Creating a green university in Thailand: a case study of Srinakharinwirot University

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Abstract

Green development is a challenge at the global level as well as for institutions of higher education. Srinakharinwirot University aims to transform itself into a sustainable university by using UI GreenMetrics Tools to make achieve environmental benefits. Data in all categories were obtained via field observations, in a report from the Sustainable University Working Group. The overall possible score is 10,000, while SWU achieved 4,475; based on 6 categories comprising 39 a total of indicators. The strongest category score for SWU Ongkharak was for Setting and Infrastructure (68.3%), while weakest was Water (25%).Becoming a sustainable university is more than having a strategic plan. Being sustainable must be made a reality. This is achieved as everyone in society (i.e., the target population) is empowered to reflect and enhance the collective well-being by investment from/in the university.

Keywords: *Green university; Sustainable development, Environmental management, Thailand*

Introduction

The goal of sustainable societies is a worldwide challenge. In the past few decades, the world's development has emphasized economic development based on a sustainable development model[1]. Sustainable development is an enormous challenge because of the underlying current dependence on older, non-sustainable, cheap energy/resource paradigms. Human society has exceeded sustainable limits in terms of greenhouse gases emissions, climate change, water depletion, and waste disposal[2]. Definitions of sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs"[3]. Thailand attaches great importance to the concept of sustainable development thanks in large part to recommendations from His Majesty the King Bhumipol who ceaselessly advocated for personal and societal self-sufficiency throughout his 60-year reign. "Thailand 4.0" is a new model for sustainable development. This model has four objectives for developing countries: economic prosperity; social well-being; improving the quality of human but not at the expense of other life; and, valuing environmental enhancement and protection. The meaning of environmental enhancement is that where there has been contamination or degradation, there needs to be reclamation and/or remediation so that the prior land use has been recovered. The meaning of environmental protection is that every activity in every sector should not adversely affect the environment, particularly the climate. By definition then this would mean aiming for a low carbon society, including in the education sector. In 2012, United Nations Conference on Sustainable Development agreed to the Climate Change Convention and Indigenous people Rio + 20. Higher education—especially at the university level—has been involved in sustainable development as they play roles

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in teaching, learning, research, and other academic work related to socio-economic and environmental enhancement. As a consequence, higher educations is affected and must confront these changes proactively[4-6]. Sustainable development in higher education is thus a major focus for university leaders. The three dimensions—social, economic, and environmental—have been conceptualized along with the long-term effects of university activities[7-13]. Several top world class universities have been taking steps to improve their sustainability (viz., University of Oxford, University of North Carolina at Chapel Hill, Massachusetts Institute of Technology and Harvard University). Srinakharinwirot University (SWU) is among this forward-acting group.

SWU was founded in 1949 by King Bhumibol Adulyadej. It is a public university in Bangkok with 15 faculties, 3 colleges, 1 graduate school, 2 research institutes, 7 centres, and 4 demonstration schools. There are 2 campuses, one at Prasarnmit in Bangkok and the other at Ongkharak, Nakhon Nayok Province.

Ongkharak campus requires a significant amount of energy and water to support its academic mission and research functions. The waste generated and air pollution (greenhouse gas emission and dust particles) emitted is significant. Efficiently managing the energy supply and demand will be considered in the future. SWU considered transforming itself into a sustainable university in an effort to minimize environmental impact, especially at the Ongkharak campus.

In 2010, the University of Indonesia developed a tool—UI GreenMetrics—for helping universities transform themselves into sustainable institutions. UI Green Metric focuses on 6 categories: academics & research, setting & infrastructure, energy & climate change, waste management, water management, and transportation. Each category is scored and the total score of all categories is 10000. In 2018, SWU committed to start to be a sustainable university by using UI GreenMetrics and aim. The purpose of the current study was to determine the feasibility of boosting SWU Ongkharak campus to the next step of being a green university using the criteria of UI GreenMetrics.

Methods and materials

Study area: Srinakharinwirot university has five campuses, but the study focused on Ongkharak campus in Nakhon Nayok province. Nakhon Nayok is in eastern region of Thailand (latitude 14°12’16.67” N; longitude 101°12’46.62” E).

Data collection: The data in each category were obtained by (a) field observations at Ongkharak campus, and (b) through reports prepared by the sustainable university working group. The data collection and analysis were done between June 2018 and November 2018

Results

The score to evaluate the sustainability of the university was calculated using the UI GreenMetrics Guideline. The data set comprised six categories and 39 indicators. The six categories included: 1) Setting and infrastructure; 2) Energy and Climate Change; 3) Waste; 4) Water; 5) Transportation; and, 6) Education. The total possible score for the 6 categories is 10,000 points while the calculated score for SWU was 4,475.

Table 1Total score based on the six categories

Category	Score	Score allocation
1. Setting and Infrastructure (SI)	1,025	1,500
2. Energy and Climate Change (EC)	750	2,100
3. Waste (WS)	525	1,800
4. Water (WR)	250	1,000
5. Transportation (TR)	1,175	1,800
6. Education (ED)	750	1,800
Total	4,475	10,000

Setting and infrastructure (SI)

This category aims to motivate the university to provide more green space for greenery and in safeguarding the environment, through the development of sustainable energy. This category comprises 6 indicators (SI 1 to SI6), and the total possible score is 1500; the total calculated score for SWU was 1025 (68.3%).

Table 2: Setting and infrastructure score

Indicator	Score	Score allocation
SI1: Ratio of open space area to total area	225	300
SI2: Total area on campus covered in forest vegetation	50	200
SI3: Total area on campus covered in planted vegetation	225	300
SI4: Total area on campus for water absorption besides forest and planted vegetation	150	200
SI5: Total open space area divided by total campus population	225	300
SI6: Percentage of university budget for sustainability efforts within a year	150	200
Total	1,025	1,500

Energy and climate change (EC)

UI GreenMetrics requires a university to increase its efforts in energy efficiency vis-à-vis their buildings and to conserve nature and energy resources. The score in this category is the largest number compared with all categories. This category comprises 8 indicators (EC1 to EC8) for a total score of 2100. The total score from per our calculations was 750 (35.7%).

Table 3: Energy and Climate Change score

Indicator	**Score**	**Score allocation**
EC1: Energy efficient appliances usage	50	200
EC2: Smart building implementation	0	300
EC3: Number of renewable energy sources on campus	75	300
EC4: Total electricity usage divided by total campus population	150	300
EC5: Ratio of renewable energy production divided by total energy usage per year	0	200
EC6: Elements of green building implementation reflected in construction and renovation policies	225	300

Cont... **Table 3: Energy and Climate Change score**

Indicator	Score	Score allocation
EC7: Greenhouse gas emission reduction program	100	200
EC8: Ratio of total carbon footprint divided by total campus population	150	300
Total	750	2,100

Waste (WS)

Waste recycle and treatment activities are important in creating a sustainable environment. The activities of university students and staff produce waste, so a university needs a program to manage waste such as a recycling program, waste treatment, and/or reduction of single use plastics. This category comprises 6 indicators (WS1 to WS6) and the total score is 1800. The total score per our calculations was 525 (29.1%).

Table 4 Waste score

Indicator	Score	Score allocation
WS1: Recycling program for university waste	75	300
WS2: Program to reduce the use of paper and plastic on campus	225	300
WS3: Organic waste treatment	75	300
WS4: Inorganic waste treatment	75	300
WS5: Toxic waste treatment	75	300
WS6: Sewerage disposal	0	300
Total	525	1,800

Water (WR)

Water use is a further critical element for a sustainable university. The aim is to increase the efficiency of water use at the university by decreasing ground water usage, increasing conservation, and protecting habitats. This category comprises 4 indicators (WR1 to WR4) and the total score is 1000. The total score per our calculations was 250 (25%).

Table 5 Water score

Indicator	Score	Score allocation
WR1: Water conservation program implementation	75	300
WR2: Water recycling program implementation	75	300
WR3: Water efficient appliances usage	50	200
WR4: Treated water consumed	50	200
Total	250	1,000

Transportation (TR)

The transportation system is associated with carbon dioxide emissions, the cause of global warming. The use of environmentally friendly public transportation will decrease the carbon footprint around the campus. This category comprises 6 indicators (TR1 to TR6) and the total potential score is 1,800. The score per our calculations was 1,175 (65.3%).

Table 6 Transportationscore

Indicator	Score	Score allocation
TR 1: Total number of vehicles (cars and motorcycles) divided by total campus population	100	200
TR 2: Shuttle services	225	300
TR 3: Zero Emission Vehicles (ZEV) policy on campus	150	200
TR 4: The total number of Zero Emission Vehicles (ZEV) divided by total campus population	100	200
TR 5: Ratio of parking area to total campus area	150	200
TR 6: Transportation program designed to limit or decrease parking area on campus for last 3 years (2016 to 2018)	50	200
TR 7: Number of transportation initiatives to decrease private vehicles on campus	100	200
TR 8: Pedestrian path policy on campus	300	300
Total	1,175	1,800

Education and research (ED)

This category represents the number of courses or subjects; the contents of which are related to sustainability offered by the respective university. This category comprises 7 indicators (ED1 to ED7) and the total potential score is 1800. The score per our calculations was 750 (41.2%).

Table 7 Education and research score

Indicator	Score	Score allocation
ED 1: Ratio of sustainability courses to total courses/subjects	75	300
ED 2: Ratio of sustainability research funding to total research funding	150	300
ED 3: Number of scholarly publications on sustainability	150	300
ED 4: Number of events related to sustainability	150	300
ED 5: Number of student organizations related to sustainability	150	300
ED 6: University-run sustainability website	50	200
ED 7: Sustainability report	25	100
Total	750	1,800

Discussion

The following discussion is a synthesis of the results per the 6 categories and 39 associated indicators.

Setting and infrastructure category

In this category, the lowest score is the SI 2 indicator—the campus area covered in forest. The calculated score was only 6.9% (50 from 200 points) because Ongkharak campus has proportionally less forested area than the total campus area (124,632 and 1,802,847 square meters, respectively). To improve these score 50 points, Ongkharak campus needs to plant 38,000 m^2 of trees.

Energy and climate change category

In this category, there were 2 indicators that scored 0 points. Ongkharak campus does not have a smart building because most buildings are old, so the EC2 indicator got 0 points. Likewise, the ratio of renewable energy production divided by total energy usage per year (EC5) scored zero points as the ratio of renewable energy production was < 1%. Improving the smart building score is limited due to budgetary constraints but administrative and engineering controls can help to reduce the energy, lighting, and water used. Buildings could undergo simple renovations of various equipment like changing fluorescent tubes to LED lights, and changing manual faucets to auto faucets[14-16].

Waste category

This category comprises 6 indicators. The sewage disposal indicator (WS6) is the only indicator that got a zero. Based on the guidelines, 0 points indicates are mean sewage is untreated before draining into waterways, resulting in serious water pollution.

The sewerage system includes the network of pipes, pumps, and force mains for the collection of wastewaters (sewage). It serves a critical role in sanitation and disease prevention. Wastewater can contaminate the local environment and drinking water supply, thereby increasing the risk of disease transmission[17, 18]. In order to improve health outcomes for both the campus and nearby communities, the University administrators should construct a sewerage system[19].

Water category

This category comprises 4 indicators. Based on our survey, the score seems good but it not. The score includes indicators WR1, WR2, and WR3 (score: 75, 75, and 50, respectively). Based on the guideline, this means that all three programs are preparatory. University administrators should thus expedite the programs to the action stage. As for the WR4 indicator, treated water consumed, from data we found that score is 50 it means Ongkharak campus use only 1 - 25% treated water consumed. This result in turn suggests that if the university were able to increase the volume of treated water used, it could reduce tap waste consumption from the reservoir[20]. Water is an increasingly scarce resource in Nakhon Nayok province: especially in Ongkharak campus due to the increasing population of students and drought. Ongkharak campus thus set a goal to reduce water use by all faculties and departments.

Transportation category

This category comprises 8 indicators. The lowest score was indicator 6—the Transportation program (score: 50 from 200). The latter was designed to limit or decrease parking on campus over the last 3 years.

The reason for the low score is that indicator requires 3 years of data, but Ongkharak campus had just collected data for 1 year. In addition, the university actually increased parking space. In 2019, parking space at Ongkharak campus was 37,751 square meters, which is larger than Tulane University (33,444 square meters)

Ongkharak campus offers a sustainable transportation program in order to reduce traffic and parking demands. The program offers a free electric shuttle bus for travel around campus, free parking area, and inexpensive bicycle rentals. Ongkharak campus is also constructing new walkways to cut greenhouse gas emissions.

Education category

This category comprises 7 indicators and 3 indicators with the lowest score but two of three indicators—

sustainable website (ED6) and sustainability report (ED7)—are in progress and under construction. Once the website and report are updated, the scores for both indicators should automatically increase.

As for the ratio of sustainability courses to total courses/subjects (ED1), improvement is needed but is achievable as the ED1 indicator only counted courses that included details on sustainability. Accordingly, were all curricula revised to include subject material on sustainability, the score would be improved. Note that sustainable courses can be in any field including environmental science, social science, art, or economics.

Conclusion

Ongkharak campus is part of a larger, interconnected ecosystem. Several activities have negative effects upon the natural environment, so the university needs to tackle these problems first. Our findings reveal that Srinakharinwirot University has a vision to become a sustainable university and could make incremental steps to achieving this objective by a) adopting sustainable designs for green spaces and buildings, b) upgrading to energy saving equipment, c) endorsing environmental policies, and d) gaining the support of university administrators. Collectively these efforts will help the University to reach its environmental goals.

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References

1. GengY, LiuK, XueB,FujitaT. Creating a "green university" in China: a case of Shenyang University. Journal of Cleaner Production. 2013; 61: 13-19. https://doi.org/10.1016/j.jclepro.2012.07.013
2. RiceC, RagbirNK, RiceS,BarciaG. Willingness to pay for sustainable aviation depends on ticket price, greenhouse gas reductions and gender. Technology in Society. 2019; 60: 101224. https://doi.org/10.1016/j.techsoc.2019.101224
3. LeeKH, BarkerM,MouasherA. Is it even espoused? An exploratory study of commitment to sustainability as evidenced in vision, mission, and graduate attribute statements in Australian universities. Journal of Cleaner Production. 2013; 48: 20-28. https://doi.org/10.1016/j.jclepro.2013.01.007
4. JorgeML, MadueñoJH,PeñaFJA. Factors influencing the presence of sustainability initiatives in the strategic planning of Spanish universities. Environmental Education Research. 2015; 21(8): 1155 – 1187. https://doi.org/10.1080/13504622.2014.977231
5. PeñaFJA, JorgeML, ReyesMJML. Analysing the incorporation of sustainability themes into the university curricula: a case study of a Spanish public university. International Journal of Sustainable Development &World Ecology. 2018; 25(7): 642-654. https://doi.org/10.1080/13504509.2018.1437484
6. LukmanR, KrajncD, GlavicP. University ranking using research, educational and environmental indicators. Journal of Cleaner Production. 2010; 18: 619-628. https://doi.org/10.1016/j.jclepro.2009.09.015
7. BeringerA,AdomßentM. Sustainable university research and development: inspecting sustainability in higher education research. Environmental Education Research. 2008; 14(6): 607-623. https://doi.org/10.1080/13504620802464866
8. FischerD, JenssenS,TappeserV. Getting an empirical hold of the sustainable university: a comparative analysis of evaluation frameworks across 12 contemporary sustainability assessment tools. Assessment & Evaluation in Higher Education. 2015; 40(6): 785-800. https://doi.org/10.1080/02602938.2015.1043234

9. HeckD. Institutionalizing Sustainability: The Case of Sustainability at Griffith University Australia. Applied Environmental Education and Communication. 2005; 4(1):55-64. https://doi.org/10.1080/15330150590905248

10. TogoM, Lotz-SisitkaH. Exploring a systems approach to mainstreaming sustainability in universities: a case study of Rhodes University in South Africa. Environmental Education Research. 2013; 19(5): 673-693. https://doi.org/10.1080/13504622.2012.749974

11. FikselJ, LivingstonR, MartinJ, RissingSW. Sustainability at The Ohio State University: beyond the physical campus. Journal of Environmental Studies and Sciences. 2013; 3(1): 74-82. https://doi:10.1007/s13412-012-0104-x

12. CoyAE, FarrellAK, GilsonKP, DavisJL,LeB. Commitment to the environment and student support for "green" campus initiatives. Journal of Environmental Studies and Sciences. 2013; 3(1): 49-55. https:// doi:10.1007/s13412-012-0100-1

13. ShribergM,HarrisK. Building sustainability change management and leadership skills in students: lessons learned from "Sustainability and the Campus" at the University of Michigan. Journal of Environmental Studies and Sciences. 2012; 2(2): 154-164. https:// doi:10.1007/s13412-012-0073-0

14. Berkley university of California.Annual Report on Sustainable Practices; 2018 [cited 2019 Jan 14]. Available from: https://sustainability.berkeley.edu/sites/default/files/2018-uc-annual-sustainability-report.pdf

15. Stanford University.Stanford University Energy and Climate Plan; 2015 [cited 2018 Dec 22]. Available from: https://sustainable.stanford.edu/sites/default/files/resource-attachments/E_C_Plan_2015.pdf

16. European Commission.Digital Transformation Monitor Smart Building: Energy efficiency application; 2017 [cited 2018 May 3]. Available from: https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Smart%20building%20-%20energy%20efficiency%20v1.pdf

17. BetancourtWQ, DuarteDC, VásquezRC,GurianPL. Cryptosporidium and Giardia in tropical recreational marine waters contaminated with domestic sewage: Estimation of bathing-associated disease risks. Marine Pollution Bulletin. 2014; 85(1): 268-273. https://doi.org/10.1016/j.marpolbul.2014.05.059

18. ZhengT, LiW, MaY,LiuJ. Sewers induce changes in the chemical characteristics, bacterial communities, and pathogen distribution of sewage and greywater. Environmental Research. 2020; 187: 109628. https://doi.org/10.1016/j.envres.2020.109628

19. Harvard University. HARVARD UNIVERSITY SUSTAINABILITY PLAN FISCAL YEAR 2015 – 2020; 2015 [cited 2019 Jan 14]. Available from: https://green.harvard.edu/campaign/our-plan

20. Georgetown University.Water Conservation on Campus; n.d [cited 2019 Jan 14]. Available from: https://sustainability.georgetown.edu/conservation/