東アジアバイオマスリサーチセンター	
題目	地域主導型スマートコミュニティの構築の海外展開に関する研究
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1. Background

There is an enormous energy potential of biomass waste in the southeast Asian developing countries. Meanwhile, electrification and digitalization of public mobility in southeast Asia is taking place in attempt to reduce air pollution from the transport sector and other basic utilities supplies. It is expected that cleaner energy supply will dramatically increase in the near future. Hopefully, the biomass waste energy conversion can fill a large portion of the demand.

Looking at the resource potential and expected demand, we collaborated with a number of southeast Asian countries to understand the environment, economic, and social feasibility and dynamics.

2. Research results in academic year 2023

(1) Collaboration with Thailand, Indonesia, and the Philippines for e-Asia project proposal

We collaborated with leading scholars from Mindanao State University – Iligan Institute of Technology, The Philippines, Universitas Gadjah Mada, Indonesia, National Research and Innovation Agency (BRIN), Indonesia, Universitas Sam Ratulangi, Indonesia, Chulalongkorn University, Thailand, and National Energy Technology Center (ENTEC / NSTDA), Thailand to construct the e-Asia project proposal.

The Thailand and Indonesian teams are experts in the wet biomass energy conversion technologies such as the Anaerobic Digestion and Fermentation and Hydrothermal Liquefaction. The Philippine's team members are experts in Geographic Information System (GIS) and spatial analysis to design an optimized energy management system. The collaborated strategy is shown in Fig. 1. We aim to design a platform where researchers, engineers, and decision makers can input data from the supply side and evaluate performance based on the resource's availability, environmental condition, demand, and other important parameters to design sustainable biorefineries appropriate for the southeast Asian countries.
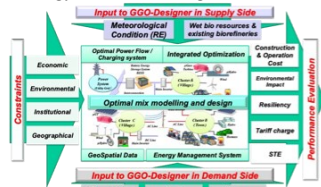

Fig. 1 Concept picture of the collaborative e-Asia project proposal

(2) Economic assessment of renewable energy for clean water supply in Indonesia

To understand the financial feasibility of renewable energy use at the grass-root level, we collaborated with a school in Indonesia to measure the financial feasibility of using solar panel to power their daily clean water supply. Our analysis showed a promising solar energy generation as well as rainwater harvesting (RWH) potential throughout the year. However, the system scenario that utilizes Photovoltaics (PV) is not as attractive as the system that does not use a PV despite of the globally falling price of PVs. The financial feasibility of PV utilization in a RWH system can be improved by extending the lifetime of the PV to its longest potential and the guarantee of the fit-in-tariff (FIT) benefit.
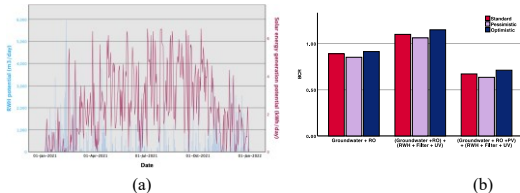

Fig. 2 Harvested rainwater and solar energy generation (a) potential (b) economic feasibility

(3) Study on smart mobility in Japan and Jakarta, Indonesia.

We studied the potential of autonomous vehicle to aid the mobility of the aging population in Japan. We used the fourth wave of the Japanese Study of Aging and Retirement (JSTAR) survey data consisting of nearly 5000 respondents from 10 municipalities in Japan. Our study showed that the ability of driving cars allows older adults to stay mobile in their advanced age and contribute to their overall wellbeing. We propose carsharing as opposed to car owning to reduce the high financial commitment of autonomous vehicle and for better environmental sustainability.

Meanwhile, we initiated a survey to 1000 commuters in Jakarta, Bogor, Depok, Bekasi, Tangerang districts in Indonesia who commute with public transport to the capital city. We selected 10 male and 10 females among the respondents and currently interview them to gain deeper understanding about the dynamics and experience of the digitalizing public transport in Jakarta. The Jakarta smart city is currently aiming for a seamless smart mobility.

(4) Study on smart waste management in Japan and Indonesia

We conducted a survey with 1000 Japanese residents nation-wide, with equal proportion of location, age group, and gender. It was found that all age groups are in favor of a smart bin that could allow unscheduled pick-up and automatized waste separation. Interestingly, it was found that the younger age groups are more in favor to those functionalities than the older group.

In Indonesia, we interviewed several "waste bank" recycling facilities operators in and around Jakarta. They expressed interest for a technology that could automatize activities in their facilities such as auto-sorting and auto-recording of the weight of the waste received by type.
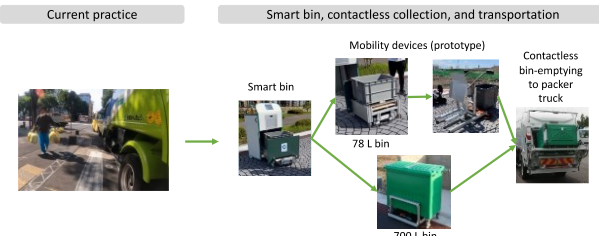

Fig. 3 The smart bin prototype for waste collection and transport in Japan

3. Next year's research plan

Because this year we have dedicated most of our efforts on Japan studies, next year we will delve further on the Indonesian and southeast Asian mobility and waste management. Ultimately, after we gather knowledge and wisdom of both regions, we will be able to do a comparative study.

4. Research Publications

1. (Scopus) Pandyaswargo, A.H., Azmi N., Darwinsyah, Onoda H. (2024) Financial assessment of groundwater and rainwater treatments for school clean water supply. Sustainable Water Resources Management, 10 (23), 1-16.
2. (Scopus) Shan C., Pandyaswargo A.H., Ogawa A., Tsubouchi R., Onoda H. (2024) Japanese public perceptions on smart bin potential to support PAYT systems. Waste Management, 177, 278-288
3. (Scopus) Ogawa A., Pandyaswargo, A.H., Tsubouchi, R. Onoda, H. (2024) Demonstration of a contactless waste collection system: A Japanese case study. IET Smart Cities, 5, 303~316
4. (Scopus) Pandyaswargo, A.H., Siregar, T. H., Onoda, H. (2023). Exploring Japan's older adults mobility challenges and the potential role of autonomous vehicles. Transportation Research Part A: Policy and Practice, 176 (103818), 1-22
5. (Invited) Pandyaswargo, A.H., The Japanese Technology Readiness Assessment (J-TRA) Method and its application on Cleaner Transportation Technologies, Third Country Training Programme (TCTP) organized by TISTR-ENTEC, NSTDA, and JICA Thailand, Bangkok, Thailand 30 May 2023 (Online)
6. Shan, C. Pandyaswargo, A.H., Onoda, H., Plastic Waste Recycling Relative-Efficiency of Japanese Prefectures: Exercising the Data Envelopment Analysis Method. International Workshop on Environmental Engineering (IWEE 2023), Shimane, Japan 25 – 28 July 2023.
7. (Invited) Pandyaswargo, A.H., Smart Technologies can boost growth, but understanding people is key. Scientific Forum of Indonesian Diaspora (Forum Ilmiah Diaspora Indonesia), South Tangerang, Indonesia 24 – 26 August 2023.
8. Cheng, T. Hu, H. Pandyaswargo, A.H., Onoda, H. Development of an Ideal Training Dataset for Visual Analysis-based Waste Sorting Robot: An Experiment with Mixed-construction Waste. EcoDesign 2023, Nara, Japan, 30 November 2023
9. Cheng, T., Pandyaswargo, A.H., Onoda, H. Environmental and Economic Assessment Towards the Utilization of CCUS Technology in Waste Incineration Facilities. EcoDesign 2023, Nara, Japan, 30 November 2023
10. Pandyaswargo, A.H. Maghfiroh, M.F.N., Sofianti, T.D., Onoda H., Factors Affecting Smart Technologies Social Acceptance: A Review Study. EcoDesign 2023, Nara, Japan, 30 November 2023

11. Shan, C., Pandyaswargo, A.H., Onoda. H., Readiness Status of Smart Waste Collection and Processing Technologies for Plastic Waste Recycling. EcoDesign 2023, Nara, Japan, 30 November 2023