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# Development of an Assessment Tool for Prioritizing Influencing Factors of Sustainability in Higher Education

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## **Abstract.**

The United Nations set 17 Sustainable Development Goals (SDGs) in August 2015 as a blueprint to achieve sustainable future for all nations at all levels. Higher education institutions are expected to significantly contribute to the goal, as they must produce the human resources and research necessary for achieving sustainability. In October 2019, Times Higher Education (THE) launched the THE University Impact Rankings, which encouraged universities to focus efforts that pose positive impacts on SDGs in the areas related to the university's operation. Since SDGs and their targets may have different priorities in different countries, we examined the perspectives of stakeholders in 16 Thai universities ranked in the THE World University Rankings to prioritize the SDG areas on which the universities should focus. We expect that this study will be used by Thai university executives to optimize resources spent on achieving better sustainability performance.

**Keywords.** Higher Education, Higher Education Institution (HEI), Sustainable Development Goals (SDGs), Sustainability in Higher Education (SHE), University Impact Ranking.

## **1. INTRODUCTION**

United Nations (UN) announced Sustainable Development Goals (SDGs) in August 2015; it was a blueprint to achieve a better and more sustainable future for all including, but not be limited to governments, businesses, civil society, the general public, and also Higher Education Institution (HEI) [1].

With only 10 years left to achieve the SDGs, world leaders at the Sustainable Development Goals Summit (SDGs Summit) in September 2019 called for a decade of action and delivery for sustainable development and pledged to mobilize financing, enhance national implementation and strengthen institutions to achieve the goals by the 2030 target, leaving no one behind [2, 3].

Thailand is one of the 193 UN member states, which joined the UN in 1946, and has contributed constructively in peacekeeping, human rights, and sustainable development. Prayut Chan-o-cha, the Prime Minister of Thailand and the Chair of ASEAN, made a statement at the 52 ASEAN foreign ministers' meeting that leave no one behind and looks to the future as well as the adoption of the ASEAN leaders' vision statement on partnership for sustainability in all members [4].

Moreover, he attended the 74 United Nations General Assembly (UNGA 74) Session, New York. He joined the SDGs Summit, which was the first gathering at the summit level of leaders from countries, that in 2015 adopted the "SDGs Agenda 2030", aiming to assess and expedite implementation of SDGs by 2020. Prayut stated that ASEAN must accelerate the implementation of SDGs by enhancing the partnership network, tackling the problems through education, science and technology, and protecting the environment, especially through the responsible use of natural resources such as soil, water, air, and mineral [5]. As a result, Thai government agencies in all levels have been trying to drive the SDGs through their policies and executions. Private sectors are also expected to contribute to the effort. For the education sector, Thai Higher Education Institution (THEI) takes many important roles in the SDGs.

HEIs are the important units that develop human resources and research necessary for achieving self-sustainability and their communities. Moreover, Times Higher Education (THE) announced the THE University Impact Rankings (THEUIR) in October 2019. One of the objectives of the rankings is to encourage universities to focus efforts that pose positive impacts on SDGs in the areas related to the university's roles and the systems that will be linked to the 17 SDGs [6].

Because SDGs and their targets have different priorities and context in different countries, there is a need for a study to examine the perspectives of stakeholders in THEI. This is especially important considering the fact that Thai universities may have relatively more limited resources to boost SDGs compared to other universities in more developed countries.

This study focuses on the 16 pioneer Thai universities ranked in the 2019 THE World University Rankings. This study aims to design and develop an assessment tool. We will understand the linkage between the factor of awareness SDG and the SDG policy. They are the factors of sustainability in HEI. Furthermore, it will help and support the Thai university executives to optimize resources spent for achieving better sustainability performance.

## **2. LITERATURE REVIEW**

### **2.1. Sustainable Development Goals**

HEIs are expected to significantly contribute to the SDGs, otherwise known as the Global Goals, build on the Millennium Development Goals (MDGs) especially quality education. The 8 goals that the world committed to achieve by 2015. The UN member countries signed the declaration in September 2000 to combat poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women. SDGs are illustrated as Figure 1 consist of 17 goals that are "the global goals" to be achieved by 2030.



Figure 2.1. 17 Sustainable Development Goals (SDGs) [7]

## 2.2. University Ranking System

HEIs have been ranked by many organizations: some are listed in Table 1. While most of the ranking systems focus on academic performance, only 8 URs from 34 URs (only 23.53%) focus on Sustainability in Higher Education (SHE).

Out of these university ranking institutions, THE is deemed as one of the most well-known institution. There were a total of 1,396 universities ranked, some 11,554 scholars from 135 countries took part of THE World University Rankings (THEWUR) in 2019 [8]. In 2019, there were 16 pioneer Thai universities ranked in the THEWUR. They apply to all the SDGs criteria [9].

## 2.3. Times Higher Education University Impact Rankings

THE launched the THE University Impact Rankings (THEUIR) in October 2018, which rank the key performance index and contribution of universities towards the SDGs [9]. The 2018 version (the first version) focused on 11 SDGs deemed more relevant to university operations. The level of relevance of SDGs to universities is presented as Figure 2. Based on THE study of the 17 SDGs, there are only 11 SDGs that were at least 30% relevant to HEI's operation. THEUIR except the SDGs had the level of relevance less than 30% as Goal 1: No Poverty, Goal 2: Zero Hunger, Goal 6: Clean Water and Sanitation, Goal 7: Affordable and Clean Energy, Goal 14: Life Below Water, and Goal 15 Life on Land.

In October 2019, THE launched the new version of THEUIR, the 2.0B 2019-0903 version, which then covered all 17 SDGs. THEUIR encourage the universities to submit data for at least four SDGs, that must include SDG 17 – partnerships for the goals. The score calculation formula consists of the mandatory SDG 17 and the scores from the best 3 SDG scores as Equation 1 [9].

$$\text{SDG 17} + \text{SDG A} + \text{SDG B} + \text{SDG C} = 100\% \quad (2.1)$$

And the weight of scores are in Equation 2 [9].

$$(22\% * \text{SDG 17}) + 26\% * (\text{SDG A} + \text{SDG B} + \text{SDG C}) = 100\% \quad (2.2)$$

This method was designed to allow universities to participate as widely as possible. The methodology was made flexible considering that different universities in different region may have different priorities and statuses on the SDGs.

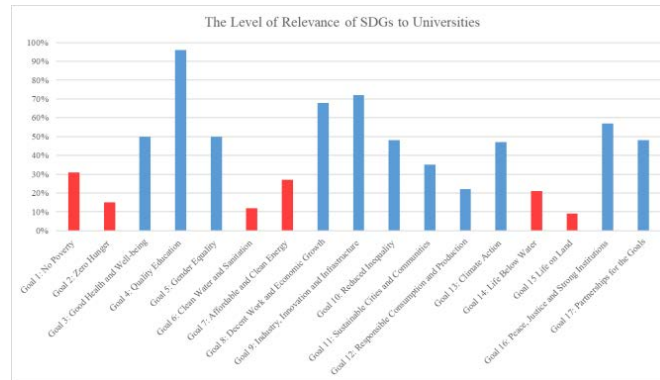


Figure 2.2. The Level of Relevance of SDGs to Universities

#### 2.4. Thai Higher Education Institution (THEI)

Thai education system was mapped and presented in Figure 4. It shows how a young child went to kindergarten for studying and passed to an elementary school (“Prathom” in Thai). After that, they can choose between two paths; a general path toward higher education and a vocational path. For the general path, the students would go to junior high school followed by high school (“Mathayom 1-6” in Thai).

If they choose a junior high school (“Mathayom 1-3”), they will study at a technical college or a senior high school (“Mathayom 4-6”). Council of University Presidents of Thailand (CUPT) officially developed and launched the new entrance system called Thai University Central Admission System (TCAS) in 2018.

TCAS solve the problem of students taking too many university entrance exams, as well as too much emphasis on tutoring schools. Thai students must pass TCAS examination to entrance in a public university or they can apply to an open university that does not require one. Graduates at bachelor level work in a startup, small or medium enterprises, large corporates, or governmental instrumentalities.

### 3. RESEARCH METHODOLOGY

#### 3.1. Research Framework

We followed the steps in Figure 4 as described below.

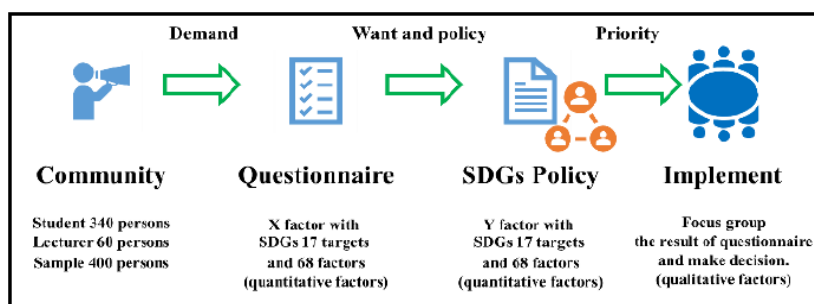


Figure 3.1. Research framework

**Step 1:** we set the sample size to be at least 400 persons, calculated by Yamane's formula [39]. The sample size consists of 2 groups of samples 1) 340 students and 2) 60 lecturers.

**Step 2:** we searched the literature for keywords - SDGs; HEIs; THEI; SHE; University Impact Ranking - to find the gaps in research on SDGs for THEI. A questionnaire as an assessment tool was developed for SDGs and THEUIR criteria that we discuss in part B.

**Step 3:** we will analyze the questionnaire responses. We aim to find community needs and demands as guides for SDG policy implementation.

**Step 4:** we will set up a focus group containing members of our academic management team and other THEI staff to discuss, prioritize, and summarize SDG policies for THEI. This research will help them to form SDG policies and implement them.

### 3.2. Developing the questionnaire as an assessment tool

We designed a questionnaire consisting of 149 questions, as the quantitative and qualitative tools. The 3 sections of the questionnaire in Figure 5 are described below. The questionnaire was designed based on general information; the independent variables, identified as the community wants, that we call "X factors"; and dependent variables, suggested for policy implementation that we call "Y factors".

#### Section I: General information

This section consists of 10 questions. It aims to collect demographic information of the respondents including name surname, university, address, department, faculty, position, experience, gender, age, and income.

#### Section II: Awareness towards SDGs

This section consists of 70 questions. It aims to collect information regarding the level of awareness of the respondents towards SDGs (X Factors).

#### Section III: Perceptions on policy related to SHE

This section consists of 69 questions. It aims to collection information regarding perception and priorities of the respondents towards different policies related to SHE (Y Factors).

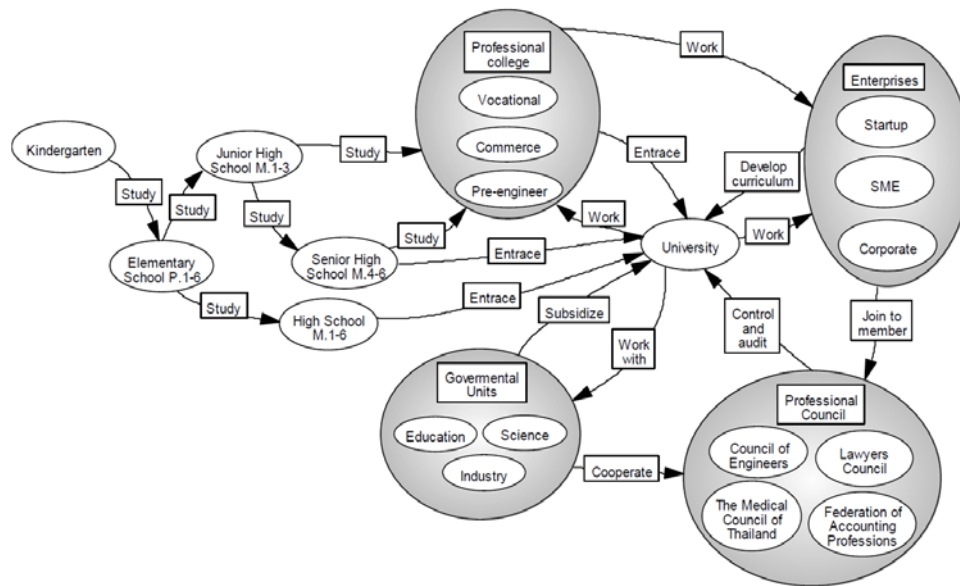


Figure 3.2. THEI systems: [38]

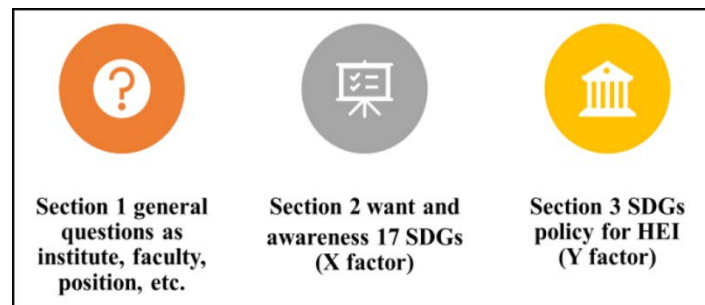


Figure 3.3. Sections of the SDGs questionnaire

We designed the linkage of relationships between awareness towards SDGs called SDG X, and perceptions on policy related to SHE called SDG Y based on the Structural Equation Modeling (SEM) method. The factors will be analyzed with SEM to identify the underlying factors and relationships from the responses. It can see the relationships between SDGx 1 and SDGx 1.1, SDGx 1.2, and SDGx 1.3. These arrows point from the latent variables to the manifest variables. It can see the relationships between SDGy 1 and SDGy 1.1, SDGy 1.2, and SDGy 1.3. SEM uses the convention that the measurements of the manifest variables. SDGx 1 was caused by the latent variables, such as SDGx 1.1, SDGx 1.2, and SDG 1.3.

**Table 1** University Ranking Organization [10]-[18]

URS	Developer	Website	Green Metrics/ SDGs Metrics
A National Report Card on Environmental Performance and Sustainability in Higher Education [19]	National Wildlife's Federation's State of the Campus Environment (SCE)	n/a	
Adaptable Model for Assessing Sustainability in Higher Education (AMAS) [20]	Pontificia Universidad Católica de Chile	n/a	
Alternative University Appraisal (AUA) [21]	Hokkaido University and United Nations University	global.hokudai.ac.jp	/
Auditing Instrument for Sustainability in Higher Education (AISHE) [22]	Dutch Foundation for Sustainable Higher Education	niko.roorda.nu	/
Business School Impact System (BSIS) [23]	EFMD Global Network	efmdglobal.org/assessments/bsis	
Campus Sustainability Assessment Framework (CSAF) [24]–[26]	Lindsay Cole, University of Victoria, Canada	n/a	
German Centre for Higher Education Development (CHE)	Centrum für Hochschulentwicklung (CHE), German	che.de	
College Scorecard	Department of Education, U.S.	collegescorecard.ed.gov	
College Sustainability Report Card (CSRC) [27]	Sustainable Endowments Institute	greenreportcard.org	/
CSA Framework [28]	Western Michigan University	n/a	

**Table 1** Continued

URS	Developer	Website	Green Metrics/ SDGs Metrics
Webometrics	Cybermetrics Lab, the Consejo Superior de Investigaciones Científicas (CSIC), Spain	webometrics.info	
DPSEEA-Sustainability Index Model (D-SiM) [29]	Waheed, Khan, and Veitch (2011)	n/a	
Global Reporting Initiative's Sustainability Report	Global Reporting Initiative (GRI)	globalreporting.org	/
Good Company's Sustainable Pathways Toolkit (SPT) [30]	University of Oregon	n/a	
Graphical Assessment of Sustainability in Universities (GASU) [31]	Rodrigo Lozano, Cardiff University	n/a	
Graz Model of Integrative Development (GMID)	University of Graz, Austria	regional-centre-of-expertise.uni-graz.at/en/research/resources-downloads/graz-model-for-integrative-development	
IREG Observatory on Academic Ranking and Excellence	International Rankings Expert Group Observatory (IREG)	ireg-observatory.org	
Penn State Indicators Report (PENN) [32]	Pennsylvania State University	n/a	



**Table 1** Continued

URS	Developer	Website	Green Metrics/ SDGs Metrics
People and Planet's University League (P&K)	People & Planet Student Activities Limited	peopleandplanet.org	
QS World University Rankings (QSWUR)	QS Quacquarelli Symonds (QS)	qs.com	
Scimago Institutions Rankings (SIR)	Scimago Lab, SRG S.L.	scimagoir.com	
Academic Ranking of World Universities (ARWU)	Shanghai Ranking Consultancy	shanghairanking.com	
Sustainability Assessment of Food and Agriculture Systems (SAFA) [33]	Food and Agriculture Organization (FAO)	fao.org/nr/sustainability/sustainability-assessments-safa	/
Sustainability Assessment Questionnaire (SAQ) for Colleges and Universities [34]	Association of University Leaders for a Sustainable Future (ULSF)	ulsf.org/sustainability-assessment-questionnaire	
Sustainability Self-assessment Concept for Higher Education Institute	German Commission for UNESCO (DUK)	n/a	
Sustainability Tool for Auditing for University Curricula in Higher Education	Rodrigo Lozano, University of Gävle, Sweden	n/a	
Sustainability Tracking, Assessment and Rating System (STARS) [26], [35]	Association of the Advancement of Sustainability in Higher Education (AASHE)	stars.aashe.org	/

**Table 1** Continued

URS	Developer	Website	Green Metrics/SDGs Metrics
Assessment of Higher Education Learning Outcomes (AHELO)	The Organisation for Economic Co-operation and Development (OECD)	oecd.org/site/ahelo	
Three-dimensional University Ranking (TUR)	University of Maribor	n/a	
Times Higher Education University Impact Rankings (THEUIR)	Time Higher Education (THE)	timeshighereducation.com	/
US News and World Report (USNWR)	U.S. News & World Report	usnews.com/rankings	
UI Green Metric University Rankings	University of Indonesia, Indonesia	greenmetric.ui.ac.id	/
U-Multirank's approach to university rankings	U-Multirank	umultirank.org	
Unit-based Sustainability Assessment Tool (USAT) [36], [37]	United Nations Environment Programme (UNEP) and Rhodes University, South Africa	auc.org.uk/theplatform/usat_unit-based_sustainability_assessment_tool	

### 3.3. Validity and Reliability of the Questionnaire

The questionnaire was checked for the both validity and reliability using

#### *Cronbach's Alpha*

The questionnaire was checked for reliability by function Analyze > Scale > Reliability Analysis in IBM SPSS Statistics 20. Cronbach's Alpha must be greater than 0.6 [40, 41].

#### *Domain Experts*

We invite five domain experts (see Table 2) to validate the questionnaire by using an Index of Item-Objective Congruence (IOC) method. IOC developed by Rovinelli and Hambleton

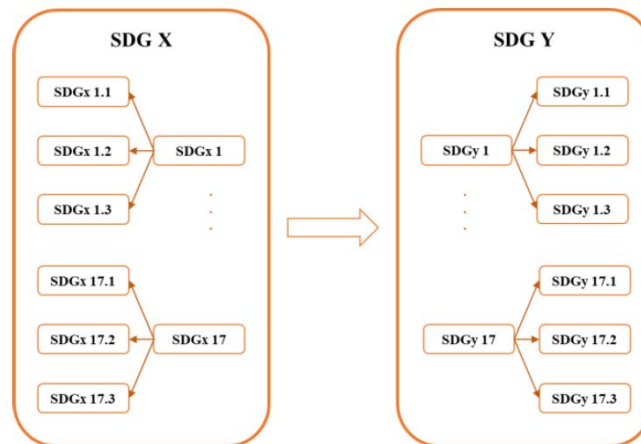


Figure 3.4. Structure and Relation of the SDG X and SDG Y factors

(1977) [42] is a procedure used in test development for evaluating content validity when we design the factors stage. IOC should be greater than 0.6 [43].

**Table 2** Domain Experts

Name	Position, Organization
Dr. Kankanit Kamolkittiwong	Head of Logistics Management Department, Faculty of Business Administration, Rangsit University, Thailand
Dr. Chodchanok Attaphong	Assistant Professor, Department of Civil Engineering, KMITL
Adhipat Warangkanand	Consultant, UNFPA Thailand and UNICEF Thailand
Dr. Weerawit Lertthairakul	Associate Dean, School of Logistics and Supply chain, Sripatum University, Thailand
Dr. Pornsri Laurujisawat	Lecturer, Faculty Administration and Management, KMITL

#### 4. RESULTS AND DISCUSSION

Briefly, the reliability of the assessment tool was measured using Cronbach's alpha. Cronbach's alpha is 0.992, which means the items of the questionnaire are constructed and connected to the inter-relatedness. The corrected item-total correlation (discrimination) are 0.311 – 0.890 for a trial sample of 50 respondents (see Tables 3 and 4), and the IOC 0.600 - 1.000 [43], that mean the high of validity and reliability of the questionnaire.

**Table 3** SDG X Factors from The Trial

SDGs (Cronbach's Alpha = 0.992)	Corrected Item-Total Correlation (Discrimination)			
	<i>SDG<sub>x</sub></i>	<i>SDG<sub>x.1</sub></i>	<i>SDG<sub>x.2</sub></i>	<i>SDG<sub>x.3</sub></i>
SDG 1: No poverty	0.458	0.392	0.342	0.418
SDG 2: Zero hunger	0.462	0.491	0.517	0.391
SDG 3: Good health and well-being	0.586	0.523	0.581	0.311
SDG 4: Quality education	0.534	0.564	0.722	0.646
SDG 5: Gender equality	0.702	0.623	0.750	0.739
SDG 6: Clean water and sanitation	0.789	0.783	0.850	0.767
SDG 7: Affordable and clean energy	0.761	0.890	0.875	0.816
SDG 8: Decent work and economic growth	0.760	0.842	0.825	0.758
SDG 9: Industry, innovation, and infrastructure	0.716	0.840	0.827	0.784
SDG 10: Reduced inequalities	0.751	0.861	0.772	0.733
SDG 11: Sustainable cities and communities	0.784	0.735	0.785	0.826
SDG 12: Responsible consumption and production	0.817	0.789	0.782	0.774
SDG 13: Climate action	0.786	0.726	0.820	0.871
SDG 14: Life below water	0.788	0.782	0.791	0.819
SDG 15: Life on land	0.777	0.763	0.692	0.767
SDG 16: Peace, justice and strong institutions	0.783	0.797	0.613	0.649
SDG 17: Partnerships for the Goals	0.768	0.716	0.733	0.720

Source: IBM SPSS Statistics 20

After that, we will diffuse the SDGs questionnaire, throughout the 16 pioneer THEIs. Next, the statistical results will be prioritized by the focus group. Finally, we will form SDG policy guidelines and implementation suggestions for THEI to implement and improve their THE rankings also.

The X factors and the Y factors link systems together, that can balance between demand (community wants) and supply (SDGs policy). Moreover, the results help us to push and drive THEIs in the same direction, and align them to the 17 SDGs, at the same time. We expect that this study will be used by Thai university executives to optimize resources spent for achieving better sustainability performance.

**Table 3** SDG Y Factors from The Trial

SDGs (Cronbach's Alpha = 0.992)	Corrected Item-Total Correlation (Discrimination)			
	<i>SDGy</i>	<i>SDGy.1</i>	<i>SDGy.2</i>	<i>SDGy.3</i>
SDG 1: No poverty	0.676	0.811	0.673	0.590
SDG 2: Zero hunger	0.768	0.719	0.730	0.713
SDG 3: Good health and well-being	0.792	0.720	0.684	0.499
SDG 4: Quality education	0.722	0.711	0.600	0.617
SDG 5: Gender equality	0.695	0.651	0.700	0.720
SDG 6: Clean water and sanitation	0.824	0.725	0.557	0.679
SDG 7: Affordable and clean energy	0.713	0.628	0.770	0.711
SDG 8: Decent work and economic growth	0.738	0.505	0.599	0.728
SDG 9: Industry, innovation, and infrastructure	0.753	0.659	0.619	0.676
SDG 10: Reduced inequalities	0.743	0.803	0.585	0.687
SDG 11: Sustainable cities and communities	0.723	0.662	0.604	0.564
SDG 12: Responsible consumption and production	0.775	0.739	0.697	0.631
SDG 13: Climate action	0.757	0.604	0.577	0.655
SDG 14: Life below water	0.749	0.617	0.636	0.727
SDG 15: Life on land	0.755	0.698	0.595	0.679
SDG 16: Peace, justice and strong institutions	0.732	0.690	0.683	0.485
SDG 17: Partnerships for the Goals	0.705	0.622	0.698	0.549

Source: IBM SPSS Statistics 20 by the author

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## 6. BIOGRAPHIES

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**Ronnachai Tiyarattanachai** is an associate professor in Department of Civil Engineering, Faculty of Engineering, KMITL. He received his Ph.D. in Environmental Sciences (Environmental Policy Concentration) from the New Jersey Institute of Technology. Prior to joining KMITL, he worked as an engineer in the Remedial Design group of the Louis Berger Group, Morristown, New Jersey.

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