



Waste Management and Its Contribution to the Sustainable Development Goals at Dhurakij Pundit University, Thailand

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Abstract. The Sustainable Development Goals (SDGs) provide the guidance for the society moving to the sustainability pathways. University is a second home for staffs, students and future leaders and play a key role in achieving the SDGs. This study aims to assess the contribution of waste management in the achievement of the SDGs and their relevant targets. The assessment was performed using the contribution scoring matrix that consists of five points and five scoring magnitudes. Using a case study of Dhurakij Pundit University (DPU) in Thailand, the results found that waste management is directly contributed to the SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production) and SDG 14 (Life below water). The analysis revealed that waste management has direct positive contributions on reducing the environment impact of cities (Target 11.6), enhancing resource use efficiency (Target 12.2), reducing food waste and losses (Target 12.3), reducing waste generation and promoting recycling and reuse (Target 12.5), and preventing and reducing marine pollution from land-based activities (Target 14.1). Waste management is not only having the positive impact of the SDGs but it also contributes to a healthy university during the COVID-19 pandemic and afterward.

Keyword:

Living Lab, Waste management, Sustainable Development Goals, UI GreenMetric

1. Introduction

The 17 Sustainable Development Goals (SDGs) with their 169 targets of the United Nations require a global action to address the challenges. At the national level, Thailand's SDG index rose from the 55th in 2017 to the 43rd in 2020 from 165 countries and the highest rank in ASEAN (Association of Southeast Asian Nations). Thailand's SDG index was 74.19, which increased from the previous year [1]. Thailand has improved the performance on the SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 3 (Quality education), SDG 10 (Reduced inequalities), SDG 14 (Life below water), and SDG 15 (Life on land). At the university level, the UI GreenMetric World University Rankings is an effective tool for universities and Higher Educational Institutions (HEIs) to facilitate sustainability assessment in practice. The previous study by [2] provides a comprehensive analysis of tools and indicators for assessing the impacts of HEIs on sustainable development.

Universities and HEIs have been considered as a second home for staffs, students and future leaders and have a key role in achieving the SDGs. Different roles of universities and HEIs on progress towards the SDGs have been highlighted in the literature. The main topics discussed in the literature are the use of education as a driving force to sustainable development, green universities and contribution of universities to sustainability [3-5]. Many universities and HEIs around the world have established the networks to address the sustainability. For example, the international Association of Universities (Founded in 1950), the Association for the Advancement of Sustainability in Higher Education (Founded in 2005), the International Sustainable Campus Network (Founded in 2007), the University Alliance for Sustainability (Founded in 2014), and Sustainability at Higher Education Institutions Network (Founded in 2016) [6]. These networks consist of a number of few members to several hundreds of members from different countries.

There are many evidences showing that universities provide opportunity to integrate their facilities, staffs and students to investigate, test and demonstrate innovative ideas for addressing the SDGs. Therefore, a number of universities have launched Living Labs for their learning systems. The Living Lab approach allows the interaction of universities' daily operation, students, academic and administrative staffs, and communities. Living Labs provide opportunities for stakeholders to engage with hands-on experience on campus to learn and solve the critical questions in real-world problems and societal needs. Students can bring their experiences to outside campus society [7,8]. There are many Living Labs have been working in the top universities and HEIs, for example KTH Live-In Lab (<https://www.liveinlab.kth.se>), MIT Office of Sustainability (<https://sustainability.mit.edu/living-labs>), Harvard Living Lab (<https://green.harvard.edu/series/living-lab>), and TU Delft's Green Village (<https://thegreenvillage.org>). These Living Labs may focus in different aspects but they are based on sustainability. In addition to the Living Labs, there are emerging approaches to the sustainable development at university level, including Real World Laboratories, Urban Transition Labs and Transformation Labs [8].

With regard to the COVID-19 pandemic, the recent review on the impact of COVID-19 on SDGs showed that the pandemic poses a significant challenge to the achievement of SDGs in developing countries more than developed countries. COVID-19 has brought negative impact on various SDGs, but it would bring positive influence to some SDGs, such as SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action) [9]. Dhurakij Pundit University

(DPU) has been actively involved in the UI GreenMetric and the SDGs. DPU has contributed to national SDGs' research on SDGs 1 (No poverty), SDG 5 (Gender equality), SDG 7 (Affordable and clean energy), and SDG 9 (Industry, innovation and infrastructure). These works investigated the current status and possible pathways of the SDGs in the context of Thailand [10,11]. According to the UI GreenMetric ranking in 2020, DPU was positioned at the global rank of 82nd and the fourth in Thailand. DPU received the highest point in waste criteria [12]. Details of the scores within the six categories are discussed in section 2.1. This leads to the interest on waste management and its contribution to the SDGs at university level. This paper aims to assess the contribution of waste management to the SDGs. Using a case study of DPU, this study contributes to the literature on the role of university in achieving the SDGs by adding an investigation on the contribution of waste management in university campus that addresses the SDGs and their relevant targets.

2. Materials and Methods

2.1. A Case Study: Dhurakij Pundit University, Bangkok, Thailand

DPU is a private university in Thailand and founded in 1968. The university is located in the north of Bangkok, and situated among local communities of more than 40,000 households and Bangkok Government Center. DPU covers an area over 161,874 m² of a beautiful green environment to accommodate modern teaching, learning and research facilities. The area covered in planted vegetation is approximately 53,087 m². DPU hosts to more than ten faculties and colleges covering art, engineering, social science, and science and technology. These faculties and colleges offer Bachelor's degrees, Master's degrees and Doctoral degrees in their specialist fields. Currently, DPU employs approximately 1,100 faculty and staff members. The total student enrolment at all levels is approximately 20,000 each year. DPU's main building group consists of more than 22 buildings with a total area of 130,961 m². Fig. 1 presents the 22 main buildings, including offices, educational buildings, laboratories, food court, library, hotel, sport complex, and residential buildings. Over the years, DPU has invested and upgraded for many infrastructures, facilities and services for staffs and students. Sustainability is one of the main concerns of campus operation. More information about DPU Green and DPU's UI GreenMetric activities is provided at the website (<https://dpu.ac.th/engreendpu/Setting.html>). Table 1 presents the scores achieved within the six categories of the UI GreenMetric in 2020.

Table 1. DPU's UI GreenMetric Ranking 2020

Category	Point	Maximum Point	Percentage (%)
Setting & infrastructure (SI)	850	1,500	56.67
Energy & climate change (EC)	1,525	2,100	72.62
Waste (WS)	1,800	1,800	100.00
Water (WR)	575	1,000	57.50
Transportation (TR)	1,350	1,800	75.00
Education & research (ED)	1,575	1,800	87.50
Total	7,675	10,000	76.75

Source: [12]

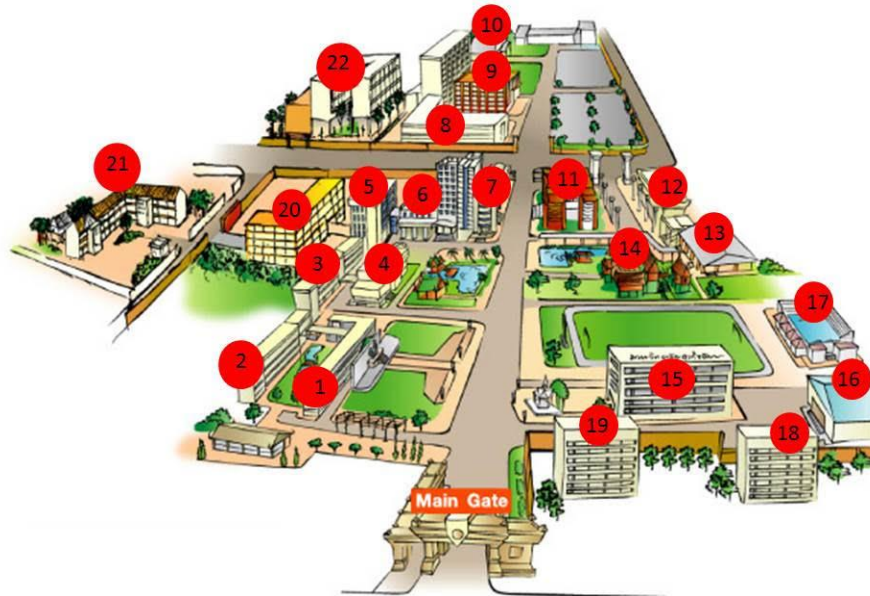


Figure 1. An overview map of Dhurakij Pundit University, Bangkok, Thailand

2.2. Analytical Framework

The research methodology is divided into five steps: I) literature review has been done based on peer-reviewed studies. The review processes used different online databases, including Scopus, Google Scholar and grey literature. This step aims to find the state-of-the-art research in the contribution of waste management to the SDGs; II) integrating the knowledge and establish insights, including the UI GreenMetric ranking methodology; III) developing and assessing the contribution scores and applying to a case study (DPU) based on the thinking of Living Lab approach; IV) analyzing and interpreting the results from step III. This step includes the synthesis of the contribution of waste management on the SDGs and their associated targets; and V) providing conclusion and recommendation for future work. Fig. 2 presents a research methodology framework used in this study.

Although waste management is not directly specified as a goal but it contributes to various SDGs and their relevant targets. This is clearly noticed in previous studies such as [13-15]. The literature reviews in the first step have been used to identify the significant contribution of waste management in the achievement of SDGs and their relevant targets. To understand the contribution of waste management, the study employed a scoring matrix approach. The contribution scoring matrix in the second step was adopted from the work done by [16] and used to assess the influence of waste management in the achievement of the SDGs.

The scoring system in the assessment process consists of five points and five scoring magnitudes, including -1 (constraining), 0 (invisible), +1 (enabling) +2 (reinforcing), and +3 (visible). A score of 0 (invisible) is assigned if there is no knowing either positive (+1 to +3) or negative (-1) contribution. In addition, the scoring method has reformed the seven points matrix introduced by [17]. The assessment is performed with the guide of the Living Lab approach [8]. In, the fourth step, findings from previous steps are analyzed. Finally, conclusion and recommendation for future work are discussed for improving other

resource utilization such as energy and water.

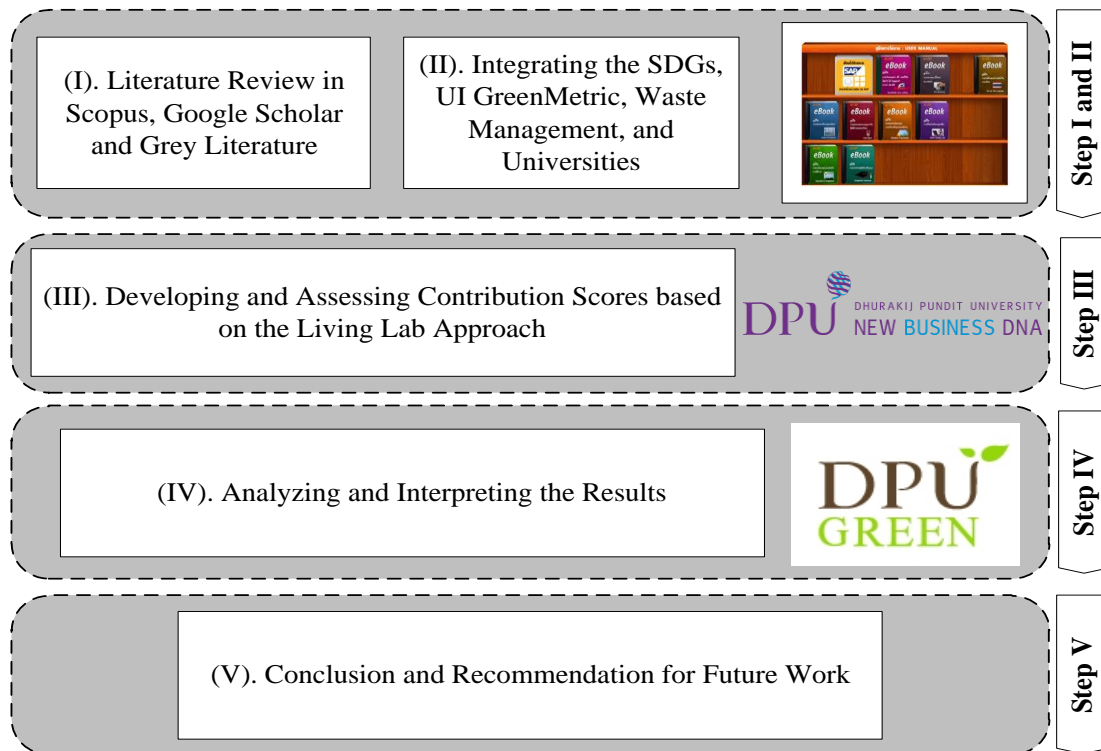


Figure 2. Research methodology

3. Results

Efficient waste management is considered a key factor in various SDGs. Many universities recognized the important of the SDGs in their teaching, research and their daily operations. Universities play an important role in driving and implementing the SDGs. The progress towards achieving various goals and targets in universities requires the engagement of different actors, not only staffs and students but also other institutions such as private sector and NGOs. The contribution of waste management in the achievement of the SDGs has been clearly noticed in several goals and targets. Table 2 presents the contribution score of waste management in the achievement of the SDGs and their relevant targets. The results identified various SDG targets that can potentially contribute to the achievement. Waste management could contribute in a single target or a combination of multiple targets.

The analysis showed that waste management is directly contribute to the SDG 11 (Sustainable cities and communities), SDG 12 (Responsible consumption and production) and SDG 14 (Life below water). Waste management has the potential to strongly affect the SDG 6 (Clean water and sanitation), SDG 7 (Affordable and clean energy), SDG 8 (Decent work and economic growth), SDG 9 (Industry, innovation and infrastructure), and SDG 13 (Climate action). Efficient waste management systems would enable to achieving the SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 4 (Quality education), SDG 15 (Life on land), and SDG 17 (Partnerships for the goals). However, the analysis revealed that there is no significant contribution to the SDG 1 (No poverty), SDG 5 (Gender equality), SDG 10 (Reduced inequalities), and SDG 16 (Peace, justice and strong institution). These goals were difficult to assess the influence of waste management of their targets. It can be seen that

waste management is not only improved environmental aspect but also enhanced economic and social aspects.

Waste is one of the environmental problems in Thailand as well as other developing countries due to the lack of efficient and proper management. Waste management considers an important part of the transition towards green and smart cities and efficient use of resources. Even this study applied at the university level, however, when applying the assessment at larger scales, such as district, city and country, the findings would have similar contributions. At university level, the study showed that waste management has a direct positive contribution (+3 or Visible) on reducing the adverse environmental impact of cities (Target 11.6), enhancing the efficient use of resources (Target 12.2), reducing the food waste and food losses in the supply chains (Target 12.3), reducing waste generation and promoting reduction, recycling and reuse (Target 12.5), and preventing and reducing marine pollution from land-based activities (Target 14.1).

Table 2. The contribution score of waste management to the SDGs and their relevant targets in a case study

17 UN SDGs	Relevant Targets	Contribution Score	Contribution Name
1: No poverty	-	0	Invisible
2: Zero hunger	2.3	+1	Enabling
3: Good health & well-being	3.9	+1	Enabling
4: Quality education	4.7	+1	Enabling
5: Gender equality	-	0	Invisible
6: Clean water & sanitation	6.3	+2	Reinforcing
7: Affordable & clean energy	7.2, 7.A	+2	Reinforcing
8: Decent work & economic growth	8.4	+2	Reinforcing
9: Industry, innovation & infrastructure	9.4	+2	Reinforcing
10: Reduced inequalities	-	0	Invisible
11: Sustainable cities & communities	11.6	+3	Visible
12: Responsible consumption & production	12.2, 12.3, 12.5	+3	Visible
13: Climate action	13.3	+2	Reinforcing
14: Life below water	14.1	+3	Visible
15: Life on land	15.5	+1	Enabling
16: Peace, justice and strong institution	-	0	Invisible
17: Partnerships for the goals	17.6, 17.7	+1	Enabling

After the COVID-19 pandemic arrived, solid hazardous waste and infectious waste became the focus of waste management at DPU as well. Basically, the hazardous waste

mostly comes from laboratory waste. Laboratory activities for research and education are the primary source but the use of face masks from staffs, students and visitors have been increasing due to the pandemic. Therefore, the proper managing discarded masks is an important issue to prevent the increased risk of infection to people in the university and outside. This creates a challenge for waste management to consider not only municipal solid waste and wastewater but also infectious waste as well. It is clear that waste management is not only having the positive impact of the SDGs but it also contributes to a healthy university during the pandemic and afterward. This includes the issue of indoor environmental quality for building occupant's health and productivity.

4. Concluding Remarks

This paper investigates how waste management contribute to the achievement of the SDGs and their relevant targets. The study analyzed the interactions between waste management and the SDGs, and assessed the contribution of waste management in achieving the SDGs. Using the case study of DPU, the study found that waste management is directly contributed to the SDG 11, 12 and 14. Results of an analysis showed that waste management plays a key role, especially in the target 11.6, 12.2, 12.3, 12.5, and 14.1. Waste management has the strongly affect to SDG 6, 7, 8, 9, and 13. However, it has no significant contribution to the SDG 1, 5, 10, and 16. DPU has been working to reduce the environmental impacts from hazardous waste and municipal solid waste, especially the infectious waste due to the COVID-19 pandemic. The waste management in DPU has been concerned as co-benefits to save the university's resources and Living Lab for staffs and students. DPU would be moved forwards from waste management to apply the nexus approach for integrating efficient use of resources. The future work would be Climate-Energy-Waste-Water Nexus in campus. The nexus approach considers climate change actions, energy utilization, water use, and waste management simultaneously, rather than consider individually.

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