) with the objective of determining how Yale's scholarship, and therefore this Network, might contribute to the SDGs. This exercise has helped to inform the implementation of several goals, and is proving valuable for developing interdisciplinary discussions, identifying faculty for special projects, and dispelling the common misunderstanding that sustainability is solely the purview of the environmental programs.

At the time of this writing, the Yale Sustainability Plan 2025 is still fresh, and therefore many of its most significant commitments have yet to yield measurable results. However, thanks to the inclusive nature of the planning process the plan transitioned from development to implementation with excellent momentum and buy-in from faculty as well as students. In the coming years, the Office of Sustainability will collect and analyze data related to key indicators, retire and add goals, communicate the on-going narrative of sustainability, and cultivate relationships and partnerships in support of the Plan.

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A top-down view of a collaborative workspace. In the top left, a person's hands are drawing a large pie chart on a clipboard with a yellow pencil. The chart has several colored segments: orange, blue, green, purple, and red. In the top right, there are various documents, including a large table with many rows of text and a smaller circular chart. In the center, four pink sticky notes are arranged in a 2x2 grid on a document. Below the sticky notes, a grey folder is visible. In the bottom left, a person's hands are typing on a silver laptop. In the bottom right, a person's hands are holding a tablet displaying a bar chart with red bars of varying heights. Another person's hands are visible in the bottom center, holding a yellow pencil and pointing at a bar chart on a document. The overall scene suggests a busy, collaborative work environment focused on data analysis and research.

Chapter Two:

Research for Sustainability



The University of British Columbia

SEEDS Sustainability Program

Universities play a central role in generating and disseminating knowledge and preparing future generations of leaders to address critical issues facing our society. Aligned with this role, and building on nearly two decades of sustainability leadership, UBC works to transform its campuses into societal test-beds for sustainability, where critical issues are explored and addressed.

Over the past 16 years, the SEEDS (Social Ecological Economic Development Studies) Sustainability Program has created partnerships between 6,500 students, faculty and staff to enable hundreds of innovative and impactful sustainability projects at UBC. These student research projects help address university sustainability priorities by engaging the Campus as a Living Lab, and supporting the integration of academic and operational work on sustainability.

The program was initiated in 2000 as part of a strategic mandate which called for the “Greening [of] the Campus”. It is Western Canada’s first academic operational program to integrate students’ energy and enthusiasm for sustainability with faculty members’ research experience, and staff members’ expertise and commitment to advance sustainability on campus and promote the use of the campus as a living laboratory.

The program is embedded in campus planning, directly supporting the University’s strategies, operational plans and international commitments. SEEDS research projects play a key role in advancing UBC’s commitments to sustainability and exploring how we can go beyond just reduction of harm to creating net-positive benefits in terms of both human and environmental wellbeing.

Our Approach: The program’s first success came by linking the university landscape architect with a graduate student in the School of Community and Regional Planning to design a campus trail to generate appreciation of place, history and landscape. From a single faculty and operational unit, SEEDS projects have taken place across 12 of 14 UBC faculties and colleges, and approximately 30 operational departments.

Campus staff, students and faculty work together on projects that address diverse campus issues in operations ranging 15 thematic areas, including climate, energy, water, waste, land, food, transportation, community, finance, buildings, materials, biodiversity, procurement, health, and wellbeing.

Projects can be classified along three broad typologies: projects taken on as a whole class or part of a class, individual projects, and cross-faculty interdisciplinary projects. When completed, the instructor evaluates SEEDS projects. Students submit a research report with recommendations, and deliver a presentation to the operational staff clients. In other cases, students develop and design a community or art installation, technology or application, build a prototype or product or create a conceptual design.

Program Results: The SEEDS Sustainability Program plays an important role in supporting the university’s sustainability objectives across a broad spectrum of policy areas including energy efficiency and GHG emission reductions, water conservation, sustainable food systems, zero-waste, and wellbeing. The outcomes of the majority of SEEDS projects get implemented or influence decision making around ecological, social and economic sustainability on campus.

Amongst 1000+ projects, some recent examples included the creation of sustainable procurement and waste guidelines for the Special Olympics Canada 2014 Summer Games held on campus; research to support the development of a rooftop garden on the new student union building, providing a public space that helps reconnect people with nature; and food and sustainability projects, including a farm-to-healthcare project between UBC's campus farm, food providers, hospital and the Vancouver coastal health authority.

Other research projects included a biodiversity related baseline study of bird collision rates at UBC to inform UBC's Green Building Plan and Guidelines, and the design and build of a first campus waste scale that can classify waste collection into organic, landfill and recycling waste streams in real time.

The second significant outcome is the knowledge base contained in the online SEEDS library. The library hosts over 1200 reports that provide an institutional resource, collective memory, and enable iterative research. These resources also benefit other organizations as a potential source of recommended practices and processes developed through applied research.

The SEEDS Sustainability Program received international recognition, including a 2015 AASHE Case Study Award and the 2016 Global Universities Partnership on Environment and Sustainability (GUPES) award for Student Engagement. The program has subsequently been replicated across several universities in North America and Europe. Few universities in North America have similar programs, and SEEDS is certainly the largest and most comprehensive.

In 2015/2016, the SEEDS Sustainability Program engaged approximately 591 students, staff, and faculty to work collaboratively on 103 innovative UBC sustainability projects integrating operations and academics.

All UBC faculties, colleges, and staff units can participate in the SEEDS Sustainability Program. To date, SEEDS projects have been integrated into 12 of 14 UBC faculties and colleges, and have involved approximately 30 operational departments, resulting in over 1,200 research reports available for free in the online SEEDS Sustainability Research Library.

The following benefits have been identified for program participants:

- Students benefit from the program by earning course credit for their project, applying research skills in a real-world situation, and by gaining professional experience;
- Faculty members benefit from providing students a hands-on experience to enrich their learning and integrating real-world sustainability challenges into the classroom;
- Staff benefit from access to current academic research and resources, and by having an opportunity to mentor students and collaborate with other departments.

Assessment Model

- 100% of faculty rated their overall experience with SEEDS as "excellent" or "good".
- 96% of faculty either agree or strongly agree that SEEDS prepares students for professional work environment.
- 81% of staff indicated that SEEDS supports efforts to increase sustainability in unit operations.
- 78% of staff agreed that SEEDS provided valuable info/data that would assist them in their area of operations.

Lessons Learned

Program evaluation revealed generally high-level of satisfaction with the program from both faculty and staff perspective. Over the past 16 years of facilitating hundreds of projects we have identified that the success of the SEEDS Sustainability Program depends on:

1. Proactive Stakeholder Relations and Engagement
2. Robust Project Management and Communication
3. Meaningful Acknowledgement and Evaluation

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Link to program: <http://bit.ly/ISCNWEF>

Link to video: <http://bit.ly/ISCNWEF-Video>



Chalmers University of Technology

Challenge Lab

Project Description: Challenge Lab follows a transformative and integrative approach, that enable underlying assumptions to be challenged in a process of double and triple loop learning. Furthermore, Challenge Lab aspires to operate across sectoral boundaries and builds capacity to deal with more than one issue at a time.

Working across boundaries requires the establishment of trust amongst actors in the triple helix. Furthermore, students demand a relevant education for their future that will enable them to make a meaningful contribution to a more sustainable future society.

In the Challenge Lab, students are empowered to take upon a transformative leadership as societal change agents. This is done by creating a space for students to address real-world challenges, and guiding them through the formulation of their own research questions with a sustainability-driven approach. The multidisciplinary staff sets the conditions and facilitates the process, but the students are in the driver's seat.

Chalmers University of Technology in Gothenburg, Sweden has by tradition engaged in societal challenges and initiated in 2014 Challenge Lab as a part of a whole-of-university approach. The purpose of Challenge Lab is to: strengthen the educational dimension in the "education-research-outreach" triangle; become an important hub for actors from academia, the public- and the private sector to gather around the students; build trust among stakeholders; give students the opportunity to develop unique capabilities in working across disciplines with a sustainability-driven approach.

Challenge Lab provides the opportunity for any master students at Chalmers to write their master thesis at the lab, as well as providing a preparatory course "Leadership for Sustainability Transitions". Challenge Lab is physically located at one of the science parks in

Gothenburg. In the Challenge Lab master students take on complex societal sustainability challenges together with actors related to the five regional knowledge clusters in West Sweden: Urban Future; Marine Environment and the Maritime Sector; Transport Solutions; Green Chemistry and Bio-based Products; and, Life Science. The students can interact cross-disciplinary within, as well as between these clusters, backed up by Chalmers' challenge-driven entities "Areas of Advance": Building Futures, Energy, Information and Communication Technology, Life Science Engineering, Materials Science, Nanoscience and Nanotechnology, Production, and Transport.

Challenge Lab follows a backcasting approach facilitated and guided by a multidisciplinary team of teachers. The process starts with a first phase (4 weeks) where the students use the backcasting methodology to develop a framework of sustainability principles in the four dimensions of ecology, economy, society, and well-being. Parallel to this, the students do individual value clarification exercises to identify their internal motivations and drivers, and, through group exercises identify their strengths and weaknesses. The students are then researching ongoing regional processes, analyzing the associated socio-technical systems by applying tools from systems thinking and transition science.

By using the sustainability principles developed in step 1, the students analyze the current state (step 2) and identify gaps in the systems. The analyzed gaps become the starting point for dialogues in which stakeholders are invited to provide their perspectives on the gaps as sustainability challenges. Based on these dialogues, the students identify leverage points for system intervention. From this, they formulate a research question, team up with a partner and connect with a supervisor. This becomes the start of the second phase (16 weeks), which is still based on backcasting

but where design thinking becomes an important part. During this phase the students connect with relevant stakeholders to address their research question formulated during the guided phase 1 process.

Project Objectives: In the Challenge Lab students engage as change agents with sustainability challenges in the triple helix. The lab is built around a transformative approach where backcasting is applied and an integrative approach realized through stakeholder dialogues. In order to be even more relevant for sustainability transitions, it is important to take a sustainability-driven innovation approach - staying in the question and then searching for needs and demands within this question from a sustainability perspective. The approach at the Challenge Lab, has been based on taking a step back and stay in the challenge and identify the gap between a future sustainable state and today's situation.

Learning Outcomes: After participating in "Leadership for Sustainability Transitions", students should be able to:

- Describe critical sustainability challenges and reflect upon necessary paradigm shifts
- Describe how sustainability challenges affect industrial and societal actors and how they are interlinked
- Reflect upon important "lock-ins" on societal, organizational and individual levels, relevant for sustainability challenges
- Apply systems perspective to meet sustainability challenges
- Apply relevant sustainability frameworks
- Apply basic theories and tools about transformative leadership in a challenge-driven process
- Apply tools to enable and facilitate dialogue with multiple stakeholders
- The students who continue their journey in the Challenge Lab master thesis further apply these learning outcomes throughout their thesis.

Assessment Model: Since the establishment of the Challenge Lab its process has been continuously monitored, documented and evaluated by its staff. Further, a continuous dialogue has been held with the students throughout their experience. Data from such enquiries were collected in the form of documentation of the lab's processes, meeting minutes and field notes. To create space for the students' voices evidence from their perspectives were gathered during a focus group interview with 13 students from the

2016 cohort upon hand-in of their final theses. They were asked to reflect upon what the Challenge Lab process meant for them, what they have learnt during the thesis and how they experienced the group work. The abovementioned data was triangulated with interviews of the student teams from the selected theses combined with survey data from their closest connected stakeholder or supervisor.

How did you define success? What can other institutions learn from your experience with this project? In terms of value created from Challenge Lab, the integrative aspects have benefited from neutrality and the student's ability to in dialogue build trust among stakeholders. The transformative aspects have benefited from the backcasting process and the freedom for the students to influence existing processes. Value creation can also be identified for the university: for its operation on developing a sustainable campus; and in collaboration between researchers and staff, within university as well as between university and society.

Engaging in sustainability transitions of socio-technical systems, where universities need to collaborate with the public- and private sector is often hindered by various kinds of lock-ins. Actors are in general divided in silo-settings dealing with one issue at a time having narrow perspectives, vested interests and serve goals of sub-systems instead of the system as a whole. Furthermore, established socio-technical regimes are subject to path dependencies and incremental realignments.

The students may have a unique role to play in the transitions since they are knowledgeable yet unthreatening fostering dialogue between triple helix stakeholders. Interviews with involved actors indicate that students can act as a bonding medium by building trust between stakeholders yet challenging underlying assumptions. Other universities can adopt this model for educating students and engaging in sustainability transitions.

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University of Campinas

Sustainability as a Belonging Vector

PLANES 2016-2020 (Strategic Planning) proposes to incorporate the vector sustainability at UNICAMP's campus. The Sustainable Unicamp program highlights two of the eight sustainable dimensions identified by Guimarães, R.P. (1997), the social and environmental ones. Socio-environmental sustainability is related both to life quality improvement and to the maintenance of the place's resilience. The university's urban environment – its campuses – has environmental problems that tend to be sensed differently by different actors (Alirol, P. 2001).

It is not a simple task to recognize where you are and the size of the space in which you live in. Conflicting situations with no apparent reason can be explained and/or avoided by being spatialized. The process of participatory mapping stimulates dialogues, the community involvement, critical thinking and collective action since it allows the development of a language of its own and the sharing of individual and collective experiences (Moore, E. & Garzón, C). At the same time, it extrapolates the presentation of the geographical characteristics of a given place to illustrate the social and cultural aspects of the local community and their interpretation of the territory. The strategy adopted here for the diagnosis of socio-environmental sustainability of the Unicamp's urban environment was social cartography (Acセルrad, H. et al 2015), which differs from traditional maps in content, appearance and methodology. The use of a personal language in the graphic representation of maps is encouraged.

However, the use of standardized icons, provided they are flexible, can contribute to the reading and interpretation of the data. The Green Map System® (GMS) [1] is an example of a standardized system of icons designed to identify potentially sustainable or environmentally negative locations. Although it includes more than one hundred and fifty (150) icons, it is insufficient to represent all the specificities of each site, thus justifying the possibility of developing in the

forms of representation, either from the creation of new icons or any other form of representation.

The process of territorial automapping was used to amalgamate the university community composed of collectives [2] little permeable to the management of their territory of coexistence. For the greater understanding and future development of proposals, the workshops were divided in two moments. In the first one, diagnostic maps were made, based on a general map of the campus and its immediate surroundings, with a radius of 2 kilometers, being the same for all units; and a smaller scale specific map of each region, where the User can better identify the areas they have the most contact on campus. In the second moment the construction of a future scenario was carried out.

In the first half of 2016, the Campinas/SP campus workshops started as an educational activity among students.

A group of Geography and Architecture and Urbanism students were selected to work on the project. Students were trained and challenged to organize participatory mapping workshops for their peers as a strike activity. The material was prepared and the workshops were carried out under professor supervision.

The engaged students, a majority of graduation students, participated actively, giving preference to the public space under different perspectives. While geography students detailed the natural elements of the landscape, future architects and urban planners focused on proposals for changes to improve urban mobility with the expansion of the public transport and

the non-motorized systems, as well as the improvement of public living spaces.

This was a collective teaching process in which, from a professor stimulus of the ones involved in the process, the monitor students took up teaching activities and involved their peers in a fruitful debate about their place of use and belonging, as well as how specific perspectives of analysis can reduce the scope of sustainability.

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[1] <http://www.greenmap.org/>

[2] professors, researchers, students and administrative technicians.



KTH Royal Institute of Technology

University-wide integration of sustainable development in education

Project Description: Since 2011 KTH (Royal Institute of Technology) has been working university-wide and systematically to ensure integration of sustainable development in all engineering and architect programs. We have used two complementary strategies: Evaluation of the programs' efforts (described below) and Providing tools and support for all program directors and teaching staff to achieve the set goals.

The support to program directors and teaching staff is provided through a number of different activities that has been developed at KTH since 2011, such as

- A 4.5 ECT credits pedagogical course "Learning for Sustainable Development" for teachers is given at least annually
- A web-based toolbox for teachers
- Three course modules of approx. 1 ECT credit that can be integrated independently in courses or programs (one each on "Introduction to sustainable development", "Social sustainability" and "Sustainable business development")
- Seminars and networking
- "Coaching" of teachers and program directors, contact information on teacher resources
- Seed funding for developing new courses and other activities

Project Objectives: The objective has been to ensure that sustainable development is integrated in all engineering and architecture programs at the university.

Learning Outcomes: The starting point was the overall learning outcomes related to sustainable development set by the Swedish Higher Education Ordinance. These were further specified and clarified in process involving teachers and program directors. The specified learning outcomes are also endorsed by the Faculty Council.

Assessment Model: The evaluation process was designed to continuously promote and verify the progress of integration of environment and sustainable development (ESD) in all engineering and architect programs. In 2012, all programs did a self-assessment of fulfilment of the ESD learning outcomes stated in the Swedish Higher Education Ordinance. In the self-evaluation, the Program directors were asked to describe the program's learning outcomes related to ESD, which courses support the learning outcomes of the programs, examples of examination, the level of progression etc. The Program directors were also asked to specify the need of further support that could be provided to improve the fulfilment of the learning outcomes.

The next step was a dialogue meeting with each of KTH's ten schools. Present at the meetings were the Dean of the school, the Director of First and Second cycle of education at the school, KTH's vice-president for sustainable development and the project leader from KTH Sustainability office. The basis for the meeting was the self-evaluation reports from the schools. The outcome of the meeting was an action program for integration of ESD in the educational programs at each school for the period 2013-2015.

During 2015, a follow-up was conducted as a four step procedure. First, all engineering and architecture programs turned in a survey containing courses in the programs that contribute to different learning outcomes, then the survey was evaluated by KTH Sustainability Office, and as a third step interviews with the Program directors were performed based on the information in the surveys. Thereafter all of the information was summarized in a short report and submitted to the Directors of First and Second cycle education at each school. The interviews were conducted as a dialogue where both the current level of integration and future development needs were discussed.

The process is now continuing. All programs have developed new action programs and these will be followed up as a part of the environmental management system (EMS). Since KTH's EMS is certified according to ISO 14001, this ensures that there will be a yearly follow-up as a part of internal and external audits.

How did you define success? What can other institutions learn from your experience with this project? The results from the 2015 follow-up clearly showed that progress has been made. Significant changes have been made in many programs and there are concrete plans for further development. Currently there are no programs that completely lack integration of sustainable development. A few programs have gone through (or are in the process of) a complete reconstruction and sustainability aspects have been integrated in several courses. New courses with relevance to ESD have evolved and new educational activities have been developed in existing courses at several schools. One of the remaining challenges is assuring the progression throughout the 5 years of education (bachelor plus master), especially since the students studying on the master level have different backgrounds.

During the interviews, several Program directors explicitly mentioned the positive effect of the different evaluations that have been conducted, making them a tool for the analysis of the progress and incitement for continuous improvement. The pedagogical course has provided insights in the different possibilities of teaching and learning sustainability and has inspired teachers to try various learning activities and methods of examination.

One of the most important factors for the progressive work on integration of sustainable development is that the leaders of the schools support Program directors, that this work is prioritized and that resources are allocated for the initiative. The support from the leaders of the university is also of high importance if changes are to be realized on the school levels.

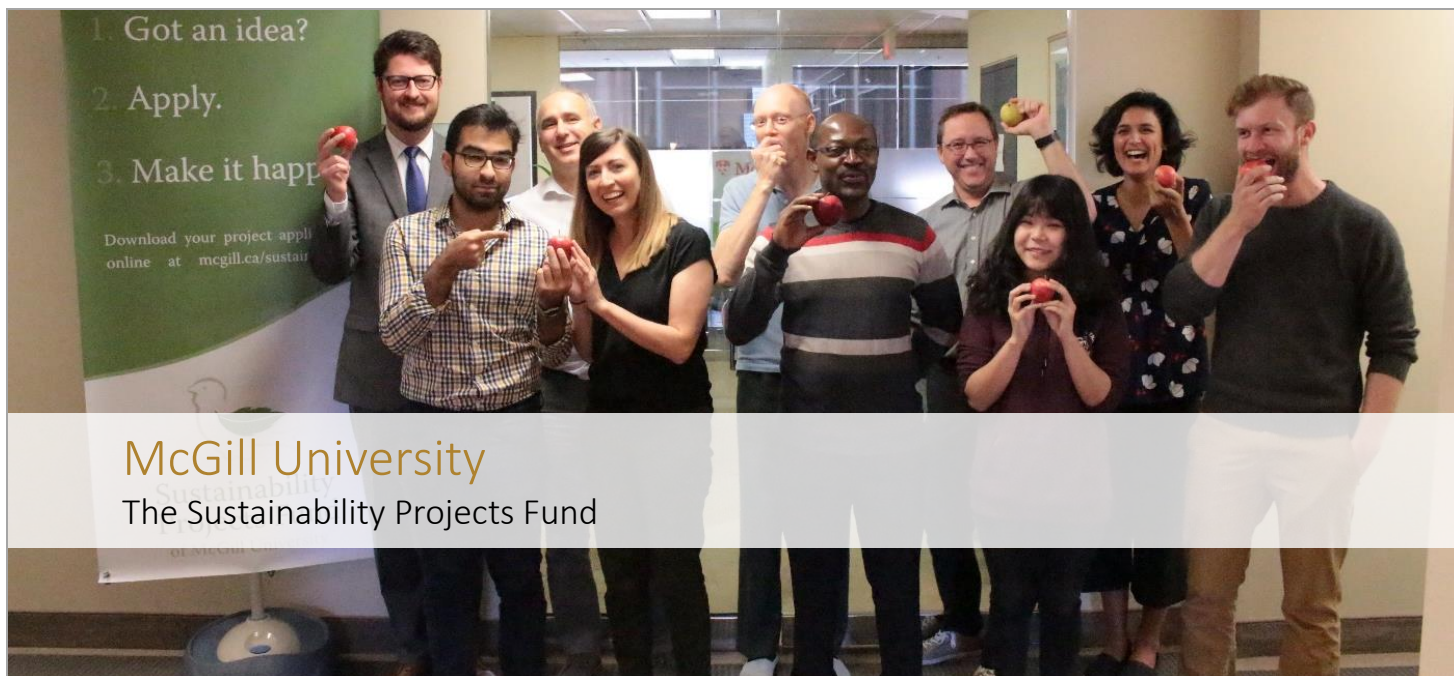
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Others involved with the project: Emma Strömberg, hundreds of staff and faculty at KTH



McGill University

The Sustainability Projects Fund

Project Description: The Sustainability Projects Fund (SPF) provides seed-funding and advice to interdisciplinary projects at McGill, in order to build a culture of sustainability on campuses. With an annual value of 885,000 CAD in 2016, the SPF is the largest dedicated campus sustainability funds of its kind in North America among peer institutions. Since its creation in 2010, the Fund has awarded over 5 million CAD to 155 projects, which have yielded lasting improvements to McGill's social, economic, and environmental sustainability performance. The Fund is also uniquely committed to collaboration between students and staff in its financing, decision-making, and project implementation.

The SPF empowers students to take action to improve the sustainability of their university. Students (and also staff) not only educate and engage others about sustainable practices, they themselves learn about the promotion and application of sustainability, using McGill as a living laboratory.

Flagship projects include McGill Feeding McGill (which enables locally grown fruits and vegetables from McGill's Macdonald Campus farm to be provided to downtown residences) and Vision 2020 (a project that brought together over 1,500 stakeholders from the McGill community to build an overarching sustainability vision and strategy for the University). SPF funding has facilitated every significant sustainability achievement at McGill over the past several years—from local and sustainable food sourcing to emissions reduction to Indigenous engagement.

Project Objectives: The objectives of the fund are threefold:

- to empower McGill stakeholders to create their own projects to address sustainability concerns,
- to leverage and increase collaboration on sustainability initiatives on campus, and
- to provide a supportive and productive outlet for tomorrow's sustainability leaders to learn project management and related skills.

Learning Outcomes: Each project team completes a self-assessment based on previously identified learning outcomes. These outcomes include a professional growth area (e.g., networking, project management, problem solving, writing, and budgeting) and a personal growth area (e.g., systems thinking, leadership, and public speaking).

Assessment Model: The SPF is assessed on two main fronts. First, how successful has the project been in meeting their project objectives and, second, how effective have they been in engaging the larger McGill community? For the latter, we track the number of people engaged or trained through the project and the number of people hired for positions among others. This is captured in both the progress and exit reports completed by the team.

How did you define success? What can other institutions learn from your experience with this project? Teams select three success indicators at the beginning of their project along with targets to reach.

The success of the fund as a whole takes into account these success indicators along with many other factors. For instance, the impact of the SPF since its creation in 2010 includes (but is not limited to):

- Over \$5 million awarded in support of 155 projects (half from student fees);
- 250 student jobs created;
- 25 peer-reviewed papers published or in review;
- Course credits for 310 students for contributing to SPF projects;
- 1,750 students took courses in which SPF projects have been integrated;
- 1,800+ volunteers mobilized for SPF projects;
- 545 acres of McGill land now growing food annually to feed the McGill community.
- Annual purchase of over 20,000 kilos of produce, 3,400 kilos of beef, and 180,000 eggs from the Macdonald Campus Farm to serve in dining halls, contrasted with almost no intercampus purchasing prior to SPF funding.
- Real-time online map powered by 400 energy meters tracks energy use in 70 campus buildings.

We believe that the Sustainability Projects Fund is a crown jewel of McGill University's sustainability efforts and a best-practice model for universities. From our experience, we learned the following:

1. Nurture engagement. We learned to empower our most invested and passionate individuals to bring ideas into reality. This included developing tools and communicating transparent and participatory processes.
2. Be unafraid. We learned to ask 'why not?' instead of 'why', allowing SPF projects to embody McGill's sustainability ethos of ambitious realism. We choose to learn from failures instead of shying away from them; using our campus as a living laboratory where knowledge is applied and learning is experiential.
3. Create a community. Instead of taking ownership of all projects, we learned to play a facilitator role, bringing together diverse people who would normally not work together, distributing leadership, and helping them share and celebrate their successes.

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University of Oxford

Carbon Innovation Programme

Project Description: In October, the Environmental Sustainability team at the University of Oxford embarked on an exciting new initiative – the Carbon Innovation Program. The aim was to establish multidisciplinary teams of staff and students, who will work collaboratively to identify new innovative ideas that help reduce carbon emissions across the University.

This program, and the resulting projects, will support the University's Carbon Management Strategy and help it achieve its ambitious target of reducing carbon emissions by 33% by 2020/21 from a 2005/6 baseline.

The teams each developed an initial concept into a detailed project and then, following a number of supporting events, ten teams presented their ideas to a panel of experts (titled the Carbon Den) during December 2015.

The quality of the projects put forward was exceptional. The diverse ideas ranged from an engagement project using sculptures to investigating heat recovery from data centres. Funding was made available to two of the projects, and five more are now being further developed.

Details on how the process ran including launch events, judging panels and mentoring sessions with industry and academic experts can be found at www.energy.ox.ac.uk/cip

Project Objectives: This program was developed with the Environmental Sustainability Policy and the University's Mission Statement in mind.

The University of Oxford's Mission Statement

<https://www.ox.ac.uk/about/organisation/strategic-plan?wssl=1>

The University of Oxford's Sustainability Policy

https://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/estatesservices/documents/intranet/EMS_P_0001_Envirionmental_Sustainability_Policy_2016.pdf

The Carbon Innovation Program is designed to

enhance students' education and experience to prepare them for future employment by developing structures for collaboration across departments and estates. It is also designed to work in collaboration with academic research to enrich desktop research that can then be implemented on site and evaluated.

Learning Outcomes: The program was relatively easy to roll out once the materials had been written. The main challenge however, was ensuring that staff and students remained engaged after the initial launch event. A number of casual networking events had to be created to get everyone together to encourage and maintain motivation. New teams were formed through these follow-up events so this is something we would look to repeat next year.

The initial scope of the program set out an expectation for teams to come to the Carbon Den with a fully thought-out business case. It became clear that this was unreasonable and therefore prior to the

Carbon Den we communicated to all of the teams that the expectations for presentations would allow for less well scoped-out projects to continue their work after December, if the team wished to and if a panel member championed the team to do so. We would look to amend the scope and time scales for next year.

How did you define success? What can other institutions learn from your experience with this project? A cross-functional approach to sourcing carbon reduction projects such as this has never been carried out before. The Environmental Sustainability team is actively trying to encourage a 'living lab' approach to works on the estate to push the boundaries of innovation and a new research post has just been established to look into this. Creating a dynamic

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Others involved with the project: University of Oxford, Siemens, Hoare Lea



Università degli Studi di Siena

Santa Chiara Lab for Sustainability

Project Description: The University of Siena has a long tradition in the promotion of research, teaching and good practices on Sustainability. Many scientists have been and are involved in such areas. Sustainability is a top priority for the University of Siena.

The University of Siena (Italy) hosts the UN-SDSN MEDITERRANEAN, the Regional hub for the Mediterranean of the Sustainable Development Solutions Network (SDSN), directed by Professor Jeffrey Sachs (Columbia University), Special Advisor to United Nations Secretary-General on the Millennium Development Goals. The aim of the SDSN is to mobilize academia, research institutes, civil society, and the private sector in pursuit of practical solutions for sustainable development.

To pursue this objective, among its multiple activities, SDSN provides FREE, high-quality content through on-line courses and similar from a global faculty of experts in the field of sustainable development.

The University of Siena promotes the introduction of this content into its existing curricula and helps to promote it. Furthermore, the University of Siena is organizing a blended massive open online course (MOOC), bringing together senior scientists and young researchers mainly, but not only, from around the Mediterranean region in order to provide a shared resource regarding the peculiarities of the management of sustainable development in MED area.

The MOOC benefits from the experience gained through the course on “Sustainability” organized by the University of Siena since 2014. The course provides the basis for understanding the problems connected to sustainability in all its aspects, analyzing environmental, economic, financial, social, juridical and institutional aspects of the communication. The planification and the exploration of the transdisciplinary aspects are needed to better comprehend the complexity of this topic.

Through such activities in Educating to Sustainability, the University of Siena supports the introduction of citizen science and co-creation activities to respond to Sustainable Development Goals (SDGs).

To strengthen and enhance the positive synergies between various activities promoted on sustainable development, their organization is integrated and coordinated within the SANTA CHIARA LAB, the innovation hub of the University of Siena based on the spirit of multidisciplinary and transdisciplinary intellectual inquiry to explore new perspectives at the frontiers of knowledge.

The aim is to create a permanent centre dedicated to the study and promotion of sustainable development in academic, institutional and professional fields, offering a long range of activities, specially focused on the Mediterranean area, such as:

- Cooperation and joint research activities among countries, universities and businesses;
- Development of practical solutions to sustainability issues;
- Elaboration of SDG indicators ;
- Promotion of networking activities among research centre, the diffusion of education tools and joint programming in the context of EU planning activities.

In this sense, Santa Chiara Lab also intends to become the point of reference for a network of national and international universities that prioritize study and training on environmental, social and economic sustainability. It will also foster the dissemination to businesses and institutions of competences gained and research results achieved.

Project Objectives

- To give basis to understand the problems linked to sustainability in all its dimensions
- To analyze environmental, economic, financial, social, juridical and institutional aspects of planning and communication
- To analyze the transdisciplinary aspects, which brings to the real comprehension of the complexity of sustainability
- To prepare students towards all aspects of sustainability
- To make students became an important mainstay for their colleagues in the Mediterranean area

Learning Outcomes

- The project has the aim to prepare students and researchers with cross-section knowledge.
- The project connects academic reality and economic operators, as to provide much more integration between companies and students
- The project create a laboratory space for exhibitions and multidisciplinary dialogue aimed at promoting hybridization of knowledge and transversal as well as digital skills.

How did you define success? What can other institutions learn from your experience with this project? The success factors in developing the sustainable initiatives of University of Siena, which also are the distinctive characteristics of Santa Chiara Lab, can be summarized as following:

- The multidisciplinary approach: includes all the sustainability dimensions in an integrated perspective, as to enhance the synergies.

- The multi-actors approach: includes the cooperation and collaboration of numerous of actors active around the Mediterranean area: from senior academics to young researchers, economic operators and civil society.
- Innovative methods: includes the blended MOOC (on-line Sustainability courses), lectures, workshops and active cooperation between academia and private economic operators. These methods are organized for the purpose of creating the opportunities of contamination of different and numerous actors involved.

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Chapter Three:
Sustainability Across the Curriculum



Ecole Polytechnique Fédérale de Lausanne (EPFL)

New first year course called Global Issues

Project Description: The Global Issues course for first year science and engineering students covers topics derived from reports produced by the United Nations and the World Bank [3]. These topics are health, food, mobility, energy, climate, and communication. Students can select any of the topics indifferently from their study program on a first registered first served basis.

For each of these six topics two modules were created to accommodate 1800 students in twelve classes of 150. As the emphasis is put on presenting each of these topics from both a technical and a societal perspective, each module is taught by a team of at least one lecturer with a background in engineering and at least one lecturer with a background in social sciences or humanities. Each one of these courses includes class activities, online activities and group activities.

During the class activities, the interdisciplinary content is presented by the lecturers. During the online activities, students receive guidelines on bibliographical research, reference management, teamwork and conflict resolution through short video sequences. Then, during their group activities students have to work on a poster for the rest of the semester. In this poster they have to present both the technical and the societal challenges and opportunities of particular instance of the issues that were studied in class. Finally, they have to defend their work in an oral presentation.

Project Objectives: Although engineers are most often required to develop highly specialized skills, their action is deployed in increasingly complex and global frameworks. To ensure they are aware of their work's impact, EPFL has created a palette of courses on global issues provided to some 1,800 first year Bachelor students. The courses, organized by the College of Humanities, seek to raise students' awareness about major global challenges by encouraging them to go beyond their core discipline and take a holistic approach to their studies from day one.

Learning Outcomes: When the time comes, they will be in a better position to make well-founded choices in full knowledge of the facts. And when engineers learn to integrate economic, social, cultural, or environmental concerns into their work, end users will benefit more from the discoveries they make and the new technologies they develop.

How did you define success? What can other institutions learn from your experience with this project? On behalf of the course coordinators and teachers, we undertook to evaluate the impact of the course. In addition to the traditional student feedback questionnaires, the impact of the course on student learning was to be assessed. The evaluation focused on:

- changes in students' moral reasoning
- their attitudes towards interdisciplinary group work.

Two internationally recognized psychometric tests (the Engineering and Science Issues Tests and the Readiness for Interprofessional Learning Scale) were translated into French and adapted for the context. These were then administered to around 1,700 students at both the beginning and the end of the course. These pre- and post-experience tests were matched and changes in student moral reasoning and attitudes towards interdisciplinary group work were identified. The results were presented to the teachers during the planning process for the 2014-15 course. Publication: <http://www.sefi.be/conference-2015/CHAP%2022.%20Ethics%20in%20engineering%20education/56039-%20R.%20TORMEY.pdf>

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Pontifical Catholic University of Peru

LEED Lab

Project Description: LEED Lab is a multidisciplinary immersion course that utilizes the built environment to educate and prepare students to become green building leaders and sustainability-focused citizens. In the course students assess the performance of existing facilities on campus and choose one building where they will facilitate the LEED for Building Operations and Maintenance (LEED O+M) process with the goal of certifying the facility. At the close of the semester the students are prepared to sit for the LEED AP O+M professional credential exam.

Project Objectives: LEED Lab has two main objectives. The first is to transform University's campuses into Green and Sustainable campus using LEED Certification, transforming existing buildings into Green Buildings. The second objective is to educate and prepare students to meet the challenging needs of the XXI century, equipping students with the skills, knowledge and expertise required to be effective communicators, project managers, critical thinkers, problem solvers, engaged leaders, and team players, by becoming Sustainable Professionals with the LEED AP Accreditation.

Learning Outcomes: The First Edition of the three-semester LEED LAB course finished in December 2016. With every semester, I have seen an increased interest in the LEED Lab course. In the first semester, I had 12 students, and six of them passed the LEED Green Associate exam. In the second semester, I had 16 new students, and seven passed the LEED Green Associate exam. Now, in the third semester, I have 47 students, which I think is great. This might land another 20 LEED

Green Associates by the end of this year, we also have the first University existing building ready to be considered for revision, aiming to achieve LEED EBOM certification Silver level. This supports the university's Sustainable Master Plan.

Assessment Model: For the buildings retrofitting, we are using the LEED rating system EBOM v4 (Existing building- operations + Maintenance) and for the students, the LEED GA Accreditation Exam.

How did you define success? What can other institutions learn from your experience with this project? I think the best definition of success has to come from the students, and here is what some are saying:

"The experience and knowledge gained in the LEED Lab course has been invaluable. Personally, the course has helped me to develop new views and a better view professionally. In addition, I have a different view of facility management and have learned about new disciplines and everything that goes into developing sustainable buildings. It was gratifying to have been a part of this experience and pass the LEED Green Associate exam. This is a first step toward obtaining a LEED AP in the coming months and to continue contributing to the growth and spread of sustainable buildings in our country. I'd like to thank PUCP and Professor Héctor Miranda for this enriching experience." —Mario Alexander Horna Espino, LEED GA

“First of all, I want to thank the PUCP, administration and teachers who participated in this great initiative that shows us, the students, to delve into a world full of opportunities, which I am sure will benefit us and carry a high name for our university. The course was very enriching, because we could learn more about how to manage the sustainability of our planet through construction and put into practice what we learned through the certification of the new building of the Arts. We are committed to continuing this line of LEED certification at the university and increasing our knowledge about it.” —Edson Antonio Cajaleon, LEED GA

“For me, to have led the pilot course of LEED Lab has been a very good decision and experience, both personally and professionally. On the professional side, I was able to learn from engineer Héctor Miranda through a dynamic class, reading documents and visiting the pavilion of the Faculty of Art at PUCP, the building chosen to submit for LEED certification. All of this has helped me to the great satisfaction of obtaining a LEED GA. I know that this is my first step in the professional world and I have many things yet to learn. And I know that building a sustainable world will always be related to my career and any specialty I choose, and this course has made us better professionals prepared to transform our environment in a sustainable way.” —Jorge Luis Espino Guevara, LEED GA.

There are many good reasons why any campus should be looking for this great opportunity. Top-level engagement is always a priority in promoting the course, and of course, regardless of the campus economy, any good step to energy efficiency and a low carbon economic model, regenerate any campus.

LEED Lab champions should be very creative and positive. It might take a little effort in the very beginning, but it is 100 percent worth it. Experiencing the happiness and motivation of the new LEED Green Associates and seeing the development of these new heroes in sustainability is priceless.

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The Hong Kong University of Science and Technology

A modular, blended-learning approach to sustainability education across the curriculum

Project Description: In June 2016 the HKUST Governing Council adopted a new five-year strategic plan, which, for the first time, included a clear commitment to “becoming a global leader in sustainability education.” Because sustainability crosses so many fields and is interconnected with numerous skill sets, it is a challenge to deliver on this strategic goal by building a broad but coherent sustainability education that would enable students to find meaningful curricular pathways.

While the University already has a substantial number of sustainability-related courses (around 10% of the course catalog), the courses tend to be single discipline and content-specific. The question arose: how could we provide a truly broad perspective on sustainability that crosses all disciplines – and do so in ways that incorporate new thinking in the delivery of course content? The result was the development of Introduction to Sustainability (SUST1000), integrating the principal contributions of science, engineering, business management, the social sciences, and the humanities. Co-taught by eight faculty members and celebrating the diversity of those perspectives, the course provides students with the opportunity to understand the principal features of sustainability as interpreted across those disciplines.

A key objective of the course was to exploit the capabilities of blended-learning and flipped classroom pedagogies, creating bite-sized learning modules roughly scaled to be equivalent of a week of a regular full-time course capable of re-use in other courses and programs. For these modules, the instructional content is delivered chiefly through online resources – video, slides, and graphics (including existing learning objects)

and embedded learning activities and this is followed by face-to-face learning sessions, including assessment activities.

This model allows discipline experts to contribute to the core course while simultaneously creating stand-alone, credit-earning components that can be incorporated into in other course and program settings. The modules also provide new ways for students to supplement their degree programs. Finally – recognizing the time constraints of faculty, this model allows our specialists to contribute meaningfully to sustainability education without making a full commitment to a course or program.

For example, a module focusing on Life Cycle Analysis designed for SUST1000 includes on-line learning materials that explain this approach and gives examples of its applications. The on-line component is followed by in-class exercises that take students through a full LCA of a simple product, with assessment aligned to their performance in these exercises. Now that the module is completed, it will be used in both engineering and business programs to supplement student learning interests.

Going forward, expanding the learning module approach will allow for more options in integrating academic program and degree requirements of experiential learning, utilizing the campus, grounds, and local surroundings as “living laboratories” for sustainability. It is also anticipated that this model can provide a vehicle for cooperation with other institutions to share the development and delivery of these sustainability modules.

Project Objectives: At this stage there are four basic objectives:

1. To establish the capacity for delivering a truly cross-disciplinary sustainability course combined with a blended learning approach.
2. Enhance access to completed learning modules beyond the original course-site through systems and processes for managing administrative data, including student registration, attendance at face-to-face sessions, and assessment
3. Embed arrangements for management and production of modules in established university structures, including systems for academic governance and module production
4. Extend the network for sustainability education across Hong Kong higher education institutions

Learning Outcomes: In particular, students should:

- Appreciate the scope and urgency of issues relating to the global impact of the anthropogenic forcing of Earth systems
- Understand the relation of their own specialist studies and career options to the broader problem of social and natural sustainability and their potential role in contributing to solutions
- Be able to apply key skills and competencies necessary to contribute to sustainability

How did you define success? What can other institutions learn from your experience with this project? The initially metrics for success were to persuade eight faculty members from different fields on the merits of participating in this effort; develop and deliver the course; and identify the “bite-sized” chunks of content that could be incorporated into modules. Going forward, we will be successful if we are able to expand the scope and number of viable, delivered modules capable of re-use in other course and program-settings; and embed this model for sustainability education across-the-curriculum.

Other institutions may find that this approach can generate an increase in available sustainability content without a large burden on the demands of faculty members and content experts.

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The University of Hong Kong

The Common Core and the Sustainable Development Goals

Project Description: The Common Core at the University of Hong Kong: Educating for Sustainability across all the Faculties.

HKU is committed to respond purposefully to the challenges identified by the United Nations (UN) through the Sustainable Development Goals (SDGs) and to play an active part in addressing the issues of inequality, health, education, disaster prevention, poverty, environment and well-being through its teaching and learning experiences. To this end, selected Common Core courses are mapped against the 17 SDGs, which can be identified by the SDG icons attached to the course page.

(<http://commoncore.hku.hk/sustainable-development-goals/>)

The University of Hong Kong is a comprehensive research intensive university with approximately 17,000 undergraduates and 10,000 graduate students. The transition in 2012-13 to a four-year undergraduate degree across the city's eight publicly-funded universities introduced a General Education component, offering new opportunities to enhance teaching on sustainability issues. At HKU, the Common Core was created to address "issues of profound significance" through a wide variety of transdisciplinary and interactive learning experiences for all undergraduates across all ten Faculties.

Common Core seeks to address the complexities of sustainability across cultures. In the Core, each undergraduate must take a total of six courses across four Areas of Inquiry: Science and Technological

Literacy, Global Issues, Humanities, and China. The more than 170 courses in the Core are transdisciplinary in scope and taught interactively, through projects, media productions, debates, interviews, and other active assessments that lead students beyond the classroom. Courses with a greater emphasis on experiential learning and blended learning options are also offered, such as the Transdisciplinary Research Student Exchange organized in collaboration with partners at Utrecht University.

The Common Core and the Sustainable Development Goals (SDGs):

Offering Common Core courses across the spectrum of sustainability issues is an essential contribution to student learning. Beginning in the 2016-17 academic year, Common Core courses have been tagged to correspond with the Sustainable Development Goals as a way to introduce students and colleagues to the SDGs and prepare the groundwork for further curricular work. This initial effort provides a useful visual mapping of courses and curricular pathways across all four AoIs and a framework for transdisciplinary and holistic learning. To date, 141 courses have been included in this exercise across all four AoIs (STL: 41; HUM: 40; GLO: 34; CHI: 26).

Almost all of the courses across the SDGs have a fieldwork and/or project component, enabling students to learn not only the necessary theoretical frameworks but, even more importantly, to begin to get an on-the-ground feel for the issues: from air and water pollution, to the sustainability of the built and

natural environment, multiple aspects of well-being, and the sustainability of minority languages and cultural practices. In addition to the tagging effort, the Common Core is now working on developing clusters of courses and a Transdisciplinary Minor in Sustaining the Earth, Cities, and Cultures, providing students with an additional pathway through the Core.

HKU is proud of the Common Core, a distinctive model of General Education for all undergraduates. As participants in the global effort to support the SDGs, we are able to make a curricular contribution to the learning of both our students and our teaching staff.

Project Objectives: To expose all of our students to the SDGs and allow those interested to navigate a pathway of coherent courses related to sustainability across all four Areas of Inquiry.

Learning Outcomes: Through this project students will be able to:

- Articulate a broader perspective and a deeper critical understanding of the complex connections between issues of profound importance.
- Better navigate the similarities and differences between one's own and other cultures.
- More fully participate as individuals, members of social groups, and citizens in global, regional, and local communities.
- Demonstrate the creative, collaborative, and communication skills that will contribute to the quality of your own and others' lives.

Assessment Model: A variety of assessments, including fieldwork notes, reflective journals, photography, video production, posters, debates and role-plays, art exhibits, essays, and exams.

How did you define success? What can other institutions learn from your experience with this project? Success occurs when our undergraduates are inspired to attend with intelligent care to the world in which we find ourselves. The Common Core offers a model of General Education that is organized around transdisciplinary courses; interactive learning, assessments, and projects; and offers coherent pathways through the SDGs.

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Nanyang Technological University

Educating for Sustainability

At Nanyang Technological University (NTU) in Singapore, our primary education mission is connected to our extensive sustainability research and applied programming. Our sustainability education is anchored by our integrated and multidisciplinary approach, and by our pioneering researchers who also teach our students. The highlight materials that follow give more details about the reinforcing layers of NTU's sustainability education ecosystem. By way of executive summary, there are several aspects of sustainability education at NTU we'd like to emphasize:

The presence of NIE (National Institute of Education) at NTU gives the university a unique opportunity for sustainability education. NIE educates all public school teachers (primary and secondary) in Singapore, allowing us to support a sustainability curriculum that begins at early ages, and lays a solid foundation for the nation's more advanced educational and degree programs.

NTU has an online sustainability course mandatory for all entering first year students (nearly 6000 every year). Introduction to Sustainability, Multidisciplinary Approaches and Solutions went live in 2014/2015 and has now run for three years.

The course provides a common foundation for sustainability, and was designed to motivate and excite students.

The main responsibility for educating NTU students rests with our academic Colleges, Schools, and Departments. Over the past 5 years, every academic unit at NTU participated in creating coursework components and new courses related to sustainability, for educating students with disciplinary expertise while

teaching tools, knowledge, and skill sets relevant to sustainability.

Since 2014, NTU and Singapore offer an undergraduate program (minor and major) in environmental earth systems science as part of NTU's new Asian School of the Environment (ASE), under the College of Science. The new interdisciplinary program is the flagship undergraduate sustainability program.

Dedicated to multidisciplinary research and postgraduate training, NTU's Interdisciplinary Graduate School (IGS), the first of its kind in Asia, opened in 2012. Currently, IGS has a cohort of 390 graduate students enrolled across 3 thematic research programs: Sustainable Earth, Secure Community, and Healthy Society.

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University of Geneva

Master's Programme in urban and regional development

Project Description: The Master's program brings together expertise in geography, architecture, landscape architecture, sociology, urban and regional economics, law, and geographical information systems. All these allow students to get a ready-to-use set of skills. This is achieved by a unique set of collaborations linking the University of Geneva and many other academic and professional institutions in Switzerland, in Europe, and beyond.

The Master's program in urban and regional development covers topics ranging from urban planning to landscape architecture, and regional development, in the global north and south. Four concentrations are proposed:

- Urban planning and design
- Landscape architecture
- Regional development in the global South
- Geographical information systems

Sustainability is a core concept of the whole curriculum. As a matter of fact, this concept is particularly relevant in teaching and practices in urban planning and regional development where integration of environmental, social, and economic issues, as well as conceptualization of temporality (the historical time of cities, the time of the project and its implementation, etc.) are the most required. Out of the three workshops the students have to follow, the first one is fully dedicated to sustainable development approaches. Students are made familiar with SD issues in urban governance; SD approaches are used for making spatial diagnosis and are guiding students' first experiences in planning.

Project Objectives: If this master program teaches students how to work with concepts, such as sustainability, and tools, such as SD index, it also expects students to develop capacities in critical thinking.

Students must become able to cast a critical glance at spatial contexts, modes of urban governance and planning processes by themselves. This critical viewpoint is essential for anticipating future issues, as well as conceiving innovative solutions for tackling them.

Learning Outcomes: Thanks to a close relationship with practical activities (studio projects, workshops, internships, fieldtrips, summer schools), the Master's program enables students to develop first-rate competencies regarding territorial diagnosis and planning. It enables students to acquire key technical, practical, theoretical, and legal skills that are used on an everyday basis by established professionals in the field.

Hands-on studio projects form the heart of the Masters' program curriculum. This efficient educational approach allows the simultaneous transfer of theoretical and practical knowledge.

How did you define success? What can other institutions learn from your experience with this project? The goals of this program are achieved whenever students, with their master degree in hands, feel at ease in applying for various jobs in regional development and urban planning, and are seen as

carrying valuable additional competencies in an administration, an association or a private company.

These additional competencies include more specifically the capacity of combining practical skills, professional knowledge and critical thinking, all of these components being framed by an overall vision of sustainability and a personal will to contribute to the improvement of built environments.

This master program is unique in French-speaking Switzerland. Compared to similar program elsewhere in Europe, it is one the most oriented toward problem-oriented and hands-on teaching, one of the most capable to train students with real-life situations and to make them able to quickly integrate professional situations.

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National University of Singapore

Multidisciplinary, holistic approach to sustainability education

The National University of Singapore (NUS) is committed to protecting the environment and incorporating sustainability in all aspects of campus life – from education and research to operations. Various undergraduate and postgraduate programs in the field of sustainability are offered at NUS. In particular, its School of Design and Environment (SDE) offers four Bachelor and 13 Master degree programs in architecture, industrial design, building and real estate, with tailored curricula to equip students with a broad and multi-disciplinary understanding of sustainability in the built environment. The School also offers sustainability specializations through three Master of Science programs in Integrated Sustainable Design, Environmental Management and Building Performance and Sustainability.

Building on this foundation in sustainability education and research, SDE embarked on a journey to conceptualize the first purpose-built net zero energy building in a Singapore tertiary institution to transform teaching in sustainable design.

Transforming Sustainability Education in a Modern Living Laboratory

With a host of green building designs such as solar energy, hybrid cooling, natural ventilation and lighting, the new Net-Zero Energy Building (NZEB@SDE) is envisioned as an ideal space for both students and staff to learn about sustainable building solutions. Through NZEB@SDE, the School aims to make the case that through design, and eventually, operations, that stringent energy targets for Singapore buildings are not only possible, but are necessary and can lead to an architectural delight.

Opening in early 2019, the NZEB@SDE will house teaching and research facilities – design studios, laboratories, workshops, test-bedding facades, a 3D scanning laboratory as well as joint research centres/smart green homes in collaboration with public agencies and industry partners. The building will offer a biophilic experience for its occupants, connecting them with nature and its processes. From uninterrupted views to greenery, to the usage of energy and water usage monitoring systems, the building will offer topicality lessons with a pedagogical edge for teachers and students.

The on-site learnings at the NZEB@SDE will augment the curricula offerings by the School, of which some highlights are featured below.

Highlights of Master Degree Programs with a Sustainability Focus

Master of Science | Integrated Sustainable Design

Learning Objectives:

- Forging an integrative, multidisciplinary approach
- Focus on the Asian context
- Lessons from the Singapore experience
- Exploring scalability of solutions; buildings to cities

Outcomes: The program equips architects, engineers, planners with insights, knowledge and skill sets for a holistic approach to sustainability, preparing them for leadership roles. It offers students an opportunity to acquire an integrative thinking mindset, converging planning, design, technology and policy towards strategic sustainability outcomes.

Assessment Model: Comprising lecture modules and studio-based assignments, the course is taught by highly qualified academics from SDE. Teaching is augmented with Master Classes by renowned experts and practitioners. A series of supporting guest lectures is scheduled each semester, offering insights into the Singapore experience and emerging viewpoints from innovative thinkers at NUS.

Master of Science | Environmental Management

Learning Objectives:

- A highly integrated, multidisciplinary program with a broad-based approach to education in the field of the environment as evidenced by a joint offering by nine faculties and schools in NUS, including
 - the Faculty of Arts and Social Sciences; Faculty of Engineering; Faculty of Law; Faculty of Science; Lee Kuan Yew School of Public Policy; NUS Business School; Saw Swee Hock School of Public Health; and Yong Loo Lin School of Medicine.
- Provide perspectives and context related to national, regional and international environmental issues
- Balance across all facets of managing the environment ranging from business and policy to law and technology
- Provide a platform for students to assume responsible and influential roles in the public and private sectors and to make sound decisions that support sustainable development in all countries

Outcomes: The program provides students with a 360 degree and a multi-faceted view of environmental management including business, economics, policy, law, planning, science, and technology. Such a breadth of topics taught in the context of local, regional and global issues allows for a truly holistic learning experience. This prepares the students with the necessary tools to properly manage the environment and to deal with the challenges of an environmentally conscious society and international markets.

Assessment Model: The program is taught as a combination of interactive lectures, case studies, workshops, field trips, dissertations, projects, and seminars by professors at NUS who are specialists in their particular fields. Every year, there are over 15 to 20 guest lectures by global environment and sustainability subject matter experts from both industry and academia. There are also joint programs

including co-teaching with leading universities (such as Yale University and Duke University) as well as leading corporations such as Shell Oil. The program also has an annual “Asia Environmental Lecture” where world luminaries are invited to provide a perspective on the state of the environment and sustainability.

For SDE Dean Professor Lam Khee Poh, the School’s foundation in sustainability education and research allows for ground-breaking innovations such as the NZEB@SDE, marking a new chapter in SDE’s vision of learning, knowledge advancement and multidisciplinary collaboration. Through the NZEB as well as SDE’s sustainability courses, students are encouraged to explore innovative ideas to push the boundaries of sustainable design, building a green and resilient urban habitat for all to enjoy.

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Özyeğin University

An Innovative Three- Fold Approach in Education of Sustainability for Business

Project Description: Coining the idea that due to the increasing awareness on sustainable development, businesses are reconsidering their objectives and beginning to formulate strategies to take into account not only economic but also social and environmental sustainability, nine faculty members of Business School at Ozyegin University started working on developing a three-fold education methodology about ‘sustainability for business’. The first was the development of a course that went beyond a single program or college and offered to all students. Second, students are provided with an opportunity to get a certificate with additional studies. Third, the content has also been revised to provide training for the private sector. For the case of the private sector training, focus point shifts based on the needs of the business world including upcoming opportunities and risks related to sustainability.

Project Objectives: This innovative initiative started five years ago, with the following two main objectives.

1. **Course Content:** Classic approach to teaching sustainability is the three pillar approach based on environment, society and economy; however, the approach taken at OZU consists of the following modules to directly address all aspects of business decision making and sustainability within the framework described below.
 - Drivers for Sustainable Business
 - Strategy for Sustainable Business
 - Innovation and Entrepreneurship for Sustainable Business

- Organization/Human Relations and Sustainability
- Operations Management and Sustainability
- Marketing and Sustainability
- Economics and Sustainability
- Finance and Sustainability
- IT/IS and Sustainability

The course starts with a factual discussion on the legislative, normative, and market forces that drive businesses to consider sustainability in their practices. The 2nd module deals with the question of how to gain strategic advantage from and how environmental and social sustainability initiatives lead to economic sustainability. As discussed in the 3rd module, businesses need innovative ideas and entrepreneurial efforts that lead to sustainability initiatives to break old habits and discontinue with the status-quo and business as usual. Business strategy shaped around sustainability principles will have a trickledown effect and each business function will need to incorporate the three impacts into their functional strategies: operations, marketing, finance, strategy, and human resources as covered in modules 4-7. Module 8 discusses the sustainability impacts of information systems and technology as an indispensable part of business infrastructure and decision making.

2. **Teaching Approach:** This course is team taught with a build-in cooperation among faculty members involved. To ensure this cooperation, the course is offered during the spring term whereby allowing faculty members to meet

throughout the fall semester to present and discuss their respective materials in order to align the course content, provide comprehensive and in depth coverage, as well as to achieve academic, and practical continuity among the modules. The goal is to prevent delivery of multi module course based on discreet and spot-lectures.

Learning Outcomes: Regardless of a student or business person taking the course, exhibiting awareness about sustainability concepts in general and specific to businesses and demonstrate an understanding on sustainability related key performance indicators for businesses are the main targeted learning outcomes of this unique three-fold Sustainability for Business Education.

Assessment Model: (iAs the course and certificate are available for OZU students and the training for private sector, students have the opportunity to provide direct or anonymous feedback. This anonymous feedback system or evaluation is already set in place for all courses OZU wide.

How did you define success? What can other institutions learn from your experience with this project? In such a meticulous approach to sustainability education, the main challenges and in its own right the definition of success is improving the content and the flow of the modular course while keeping the interest of students as well as the commitment of the faculty members.

Sustainability Education has been on the agenda of the universities for many years but this was and maybe it still is understood as only environmental sustainability. As the definition of sustainability involves at least two more pillars, only considering the environmental sustainability is not sufficient to understand sustainability. Complementing the environmental approach with economy and society, governance and culture; both being factors heavily effecting sustainability; this innovative project implemented at Ozyegin University provides a much needed effective exemplar. The first-hand challenges encountered and solutions created both in developing the course content and in ensuring collaborative, seamless team teaching are expected to be the main takeaways for any institution adopting an integrated and

comprehensive approach to education of sustainability.

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Università degli Studi di Torino (UNITO)

Master on Socio - Environmental sustainability of Agri-food Networks (MASRA)

Project Description: The development of sustainable agriculture and agri-food networks – that ensure access to food in sufficient quantity and quality, reducing the ecological impact through a redesign of the agricultural sectors - is a challenge for the coming decades. Various players in the area, following the Agriculture and Rural Development Program by the European Commission, aim to innovate strategies and interventions in agriculture sector with multifunctional good employment opportunities that find new centrality in policies of socio-economic development and regional planning.

The Master in Socio-environmental sustainability of Agri-food Networks is a program of studies that meets the needs of those who want to complete their education through acquisition of knowledge to realize new agribusiness paths, through an integrated approach towards participatory planning, monitoring, evaluation and strategic management of environmental, social and economic impacts.

The acquisition of these skills will be of fundamental importance for public and private operators, and for all those who want to operate in the sector of small and medium enterprise, associations of producers, in consortia and, thanks to the development of self-entrepreneurship skills, the creation of microenterprises for Sustainable food chains.

CAREER OPPORTUNITIES

Through an interdisciplinary approach and a constant dialogue with farms, companies and institutions, MASRA graduates develop an overall view of the agri-food industry and acquire specific skills essential to design and implement transition plans towards sustainability for companies and organizations. The network of relationships built during the course

represents a personal and professional resource for those who wish manage their business activities.

RECIPIENTS

Admission to the program is open to students holding the equivalent of an undergraduate/first cycle degree program (Italian Laurea triennale), who will be selected on the basis of their research skills, basic knowledge of natural and/or social sciences, and a general insight in the subject of sustainable development. Five places are reserved for students that apply for national or international scholarship.

Project Objectives: The master intends to respond to the needs of formation of new graduates or deepening for those who already work and intends to broaden and enrich their expertise on Sustainability of agri-food sector. The exchange of knowledge that comes from comparison between participants - different by age, courses of training, professional experience and geographical origin - represents an invaluable opportunity to growth.

Learning Outcomes: Food system is a very complex reality guided by economic, cultural, social and environmental factors. A better understanding of these drivers and their interaction, is essential for reducing the impact of food supply chains, and building a future where cultivating, transforming, distributing and consuming constitute acts of sustainable daily life. In particular, the main challenge the master face is to understand, monitor and evaluate the highly dynamic contexts of food chains today and tomorrow, not only from a technological point of view but also from a socio-organizational one. Firstly public policies but also businesses of all sizes and sectors have to address this

challenge in order to be competitive on an ever-changing market that address consumers more and more sensitive to environmental issues.

The purpose of the Master is to provide cognitive tools to read and interpret complex situations, assess the sustainability of a territory, analyze the elements that characterize a sustainable food chain and relevant legislation, designing instruments for the promotion and design of local networks in sustainable agri-food sector.

MASRA graduate will be able to promote, in local and global scenarios, the transition to environmental sustainability and provide local actors expertise for the design and management of sustainable supply chains and rural development interventions in a landscape perspective.

Assessment Model: The master offer an interdisciplinary approach: teachers from academia alongside professionals and technicians, it combines courses and workshops in the field of social science, agriculture, economy, local marketing and communication.

The program is based on active teaching that guarantee a rigorous, but interactive, approach. In addition to lectures, the master provides workshops, discussions of case studies, group work, meetings with expert and company visits.

1. Complexity and territory - introduction to issues of the use and reuse of resources not renewable (biodiversity, water and soil), the characterization of territories and landscapes, and the bio-economy
2. Analysis and design of food chains - Description and analysis of the main food chains and economic networks social derived from them.
3. Methods and tools - practical application module deputy to the acquisition of methods and tools for accounting and valuation environmental social sustainability and economic.
4. Communication and marketing – form the development of efficient communication paths and effective for the promotion and enhancement of territories, companies and products.

To deepen the topics of the master Students will be invited to participate in a series of seminars and events, in Italian or in English, organized by the

University of Turin and other local authorities on food and development sustainable.

How did you define success? What can other institutions learn from your experience with this project? The success of MASRA can be defined by the total number of participants, their characteristic (new graduates, workers, their origins) but also by the cooperative relationship for internship and lectures with important institutions and companies of the Agri-food sector.

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Others involved with the project: This Master is set by the Department of Culture, Politics and Society and Department of Agricultural, Forest and Food Sciences at the University of Turin in the activities UNESCO Chair in Sustainable Development and Territory Management that has been operating since 2010 promoting an integrated system of research, training, information and documentation.





Leuphana University of Lüneburg

Presenting “The Glocal Curriculum” A Guide to Teaching and Learning in An Interconnected World

Project Description: Higher Education in the 21st Century

Real-world problems, from loss of biodiversity to epidemics and violent conflicts, manifest globally but strongly affect the lives of people in their local contexts. In order to empower students to address these problems as change agents, we need innovative approaches for teaching and learning that allow them to develop respective competencies, learn about the local nature of sustainability problems, while dealing and connecting these issues on a global scale.

This idea motivated the Global Classroom project in which we worked with undergraduate students from Germany and the United States on urban sustainability issues. We experimented together with different teaching concepts and pedagogies, a variety of technological equipment to facilitate trans-Atlantic collaboration, as well as forms of engagement between students and instructors.

The Global Classroom Project - Facts

- Participating Universities: Arizona State University (USA), Leuphana University of Lüneburg (Germany)
- Funding: Stiftung Mercator (Germany)
- Duration: August 2012 - September 2016
- Students: 72 students in 2 cohorts, majoring in 7 different subjects
- Duration: 3 semesters at Arizona State University, 3,5 semesters at Leuphana University.

Project Objectives: A Glocal Curriculum, Program, and Teaching-Learning Environment

Transnational collaboration projects, such as the Global Classroom, offer unique opportunities for the education of change agents in our globalized societies. They also make it possible to move beyond the distinction between global and local and provide a unique space to understand and find solutions to pressing sustainability problems that are global, but substantially differ in local contexts. The mix of global and local – glocal – characterizes our approach to transnational collaboration and our teaching and learning model. Merging global and local means bringing together local learning, engagement, and impact with global communication, collaboration, and knowledge production. This process takes place across social, cultural, and geographical boundaries and involves the way students learn about the world as well as how they learn to act responsibly in it.

Learning Outcomes: We introduce a glocal curriculum that aims to foster such education in fields as diverse as higher education for sustainable development, global health, the humanities, philosophy, etc. The core idea of the curriculum can be visualized as a triangle whose edges represent three dimensions of learning (see picture): Knowing (Which kinds of knowledge do students need in order to creatively address sustainability challenges?); Acting (Which skills and competencies do students need in order to address sustainability challenges?); and Being (What kind of mind-set and sense of being-in-the- world do students need in order to address sustainability challenges?).

Five learning areas traverse the triangle to build the full set of change agent competencies: (i) subject learning about topics enabling students as critical and transformative thinkers, (ii) research learning to produce actionable knowledge, (iii) collaborative learning to work together in practice as well as in science, (iv) professional learning for a successful participation in a wide range work environments, and (v) personal learning for enabling students to develop as reflective and active citizens. The glocal curriculum is embedded and aligned in four dimensions of a glocal teaching-learning environment, visualized in the picture above as intersecting spheres around the triangle, that facilitates formats and settings to address global, real-world challenges in different local contexts: Direction (self- and student-directed learning), place (social and cultural environment on the global and local scale), space (merging of virtual and real by e-learning and digitalization), and people (collaboration and relationships in group learning).

This curriculum has been operationalized with transformative teaching concepts and settings:

- Experience-based learning and research-based learning in transnational research projects; students exchange on local understandings with community actors as well as address sustainability phenomena on a global scale.
- Engagement in advanced blended learning environments for virtual student mobility; Students develop work environments for virtual collaboration and e-learning.

This model curriculum is presented in our handbook fostering the education of change agents who are willing to critically and creatively contribute to sustainability transformations.

Assessment Model: Through our accompanying research in form of formative and summative evaluations we gained insights which resulted in the comprehensive concept of the Glocal Curriculum.

How did you define success? What can other institutions learn from your experience with this project?

The Handbook and Transfer of the Curriculum

Our handbook “The Glocal Curriculum. A Practical Guide to Teaching and Learning in an Interconnected World” presents reflections and resources in a workshop-like and application oriented way, aiming to inspire administrators, strategic university leaders,

curriculum and program designers as well as teachers and instructors. The book covers three different stages, from (i) envisioning glocal curricula and their design to (ii) implementing and evaluating glocal curricula and programs, to (iii) designing glocal teaching-learning environments. Find eBook and Softcover here: <http://www.leuphana.de/college-global-classroom>

Further transfer has been initiated already: Since fall 2015, the curriculum has been implemented in form of a double degree Master’s program between Arizona State University and Leuphana University Lüneburg– the Global Sustainability Science Master (<http://www.leuphana.de/graduate-school/master/studienangebot/global-sustainability-science.html>).

Additionally, the transnational collaboration was institutionalized with the foundation of a joint center, hosting current and future research endeavors between both universities– the Center for Global Sustainability and Cultural Transformations (<http://www.leuphana.de/zentren/cgsc.html>)

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Others involved with the project: Guido Caniglia (1), Leonie Bellina (1), Manfred Laubichler (2), Daniel J. Lang (1)

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Chapter Four:
Collaborations to Address Global Challenges





Carnegie Mellon University

CMU Sustainability Weekend Conference

Project Description: On the weekend of March 31 – April 2, 2016, CMU Sustainability Weekend Conference, a student-led initiative, sparked synergetic conversations around the aspects of sustainability in relation to today’s society. The event was made possible by Sustainable Earth, our environmentally passionate student organization with support from staff and faculty members.

The Conference was held on the CMU campus in Pittsburgh, Pennsylvania and programming included panels, speakers, and keynote speakers that sparked conversations about sustainability and addressed relevant topics. We talked about local issues (Pittsburgh 2030 Districts – a resiliency project; the new Frick Environmental Center – including a field trip and the Living Building Challenge; Student Activism – a discussion with the local universities) and more holistic issues such as zero waste living (keynote speaker Bea Johnson), public art and its role in sustainability, entrepreneurial support of other (plastic trash transformation in Haiti), women’s health (environmentally-preferable purchasing), and environmental justice in Flint, Michigan (Jacqueline Patterson, Director of the NAACP Environmental and Climate Justice Program). The inaugural conference attracted about 50 undergraduate and graduate students (and some faculty members) from across the CMU campus plus students from the University of Pittsburgh as well as others environmental advocates from the Pittsburgh community for a total of about 75 participants. (News coverage: <http://www.post-gazette.com/news/education/2016/04/03/CMU-Sustainability-Weekend-explores-ways-to-conserve-energy/stories/201604030210>)

Project Objectives:

- Create collaborate conversations around the aspects of sustainability that touch everyone’s lives;
- Bring different groups on campus that normally do not converse;
- Explore how particular topics and conversations fit into the net impacts of sustainability practices as well as our economy;
- Address issues of sustainability that some people may neglect to consider; and,
- Create a catalytic educational opportunity that continues outside of the event.

Learning Outcomes: The primary intent of the conference was to attract a variety of stakeholders and begin to consider innovation (in the sciences, humanities, art, and business) and the intersections with sustainability. Key points of the educational discussion included: climate literacy conversations; evidence-based experience of local and national expert; and city-wide programming and impacts.

Other intentions included:

- Support of the NAACP national efforts for the Flint, Michigan water crisis;
- Engagement of a multi-cultural student initiative (SPIRIT, which collaborates with the National Society of Black Engineers, the Society of Professional Hispanic Engineers and other STEM-focused organizations) to expand the conversations of sustainability -- bringing in groups who would not normally sit together to have conversations over a shared topic; and,

- Incorporation of an artistic lens into the conversations to create more collaboration.

Students left the event with local projects for them to further explore in relation to sustainability practices and policies. They were challenged to use their new practical skill sets to incorporate sustainable practices into their personal and service learning experiences with the hope of changing human behavior in decision-making and choice selection.

Assessment Model: We did not have an assessment model for the first year, but based on the experience of the pilot, we propose the following for the April 2017 event:

- Ask registrants how they relate to sustainability topics and where they are most concerned; and,
- Follow up with a survey to see how that has changed.

These pre- and post-event questions will allow us to baseline the registrants' level of understanding and determine if the event has influenced their level of understanding.

How did you define success? What can other institutions learn from your experience with this project? Our primary hope was to initiate a dialogue between groups that might not ordinarily converse because sustainability is dependent upon connections of various disciplines and stakeholder groups. Sustainability is complex and solutions will demand both collaboration of stakeholders and creativity to be found at the intersection of science, humanities, art and business. We did attract a small diversity of disciplines and attendance was adequate, but we can and will do better in 2017 given our 2016 experience. And, the dialogue continues – if for no other reason than the fact that the 2017 planning effort requires proactive outreach and engagement.

Primarily, there is both a need and an interest in assembling a diversity of stakeholders around an issue as complex as sustainability. And, there is an embodied energy when bringing together disparate groups.

We can share the following logistical insights with other institutions:

- Give ownership to the students but provide them with the structure to succeed;
- Assemble your partners from within as well as outside of the university;
- Retain your keynote speakers at least 4 months in advance;

- Engage outside organizations for sponsorships;
- Prepare pre- and post- evaluations to assess your impact (this is a great opportunity for institutions to share their respective techniques for assessment); and,
- Leverage the experience to create on-going experiences on campus (another great opportunity for institutions to share.)

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Others involved with the project: Barbara Kviz, M. Shernell Smith, David Dzombak and Neil Donahue.





The Korea Advanced Institute of Science and Technology

EEWS 2016 Forum on Sustainable Energy Science and Technology

Project Description: Korea Advanced Institute of Science and Technology (KAIST) established in 1971 is the nation's first public research-focused university, with over 10,000 full-time students and 1,100 research-active faculty members. The institution's mission is to create knowledge and cultivate human talent with academic excellence and creativity. In a recent survey by Thompson Reuters on Most Innovative Universities, KAIST is ranked No. 1 in Asia and No. 6 in the World. KAIST seeks to share two major practices for sustainability education in 2016 for the 2017 ISCN-GULF.

EEWS 2016 Forum on Sustainable Energy Science and Technology

EEWS (Energy, Environment, Water, and Sustainability) at KAIST stands for interdisciplinary programs to address the important issues in energy, environment, and water for sustainable society through research and education with interdisciplinary approaches. To evaluate the current progress of the energy research, identify key challenges, and stimulate further interactions among the different disciplines and researchers, EEWS held its first international forum "EEWS 2016: Progress and Perspectives of Energy Science and Technology" on October 20th, 2016. Eight internationally recognized energy experts were invited to share their cutting-edge research in energy materials, advanced characterizations, and catalysis. Over 200 participants gathered, including undergraduate and graduate students of KAIST in many different disciplines. Students have learned, during the forum, recent advances, challenges and future opportunities in energy science and technology for EEWS problems. The challenges in the development of sustainable energy harvesting and storage materials, molecules and materials for catalytic energy conversion technology, advanced analytical tools to characterize them, and atomistic simulations for the systems were discussed. In the first lecture, students learned how to design and develop effective lithium ion batteries for sustainable energy storage. The following two lectures explained fine-tuning atomistic

scale engineering of crystals for better electrodes and catalysts. Cutting edge techniques for nanoscale characterization were introduced in a separate lecture that aimed at perfecting industrial catalysts for a sustainable future. Students also learned new chemical routes to make fine chemicals with excellent atom economy, a vital component of green chemistry. In the talk on made-to-order porous materials, energy efficient separations by molecular sieving informed the students that there is still a lot more research to be done on how to refine chemicals. Lastly, the students learned how photocatalytic systems could be effectively used for sustainable water treatment.

The forum brought well-known scholars and young students together to discuss critical concepts in sustainable energy sciences and technologies. Our students expressed their continued interest in the symposium and the EEWS international forum will continue to address new challenges in energy research and technology in the coming years.

Building Global Alliance for Sustainable Growth

In the College of Business, KAIST Graduate School of Green growth (GSGG) was established in 2013 to pursue world-class education and research on green business, finance, and policy. Annually, GSGG shares knowledge by hosting an international conference and research workshop. GSGG has annually held the Seoul Climate-Energy Conference (CEC) since 2014, where world-renowned climate and energy policy makers and scholars have been participated. On November 30th, 2016, over 400 international participants gathered at the 2016 Seoul Climate-Energy Conference (CEC). Through this annual conference, GSGG promotes strengthened relationships with many organizations. As the first academic institution in the world, KAIST recently joined the Green Growth Knowledge Platform (GGKP) as one of Knowledge Partners (<http://www.greengrowthknowledge.org/partners>). Established by GGGI, OECD, UNEP, and the World Bank in 2012, GGKP is a global network of international organizations and experts that encourages collaboration for world-class research and

disseminates knowledge on green growth and green economy. GSGG also established academic exchange programs with other institutions including IIASA (International Institute for Applied Systems Analysis). GSGG alums currently work for leading non-profit and profit organizations such as World Bank, PWC, KPMG, Samsung Economic Research Institute, Pfizer, and share knowledge on green growth. With all these efforts, GSGG was ranked No. 1 in Asia and No. 4 in the world in the Better World MBA category by Corporate Knight Magazine in 2015.

As a member of G(Green)-Group and a knowledge partner for the GGKP, GSGG will extend its scope of sharing knowledge on green growth around the world through alliance with leading institutions in green economy. GSGG will disseminate the research outputs generated on green growth, and our faculty members, students, and alumni members intend to team up with the G-Group members, GGKP, and the international green growth community.

Project Objectives: To address important issues in energy, environment, and water for sustainable society through research and education with interdisciplinary approaches.

Learning Outcomes: Students learned how photocatalytic systems could be effectively used for sustainable water treatment.

How did you define success? What can other institutions learn from your experience with this project? Close collaboration/relationship with other organizations, organizing conferences

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Others involved with the project: Cafer Yavuz, Yousung Jung, Kwangwoo Park



Swiss Federal Institute of Technology (ETH Zurich)

Transdisciplinary Case Studies at ETH Zurich: Teaching, learning, and researching outside the comfort zone

Project Description: This summer, ETH students worked on solutions to the urgent waste problem in the Seychelles, along with their counterparts from the University of Seychelles and representatives from the local authorities, businesses, NGOs, civil society and government. The program was part of ETH's transdisciplinary case studies. The studies are problem-oriented, research-based seminars that are targeting real-life situations in order to facilitate the production of scientific and praxis-relevant joint knowledge. The Seychelles microcosm served as a living lab to develop new ways of tackling sustainable development.

Learning Outcomes: Overall, this novel approach joining students of two different cultures and education systems in a real world setting and in a partly sensitive political environment was a success. Volunteering ETH master students were optimally motivated. Teachers in their role as coaches allowed students to take responsibility and self-organize the project as far as possible. Initially unfamiliar with the waste topic, students managed to promptly adapt and further deepen their current knowledge and methodological skills in a meaningful way. In their capacity as outsiders, students managed to bring observations and insights to the surface that neither private consultants nor local experts would have been able to do. Although collaboration between ETH and UniSey students turned out to be partly problematic, this transdisciplinary and intercultural approach might become a role model for north-south collaboration, both in terms of education and research activities.

A novel initiative – living labs outside the campus

These transdisciplinary and intercultural teaching-research courses are a novel initiative by ETH Zurich. It was the first of a series of upcoming activities as part of a collaboration agreement between the ETH Department of Environmental Systems Science and the University of Seychelles.

The Seychelles' Ministry of Environment, Energy & Climate Change is a major partner in the collaboration as well. The Seychelles is a living lab for exploring new ways to tackle sustainable development. In addition to the living lab presented here, a second living lab has been launched in the city of Zurich (Switzerland). Here, interventions for sustainable practices are developed, implemented and analyzed together with a local housing cooperation.

Valuable results produced

The case study was organized in seven themes to gain comprehensive and in depth knowledge about the solid waste management system. The following topics were explored: Legal & Institutional Framework, Recycling Markets, Material Flow Analysis, Environmental Impacts of Landfills, Consumer's Perspective, Potential for Biogas Production, and Landfill Scenario Modelling. Throughout the study, interdisciplinary methods were employed (e.g., multi-criteria assessment) and combined with disciplinary methods (e.g., material flow analysis). The final study report, which includes a number of concrete options

for improving waste management, was recently presented and handed over to the Seychelles' Minister of Environment, Energy and Climate Change.

Case Study on waste management in the Seychelles

Solid waste management (SWM) is a significant challenge for the Seychelles. Landfilling, the currently employed waste management strategy, poses direct threats to the island nation's specific vulnerabilities as a result of greenhouse gas production, consumption of scarce land, and leachate release to the nearby environment. Unfortunately, due to the small scale of the Seychelles economy, limited capital is available to stimulate innovations regarding SWM. The focus of this case study was to understand the current solid waste management system in the Seychelles and to gain insights into the obstacles and opportunities related to waste reduction.

The case study engaged 18 ETH master's students with diverse scientific backgrounds such as environmental, agricultural, environmental engineering, and planning sciences. They represented eight major profiles. In addition, 18 bachelor's students at the University of Seychelles (UniSey) participated. This team conducted the case study in two phases. During the February through June semester, ETH students engaged in literature review, research plan development, and field phase preparation. About halfway into this period the team members engaged in a two-day workshop involving stakeholders from the Seychelles. Its purpose was to validate the on-going work. This preparatory phase was followed by three weeks of intensive field research in the Seychelles, a collaborative effort by

Researchers and teachers from ETH and UniSey guided students throughout the case study which, in turn, was supplemented by additional directions and support from an advisory board of local experts and stakeholders. Students intensively engaged with a wide variety of stakeholders from government, administration, business, NGOs, and civil society. Students worked individually and in small groups. Pairing ETH and UniSey students during the Spring semester allowed for early intercultural exchanges and peer to peer learning. Groups of equal numbers of ETH and UniSey students were formed during the fieldwork to optimize methods skills, scientific and local knowledge.

For further information on the Transdisciplinary Case Study 2016 see:

<http://www.tdlab.usys.ethz.ch/education/tdfords/tdcs/former/cs2016.html>

Transdisciplinary case studies are conducted by the Transdisciplinarity Lab (TdLab), Department of Environmental Systems Science at ETH Zurich. The transdisciplinary case study of the TdLab is part of the numerous sustainability related teaching projects at the ETH Zurich. For further information see:

www.ethz.ch/sustainability

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Technical University of Madrid

Sustainability in practice: the case of itdUPM

Project Description: The Innovation and Technology for Development Centre at the Technical University of Madrid (itdUPM) in Spain is a collaborative network of lecturers, research students and non-academic professionals with a common interest in promoting action research for sustainable development.

This document provides a brief outline of the collaborative activities carried out during the co-creative design process that resulted in the construction of the inter-disciplinary and multi-actor space that currently hosts itdUPM's headquarters. These activities contributed to the establishment of a space with an open environment that characterizes the network's dynamics for addressing sustainable development challenges through innovative technical and organizational solutions.

Project Objectives: The co-creative design process for the itdUPM building responded to the need for an appropriate physical space for the Centre to pursue its activities. The project was planned as an expression of "regenerative sustainability" (Robinson et al., 2013) with the development of a working space to encompass an organizational model underpinned by the principles of transdisciplinary, co-generation and community involvement.

Learning Outcomes: Following informal conversations among researchers and experts to explore this idea further, it was concluded that the itdUPM space should offer a place for experimentation in sustainable technologies and behaviors. This would be achieved by constructing a bioclimatic building in the heart of the main university campus (International Excellence Campus Moncloa) and involve architects, agronomists, engineers, other experts and students.

Drawing on overarching biodiversity concepts, research was conducted to incorporate analysis from air pollution programs into the design of the building. This research included: the use of heating sources for experimental crops, grey water recycling, use of rain water, photovoltaic panels, and the incorporation of green walls and roofs.

The external features were designed by a group of 50 students from 6 different engineering and architectural schools and faculties who worked with members of itdUPM and a professional group of architects. This collaborative experience allowed students to apply their knowledge, techniques and skills to a realistic task with a concrete physical output and long-term impact.

This was perceived as an opportunity to practice problem-based learning strategies and develop team-working skills. In the words of Esther Jiménez, a student in Architecture and Urbanism, "It has been a wonderful experience from both the human and the academic point of view because of a methodology based on knowledge sharing". For Nilay Desai and Sahithi Sadasivuni, exchange students from the Centre for Environmental Planning and Technology University, Gujarat in India, "This initiative shows that when teaching and innovation work together the results are highly satisfying."

A fundamental piece of the building's external structure is a technological facade which incorporates different bioclimatic structures due to its modular grid design. Amongst the experimental multipurpose systems in place, the vertical garden is particularly noteworthy. The planning and building of the

experimental vertical garden was undertaken by a diverse group of students, researchers and professors from various academic backgrounds who worked alongside professionals from a specialized local company. This process involved 7 practical workshops based on action-research and problem-based learning principles.

The thermal insulation of the building is analyzed by collating data through a monitored network of thermocouples. Concurrently, the thermo-physical properties of the 3 different substrates employed are measured, examined and contrasted on a constant basis using air purification, noise absorption and water consumption criteria.

To make use of the multiple experimental systems real-time measurements are gathered from within and outside the building through a network of sensors and a compact weather station. An interdisciplinary group of teachers and students was commissioned to put the system in place and develop a platform so that the information could be updated automatically and be made accessible via the internet.

This bioclimatic design and urban laboratory concept was awarded second place in the 2016 NEXT GREEN prize for the Global Design Category at the World Green Infrastructure Congress in Bogotá, Colombia.

An emphasis on collaborative initiatives fits with the itdUPM network's principles of interdisciplinary, co-creation, action-research and problem-based learning processes. It made us mindful of the need to open up the more formal environments a university traditionally offers if partnership working is to thrive (Davies et al., 2016). These processes rely upon open, participative models that involve public agencies, private actors, members of the educational community and society working together proactively to address sustainability challenges through technology-based social innovations. Because these initiatives are developed from the bottom-up with limited financial resources their scalability and adaptability to different contexts is enhanced.

References: Robinson, J., Berkhout, T., Cayuela, A., & Campbell, A. (2013). Next Generation Sustainability at The University of British Columbia: The University as Societal Test-Bed for Sustainability. In *Regenerative Sustainable Development of Universities and Cities: The Role of Living Laboratories*, 27-48.

Davies, C., Gant, N., Hart, A., Millican, J., Wolff, D., Prosser, B., & Laing, S. (2016). Exploring engaged

spaces in community-university partnership. In *Metropolitan Universities*, 27(3), 6-26.

How did you define success? What can other institutions learn from your experience with this project? These processes rely upon open, participative models that involve public agencies, private actors, members of the educational community and society working together proactively to address sustainability challenges through technology-based social innovations. Because these initiatives are developed from the bottom-up with limited financial resources their scalability and adaptability to different contexts is enhanced.

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Appendix A: ISCN-GULF SUSTAINABLE CAMPUS CHARTER

The signatories of the ISCN-GULF Sustainable Campus Charter acknowledge that organizations of research and higher education have a unique role to play in developing the technologies, strategies, citizens, and leaders required for a more sustainable future. Signature of the present charter represents an organization's public commitment to aligning its operations, research, and teaching with the goal of sustainability. The signatories commit to:

- implement the three ISCN/GULF sustainable campus principles described below,
- set concrete and measurable goals for each of the three principles, and strive to achieve them,
- and report regularly and publicly on their organizations' performance in this regard.

Principle 1: To demonstrate respect for nature and society, sustainability considerations should be an integral part of planning, construction, renovation, and operation of buildings on campus.

A sustainable campus infrastructure is governed by respect for natural resources and social responsibility, and embraces the principle of a low carbon economy. Concrete goals embodied in individual buildings can include minimizing environmental impacts (such as energy and water consumption or waste), furthering equal access (such as nondiscrimination of the disabled), and optimizing the integration of the built and natural environments. To ensure buildings on campus can meet these goals in the long term, and in a flexible manner, useful processes include participatory planning (integrating end-users such as faculty, staff, and students) and life-cycle costing (taking into account future cost-savings from sustainable construction).

Principle 2: To ensure long-term sustainable campus development, campus-wide master planning and target setting should include environmental and social goals.

Sustainable campus development needs to rely on forward-looking planning processes that consider the campus as a whole, and not just individual buildings. These processes can include comprehensive master planning with goals for impact management (for example, limiting use of land and other natural resources and protecting ecosystems), responsible operation (for example encouraging environmentally compatible transport modes and efficiently managing urban flows), and social integration (ensuring user diversity, creating indoor and outdoor spaces for social exchange and shared learning, and supporting ease of access to commerce and services). Such integrated planning can profit from including users and neighbors, and can be strengthened by organization-wide target setting (for example greenhouse gas emission goals).

Principle 3: To align the organization's core mission with sustainable development, facilities, research, and education should be linked to create a "living laboratory" for sustainability.

On a sustainable campus, the built environment, operational systems, research, scholarship, and education are linked as a "living laboratory" for sustainability. Users (such as students, faculty, and staff) have access to research, teaching, and learning opportunities on connections between environmental, social, and economic issues. Campus sustainability programs have concrete goals and can bring together campus residents with external partners, such as industry, government, or organized civil society. Beyond exploring a sustainable future in general, such programs can address issues pertinent to research and higher education (such as environmental impacts of research facilities, participatory teaching, or research that transcends disciplines). Institutional commitments (such as a sustainability policy) and dedicated resources (such as a person or team in the administration focused on this task) contribute to success.

As signatories to the ISCN-GULF Charter, we strive to share our goals and experiences on sustainable campus initiatives amongst our peers and other stakeholders. A key instrument for this is our regular reporting on progress under this Charter, which will be supported by the Charter stewardship (provided by the GULF group) and the Charter secretariat function (provided by the ISCN).

Signatory's organization:

Signatory's name/function:

Date:

ISCN Member Directory

Appendix B: ISCN Members

Americas

Ball State University
Brown University
Carnegie Mellon University
Chatham University
Columbia University
Federal University of Rio de Janeiro
Georgetown University
Harvard University
Massachusetts Institute of Technology
Monterrey Institute for Technology and Higher Education
Pontifical Catholic University of Peru
Princeton University
The University of British Columbia
University of Campinas
Universidad Internacional del Ecuador
Universidad del Norte
University of Pennsylvania
University of São Paulo
Yale University

Europe

Aalto University
Aarhus University
Anglia Ruskin University
Bogazici University
Chalmers University of Technology
Cyprus University of Technology
DTU, Technical University of Denmark
Ecole Polytechnique Fédérale de Lausanne (EPFL)
Eindhoven University of Technology
Freie Universität Berlin
Institut Européen d'Administration des Affaires (INSEAD)
KEDGE Business School

Koç University
KTH Royal Institute of Technology
Lappeenranta University of Technology (LUT)
Leuphana University of Lüneburg
Norwegian University of Science and Technology
Özyeğin University
Politecnico di Milano
Politecnico di Torino
Stuttgart University of Applied Sciences
Swiss Federal Institute of Technology (ETH Zurich)
Technical University of Madrid
Technische Universität Darmstadt
TU Delft
Università Ca' Foscari Venezia
Università degli studi di Milano (UNIMI)
Università degli Studi di Torino (UNITO)
Université Libre de Bruxelles
University of Duisburg-Essen
University of Edinburgh
University of Geneva
University of Genova
University of Gothenburg
University of Lausanne
University of Luxembourg
University of Milano-Bicocca
University of Minho
University of Oxford
University of Salerno
University of Siena
University of York
University of Zagreb

Africa

Covenant University
University of Cape Town

Asia

Chulalongkorn University
City University of Hong Kong
De La Salle University - Dasmarias
Hokkaido University
Indian Institute of Technology Madras
Keio University
Nanyang Technological University
National University of Singapore
Osaka University
Peking University
RMIT International University Vietnam
Shandong Jiaotong University
Thammasat University
The University of Hong Kong
Tsinghua University
The University of Malaya
Universiti Malaysia Sabah

Australia

The University of Melbourne
The University of Western Australia

The ISCN Membership Directory is available at: <http://www.international-sustainable-campus-network.org>

About the ISCN

The International Sustainable Campus Network (ISCN) is a non-profit association of globally leading colleges and universities representing over 30 countries and working together to holistically integrate sustainability into campus operations, research and teaching.

The ISCN is governed by the ISCN Board, composed of senior representatives of the ISCN co-host member universities. The Board is supported by an ISCN Advisory Committee that includes representatives elected by the ISCN network universities.

Execution of the ISCN's strategic goals is supported by the ISCN Secretariat, operated by Sustainserve, Inc., and led by the Executive Director of the ISCN. The Secretariat supports and manages member relations, network development and outreach, resource materials, and strategic program management activities.

The ISCN has instituted working groups to explore critical issues and facilitate the development of resources related to the three ISCN-GULF Sustainable Campus Charter principles. These working groups are led by experienced faculty and staff from institutions that participate in the ISCN network and are located all over the world.

ISCN Co-Host Schools



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ISCN
International Sustainable Campus Network

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