ปัจจัยที่มีผลต่อการพัฒนาเป็นมหาวิทยาลัยสีเขียวของมหาวิทยาลัยเอกชนไทย
Factors Affecting the Development to Become a Green University
of Thai Private Universities

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บทคัดย่อ

การวิจัยมีวัตถุประสงค์เพื่อศึกษาปัจจัยที่มีผลต่อการพัฒนาเป็นมหาวิทยาลัยสีเขียวของมหาวิทยาลัยเอกชนไทย ใช้แบบสอบถามเป็นเครื่องมือในการเก็บรวบรวมข้อมูลจากกลุ่มตัวอย่างที่เป็นมหาวิทยาลัยเอกชนในประเทศไทย จำนวน 42 แห่ง ใช้การวิเคราะห์สมการโครงสร้างแบบมิมิคเพื่อทดสอบสมมติฐาน ผลการวิจัยพบว่า ปัจจัยที่มีผลต่อการพัฒนาเป็นมหาวิทยาลัยสีเขียว ได้แก่ ความชัดเจนของนโยบาย ภาวะผู้นำและวิสัยทัศน์ของผู้บริหาร การมีส่วนร่วมของบุคลากร การติดตามประเมินผล สมรรถนะองค์กร และการสนับสนุนจากภายนอก ปัจจัยทั้งหมดสามารถร่วมกันทำนายการพัฒนาเป็นมหาวิทยาลัยสีเขียวได้ร้อยละ 60

คำสำคัญ: การพัฒนาเป็นมหาวิทยาลัยสีเขียว มหาวิทยาลัยเอกชนไทย

Abstract

The research aimed to study the factors affecting the development to become a green university of Thai private universities. A questionnaire was used to collect data from a sample of 42 private universities in Thailand. MIMIC structural equation analysis was used to test hypotheses. The results found that factors affecting the development to become a green university were policy clarity, executive leadership and vision, personnel participation, monitoring and evaluation, organizational competencies, and external support. All factors can jointly predict 60% of the development to become a green university.

Keyword: Development to Become a Green University Thai Private Universities

Introduction

The green organization is intended to operate or develop its organization without the desire to impact the global environment negatively. Be it towards the local community or surrounding society. It also means not having a severe impact on the economy. There are policy principles and functions that consider sustainability and social and environmental

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responsibility (Xing, Wang & Tou, 2019). Both public and private organizations are currently interested in ecological and environmental development, more environmentally-friendly enterprises (Chidchob & Pianthong, 2018). Protecting the environment and ecosystems is, therefore, a significant challenge during economic transformation. The balance between corporate development and environmental protection has a significant influence on economic and social development (Tourism Authority of Thailand, 2019).

Since 2014, a trend in enterprise environmental management has made Green Organizational Identity (GOI) became what the government had been trying to drive by establishing a green organization policy for agencies in both the public and private sectors to improve its efficiency effectiveness in environmental management. However, many previous studies show that the government needed to set environmental regulations to regulate environmental management (Office of Natural Resources and Environmental Policy and Planning, 2014). One of the government's green organization policies is to push for educational institutions, especially at the tertiary level, to create a green corporate identity under the policy of "Green University" for universities to manage the organization's environment by integrating energy and environmental conservation into teaching, research and in all activities of the university. This is to work in a safe atmosphere, environmentally friendly, and energy-saving. It contributes to the good for the environment and the nation's community (Rodtassana, 2015). Part of the green university's principles come from the sustainability concept that aims to develop three main areas: society, economy, and environment to be balanced. Society places importance on participation and improvement of the public's quality of life. The economy focuses on benefiting the people majority and is continuing for the long term. The environment emphasizes the cost-effective use of resources, taking into account the environmental impacts as a priority (Tiyarattanachai & Hollmann, 2016).

The ranking of the world green university, also known as "UI GreenMetric 2018" by the University of Indonesia (UI Green Metric World University Rankings), is a world-class ranking of green educational institutions, which is held annually almost every year. There are six evaluation criteria: location and infrastructure, energy management and climate change, waste management, water management, eco-friendly transportation, and the ability to educate the environment and sustainable development. 719 Universities from around the world have joined the ranks (UI GreenMetric Secretariat, 2018). The results of the 2020 UI GreenMetric World University Ranking, the top 10 Green Universities were: No. 1-Wageningen University and Research, Netherlands; No. 2 - University of Oxford, United Kingdom; No. 3 - University of Nottingham, United Kingdom; No. 4 - Nottingham Trent University, United Kingdom; No. 5 - University of California, Davis, USA; No. 6 - Umwelt-Campus Birkenfeld (Trier University of Applied Sciences), Germany; No. 7 - University of Groningen, Netherlands; No. 8 - Leiden University, Netherlands; No. 9 - University College

Cork, Ireland; No.10 - Universita di Bologna, Italy. There were four universities from Thailand ranked in the top 100: Kasetsart University ranked 73th in the world and 1st in Thailand, King Mongkut 's University of Technology Thonburi ranked 81th in the world and 2nd in Thailand, Dhurakij Pundit University ranked 82th in the world and 3rd in Thailand, and Siam University 93th in the world and 4th in Thailand. Many Thai universities are world-ranked in 2020, such as No. 110-Mae Jo University, No. 111 - Chulalongkorn University, No. 115 - Suranaree University of Technology, No. 141 - Srinakharinwirot University, No. 159 - Rajamangala University of Technology Thanyaburi (RMUTT), No.171 - Mae Fah Luang University, No.178 – Northeastern University, No. 195 - Phetchaburi Rajabhat University, No. 195 - Walailak University, etc. (UI GreenMetric Secretariat, 2020).

The development that aimed to become a green university should have a development plan that follows the area's conditions and the surrounding environment. There is a development guideline based on nine principles consisting of 1) supporting excellence 2) an enhanced research focus 3) strengthening community connection 4) an International Perspective 5) green campus 6) a connected campus, 7) a livable campus, 8) the life-long campus, and 9) a tradition of design excellence (UI GreenMetric Secretariat, 2018), in which the above criteria focus on resource utilization and environmental management within educational institutions. However, the above issues are not yet covered by the personnel and students' participation in environmental management and bringing knowledge and new tools to manage its environment.

From the issues mentioned above, the researcher would like to investigate factors affecting the development to become a green university by choosing to study a sample of Thai private universities and hopes that the findings can be used as guidelines for development becoming a green university of Thai private universities and universities in other groups. This follows the country's policy to develop the organizations, both public and private sectors, to be sustainable green organizations.

Research Objective

To study the factors affecting the development to become a green university of Thai private universities.

Research Scope

Population - the unit of analysis was the organization. The population for this study was 42 private universities in Thailand. The informants were administrators, lecturers, and personnel of Thai private universities.

Content - the UI GreenMetric Secretariat concept was used as a framework for studying green university development (GU). It refers to the university's development according to the UI GreenMetric World University ranking criteria, which has six elements: 1) Location and infrastructure (LI), 2) Energy Management and Climate Change (EC), 3) Waste

Management (WM), 4) Water Management (WR), 5) Transportation (TR), and 6) Education (ED).

Time - the research was conducted between February 2020 - August 2020.

Conceptual Research Framework and Hypotheses

Green University

Green university refers to a higher education society that uses energy efficiency, conserves natural resources, and enhances environmental quality through sustainable education, contributing to the quality of life and enhancing the learning environment (USGBC, 2013).

In 2015, Green university's development was ranked in order to increase the competitiveness of sustainable development. "The Green Metric World University Ranking 2015" was organized by Universitas Indonesia (UI) in Indonesia. The ranking criteria were considered in 6 areas: (UI GreenMetric Secretariat, 2018)

Location and Infrastructure: plan the university location area, environmental management, and green elements.

Energy Management and Climate Change: activities that reduce energy, renewable use, increase green areas.

Waste Management: manage garbage, pollution, and water treatment in the central effluent system.

Water Management: water conservation, use and storage, and wastewater treatment.

Transportation: reduce the use of motor vehicles, focus on the use of car-sharing, support the use of bicycles and walking.

Education: manage instruction, curriculum, research, projects, and activities for the environment

These areas were assigned as components of the development to become a green university (GU) in this study:

Location and Infrastructure (LI) refers to a university sustainable development policy or concept that values the environment's quality and permanence, creating and improving the university landscape, and creating the university's overall image to create a continuity and harmony plants and materials to control the university area's landscape. The sharing of resources in the management of physical resources, buildings, facilities, and the university's environment to be safe and has a master plan on building conservation to promote arts and culture or build a new building on an old site to maintain open space.

Energy Management and Climate Change (EC) refers to a university sustainable development policy or concept in energy-saving and renewable energy production, promoting creating and preserving an environment that is green space or the university's natural forest.

Waste Management (WM) refers to a university sustainable development policy or concept for building waste and waste management systems, building systems, and wastewater treatment ponds before releasing them to natural water sources or recycling.

Water Management (WR) refers to a university sustainable development policy or concept for developing an efficient water management system to provide adequate and safe drinking and consuming water.

Transportation (TR) refers to a university sustainable development policy or concept for developing transport systems that set the university bus routes; establish a parking space for cars, motorcycles, and bicycles and determine vehicles' right to access the building area; promoting walking, bicycles, and trams as public policy in universities; building a pedestrian roof on the university campus and do a bicycle path (bike lane).

Education (ED) refers to a university sustainable development policy or concept in organizing activities/projects to instill awareness among faculty staff and students to be aware of the environment; establishing a club on the environment promotes the budget for conducting research related to the environment; creating websites for presenting information about the environment up to date and continuously; and promoting and supporting the opening of more subjects/courses related to the environment both at bachelor's, master's, and doctoral levels.

Factors affecting the development to become a green university

It refers to factors that may relate to and affect the success of university development towards being a green university were as follows:

1) Policy Clarity (PC) - A precise environmental policy setting in line with the university's vision and strategy consists of setting clear indicators, timelines, and ccountability (Geng, Xue, Liu & Fujita, 2012. It will reflect environmental management changes and achievements within universities (Mungai, 2017; Sonetti, Lombardi & Chelleri, 2015) and allows the university to effectively move towards being a green university (Rodtassana, 2015). This study refers to having policies and goals clear to a green university's development. The university departments have plans/projects and clear manual guidelines for green university development implementation.

2) Executive Leadership and Vision (LV) - A university executive is a crucial person in setting policy on various matters and promoting and supporting implementing the goals set on developing to become a green university. Therefore, university administrators' leadership and vision are crucial to green universities' development (Buakhao & Phetcharanont, 2012). This study refers to executives set the vision and values of being a green university and communicated to action at the agency and individual levels. Executives have acted as role models in developing a green university, both in management and personal life. Include promoting and supporting university departments and personnel

to organize green university development activities, both student or staff activities, including encouragement and incentives to develop the university into a green university.

3) Personnel Participation (PA)- The development of a green university requires participation and cooperation from personnel within the university (Wattanathum, 2015). This study refers to the university personnel recognizing, realizing, and following the university's guidelines to become a green university. Personnel is willing and able to participate and cooperate with a total capacity to create and propose guidelines or practices, including participation in university operations for developing a green university.

4) Monitoring and Evaluation (ME)- Continuous monitoring and evaluation of the policy's implementation will allow us to see operational directions in various fields for developing to become a green university. (Sonetti, Lombardi & Chelleri, 2015). This study refers to developing green university development performance indicators and is transmitted and linked to the organizational and individual indicators. There is a process for monitoring the implementation of indicators and linking or implementing green university development performance as part of the agency and individual performance assessment.

5) Organizational Competency (OC)- Organizational competencies in terms of structure, personnel, resources, and budget will facilitate and support the university's development in various fields to be a green university (Lozano, 2010; Hungate, Koch & Chopin, 2007). This study refers to developing the university infrastructure conducive to developing a green university. A unit is responsible for developing a green university and supporting the budget and personnel to implement green university development.

6) External Support (ES)- Support from outside in promoting and supporting university activities and strategies affect the success of a green university development (Ronnachai, (2015); Tiyarattanachai & Hollmann, 2016; Tu & Hu, 2017). This study refers to the university has an agreement or cooperation and receives support in areas such as budget, knowledge, personnel from outside agencies that were the public and private sectors, or other agencies to develop a green university, including formulating rules or measures related to the development of a green university of government agencies or agencies responsible for university supervision.

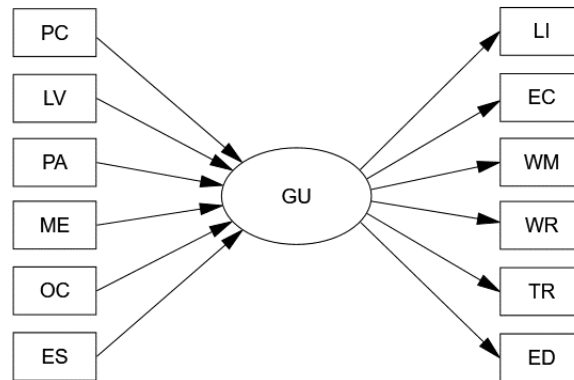A Conceptual research framework is shown in Figure 1.

Figure 1 Conceptual Research Framework

Hypotheses

H1: Policy clarity had a positive impact on the development to become a green university.

H2: Executive leadership and vision had a positive impact on the development to become a green university.

H3: Personnel participation had a positive impact on the development to become a green university.

H4: Monitoring and evaluation had a positive impact on the development to become a green university.

H5: Organizational competency had a positive impact on the development to become a green university.

H6: External support had a positive impact on the development to become a green university.

Research Methods

Population and Sample Selection Procedure

The research population was 42 private universities in Thailand. The key informants were its administrators, lecturers, and personnel. The sample was determined for structural equation modeling (SEM) analysis by Nunnally's (1967) criteria, was suggested that the sample size for the analysis of linear structural equations. There should be a ratio of 10-20 sample units per 1 observed variable. In this study, twelve observable variables were involved. Therefore, the analysis's optimum sample size was more than 240 ($N > 240$). Four hundred participants were selected by stratified random sampling and a population

proportion of each university, then select the sample according to the proportion calculated by chance.

Instrument and Data Collection

The research instrument was a questionnaire that the researcher created according to the established objectives and conceptual framework. It was divided into three parts: 1) Inquiring about the general information of the respondents. Questions were a checklist of 5 items: gender, age, education level, position, and work experience. 2) Inquiring about the development to become a green university, 24 questions, and 3) Inquiring about factors affecting the development to become a green university, 18 questions. The question characteristics in parts 2 and 3 were the five-point rating based on Likert's scale concept. The content validity was examined by five experts using the index of item objective congruence: IOC. The results showed that the IOC of all questions in the questionnaire was more significant than .60 (IOC > .60) (Hambleton, 1984). The experts' suggestions were then brought to improve the questionnaire before introducing the reliability by Cronbach's alpha coefficient method (Cronbach, 1951) with 30 private university lecturers in Lampang province that was non-sample. The reliability of the whole questionnaire was .85, and the questionnaire's reliability was used to collect data for the development to become a green university, and the factors affecting it were .90 and .84. The questionnaire was sent to 400 participants and returned with 338 entirely correct information, representing 84.5%.

Data analysis

The statistical programs SPSS and AMOS were used for statistical analysis: 1) General data analysis of respondents using descriptive statistics were frequency and percent. 2) The relationship analysis of variables using Pearson's correlation analysis. 3) Hypotheses testing using MIMIC (multiple indicators and multiple causes) structural equation modeling analysis.

Results

Information of respondents

The majority of the respondents were female (54.1%), aged 30-40 years (42.6%), graduated with a master's degree (65.1%), teachers (52.9%), 11-15 years of work experience (61.6%). More details were shown in Table 1.

Table 1. Descriptive Statistics of General information of Respondents

Information of Respondents	Descriptive Statistics
Gender	Male: 155 (45.9%)
	Female: 183 (54.1%)
Age	Less than 30 years: 20 (8.0%)
	31- 40 years: 144 (42.6%)
	41- 50 years: 89 (26.3%)
	More than 50 years: 78 (23.1%)
Graduate	Bachelor degree: 15 (4.4%)
	Master degree: 220 (65.1%)
	Doctoral degree: 103 (30.5%)
Job Position	Director of Division or equivalent departments: 16 (4.7%)
	Director of the Office of the President/equivalent departments: 9 (2.7%)
	Lecturer: 179 (52.9%)
	Assistant Professor: 76 (22.5%)
	Associate Professor: 58 (17.2%)
Work Experience	Less than 5 years: 21 (6.2%)
	5-10 years: 64 (18.9%)
	11-15 years: 208 (61.6%)
	More than 15 years: 45 (13.3%)

* N=338

The Relationship Analysis of Variables

The relationship of factor variables found that policy clarity (PC) , executive leadership and vision (LV), personnel participation (PA), monitoring and evaluation (ME), organizational competency (OC), and external support (ES) was significantly related to the development to become a green university (GU). The correlation coefficients were in descending order as follows: ME (r=.449, p<.01), ES (r=.431, p<.01), PA (r=.402, p<.01), LV (r=.203, p<.01), PC (r=.147, p<.01), and OC (r =.123, p<.05). The relationship between factor variables is shown in Table 2.

Table 2 Correlation Matrix of Factor Variables

ตัวแปร	$\overline{X}$	SD	PC	LV	PA	ME	OC	ES
Policy Clarity (PC)	4.19	0.71	1					
Executive Leadership and Vision (LV)	3.64	0.79	.538**	1				
Personnel Participation (PA)	3.67	0.81	.171**	.462**	1			
Monitoring and Evaluation (ME)	4.13	0.65	.387**	.031	.363**	1		
Organizational Competency (OC)	3.93	0.76	.140**	.252**	.627**	.539**	1	
External Support (ES)	3.62	0.80	.634**	.055	.221**	.646**	.546**	1
Development to Become a Green University (GU)	3.61	0.69	.147**	.223**	.402**	.449**	.123*	.431**

** Statistically significant at the .01 level ($p<.01$), * Statistically significant at the .05 level ($p<.05$).

MIMIC Model Analysis to Test Hypotheses

The consistency of the hypothesis model with the empirical data showed that the hypothesis model proposed was consistent with the empirical data by data model-fit indices, including χ^2 =71.958 df =39 p =.001, χ^2/df =1.845 (<2), GFI) =.968 (>.90), CFI =.987 (>.90) and (4) $RMSEA$ .050(<.08) (Byrne, 2001; Kline, 2005), as shown in Figure 1.
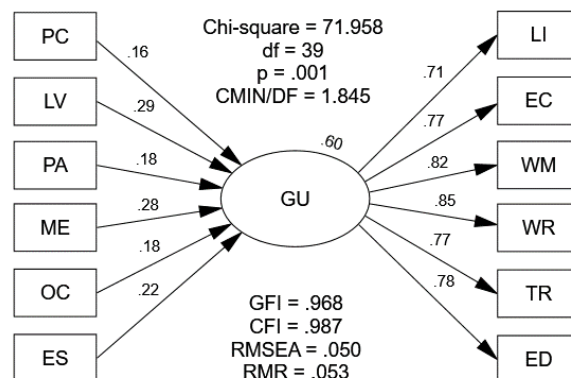

Figure 1 Consistency Statistics of the Proposed model with Empirical Data

The component weights of the observed variables that were components of the latent variable of development to become a green university (GU) in six areas: location and infrastructure (LI), energy management, and climate change (EC) management. Wastes (WM), water management (WR), transport (TR) and education (ED) have a component weight of .714 (β=.714), .767 (β=.767), .822 (β=.822), .847 (β=.847), .767 (β=.767) and .782 (β=.782). The component weights (standardized factor loadings) of all observable variables were statistically significant at the .01 level - Observed variables' factor loadings (β>.70), construct reliability (CR>.70), and convergent validity (AVE>.50) (Hair, Black, Babin & Anderson, 2014), as shown in Table 3.

Table 3 Observed Variables' Factor Loadings, CR, and AVE

Variables	$\overline{X}$	SD	factor loadings b(SE)	β	t	R^2	CR	AVE
GU	4.40	.36					.905	.615
LI	4.43	.41	.894(.059)	.714	15.094**	.467		
EC	4.41	.42	1.000	.767	Scaling	.538		
WM	4.38	.46	.989(.060)	.822	16.617**	.723		
WR	4.41	.47	1.053(.062)	.847	16.855**	.765		
TR	4.38	.43	.994(.067)	.767	14.854**	.589		
ED	4.38	.45	1.063(.044)	.782	24.428**	.544		

$*p < .05, **p < .01$

The hypothesis testing results were summarized that policy clarity (PC), executive leadership and vision (LV), personnel participation (PA), monitoring and evaluation (ME), organizational competency (OC), and external support (ES) had a positive impact on the development to become a green university (GU) with impact coefficients of .163 (β=.163, p<.01), .285 (β=.285, p<.01), .175 (β=.175, p<.01), .283 (β=.283, p<.01), .184 (β=.184, p<.01), and .218 (β=.218, p<.01). It supported the hypothesis H1-H6) at the statistical significance level < .01 ($p < .01$), as shown in Table 4.

Table 4. Shows the Hypothesis Testing Results

Hypotheses	coefficient (β)	t-value	SE	p-value	Results
H1: PC $\rightarrow$ GU	.163	3.492**	.040	.000	Supported
H2: LV $\rightarrow$ GU	.285	4.559**	.048	.000	Supported
H3: PA $\rightarrow$ GU	.175	3.082**	.043	.000	Supported
H4: ME $\rightarrow$ GU	.283	6.023**	.045	.000	Supported
H5: OC $\rightarrow$ GU	.184	3.920**	.038	.000	Supported
H6: ES $\rightarrow$ GU	.218	3.642**	.046	.000	Supported
$R^2_{GU} = .60, p<.01$					

** Statistically significant at the .01 level (p <.01).

Also, in Figure 1 and Table 4, the prediction coefficient of the development to become a green universities' was .90 ($R^2 = .90$), indicating that policy clarity, executive leadership and vision, personnel participation, monitoring and evaluation, organizational competency, and external support can jointly predict 90% of the development to become a green university.

Conclusion and Discussion

The study of factors affecting the development to become a green university of Thai private universities was concluded that policy clarity, executive leadership and vision, personnel participation, monitoring and evaluation, organizational competency, and external support positively affected the development to become a green university by can jointly predict 90% of it.

The executive leadership and vision is the most influential factor because executives are the key person of setting policy on various matters and promoting and supporting the implementation of achieving the goals set on developing to became a green university. The executive team must set a clear policy towards being a green university and align with each university's vision and strategy and cover various environmental issues, including infrastructure improvements, reduction in energy consumption, climate change management, waste management, water resource management, transportation system improvements, environmental education and research, and creating knowledge and awareness among students and staff. The timeframe, indicators, and a responsible person must be clearly defined (Geng, Xue, Liu & Fujita, 2012; Rodtassana, 2015)

The following important factor in developing to become a green university was the monitoring and evaluation factor. This is because the continuous monitoring and evaluation of policy implementation will allow us to see operational directions in various fields through indicators and targets of developing to become a green university. Therefore, universities have to set clear indicators, goals, and assessments of the project's performance/activity. It must reflect environmental management changes and achievements within universities (Mungai, 2017; Sonetti, Lombardi & Chelleri, 2015). Besides, the development to become a green university requires participation and cooperation from within the university (Mongkhonvanit, Panklib & Bhalla, 2015; Wattanathum, 2015) and from outside in promoting and supporting various activities and resources (Tu & Hu, 2017; Tiyarattanachai & Hollmann, 2016). However, if any university continues to manage the environment in its context and follow the success factors mentioned above, it will become a green university with efficient resource management and sustainable development.

Suggestion

The study result found that the policy clarity, executive leadership and vision, personnel participation, monitoring and evaluation, organizational competency, and external support affected development to become a green university, so universities want to become a green university. Therefore, it is essential to realize the importance of developing the various factors based on these research findings and develop

management's fundamental elements and establish a basic management framework of a green university. For example, universities should focus on education and scientific research and integrating sustainable university education development into teaching and learning. Establish a green management and coordination agency and generate the necessary support system of work and participation through a quality assessment system to verify the correctness, management, and continual improvement. So, universities should adopt the criteria set out in the UI GreenMetric World University Ranking as a guideline for achieving goals in becoming a green university goal, better sustainability on campus, and the stakeholders' quality of life. Future research guidelines should be studied to find suitable models and green university development indicators for Thai universities to develop into a green university with efficient and continued sustainable resource management.

References

Buakhao, T. & Phetcharanont, M. (2012). Policy and strategy format toward green universities a case of Thaksin University, Phatthalung Campus. *Journal Faculty of the Architecture, King Mongkut's Institute of Technology Ladkrabang, 14*(1), 40-55. (In Thai)

Byrne, B. (2001). *Structural equation modeling with AMOS: Basic concept, application, and programming*. Mahwah, NJ.: Lawrence Erlbaum Associate.

Chidchob, T. & Pianthong, N. (2018). The causal model of executive commitment, customer pressure, green purchasing, and business performance of manufacturing industries in Thailand: A review. *Executive Journal, 38*(1), 79-90. (In Thai)

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*(3), 297-334.

Geng, Y., Xue, B., Liu, K. & Fujita, T. (2013). Creating a "green university" in China: A case of Shenyang University. *Journal of Cleaner Production, 61*, 13-19.

Hair, J., Black, W., Babin, B. & Anderson, R. (2014). *Multivariate data analysis with readings.* 7th ed. England: Pearson.

Hambleton, R.K. (1984). Validating the test scores. In R.A. Berk. (Ed). *A guide to criterion referenced test construction.* (pp.199–223). Baltimore: The Johns Hopkins University Press.

Hungate, B., Koch, G. & Chopin, M. (2007). *Greenhouse Gas Emissions at Northern Arizona University: Strategies for Reduced Emissions*. Interdisciplinary Approaches to Climate Change Mitigation Spring, 2007.

Kline, R. (2005). *Principle and practice of structural equation modeling*. New York: Guilford.

Lozano, R. (2010) Diffusion of sustainable development in universities' curricula: An empirical example from Cardiff University. *Journal of Cleaner Production, 18*(7), 637-644.

Mongkhonvanit, P., Panklib, T. & Bhalla, S.K. (2015). A Survey of Green University: Challenges and opportunities. *International Journal of the Computer, the Internet and Management, 23*(2), 20-26.

Mungai, D.N. (2017). Tracking environmental sustainability performance of Public Universities in Kenya. *Universal Journal of Educational Research, 5*(11), 1869-1877.

Nunnally, J.C. (1967). *Psychometric theory*. New York: McGraw-Hill.

Office of Natural Resources and Environmental Policy and Planning. (2014). *Information system to support strategy.* Retrieved December 5, 2019, from https://www.egov.go.th/th/e-government-service/1460/ (In Thai)

Rodtassana. (2015). Green university. *HCU Journal, 18*(36), 171-187. (In Thai)

Sonetti, G., Lombardi, P. & Chelleri, L. (2015). True green and sustainable university campuses? Toward a clusters approach. *Sustainability 2016*, 8, 83.

Tiyarattanachai, R. & Hollmann N.M. (2016). Green campus initiative and its impacts on the quality of life of stakeholders in Green and Non-Green campus universities. *SpringerPlus, 5, 84.*

Tourism Authority of Thailand. (2019). *Green business.* Retrieved December 5, 2019, from https://7greens.tourismthailand.org/green-content (In Thai)

Tu, J. & Hu, M. (2017). Building on management model of modern green university. *Advances in Social Science, Education, and HumanitiesResearch, 155,* 391-396.

UI GreenMetric Secretariat. (2018). *UI GreenMetric World University Rankings*. Retrieved December 5, 2019, from http://www.greenmetric.ui.ac.id/

UI GreenMetric Secretariat, (2020). *Overall, rankings 2020*. Retrieved November 15, 2020, from http://greenmetric.ui.ac.id/overall-rankings-2020/

USGBC. (2013). *The Campus as a living laboratory*. Retrieved November 15, 2020, from http://www.centerforgreenschools.org

Wattanathum, S. (2015). *Guidelines for the green campus development*. Master of Engineering Program in Engineering Management, Siam University. (In Thai)

Xing, X., Wang, J. & Tou, L. (2019). The relationship between green organization identity and corporate environmental performance: The mediating role of sustainability exploration and exploitation innovation. *International Journal of Environmental Research and Public Health, 16*(921), 1-16.