

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

This study approached the topic of region-led smart community development from three perspectives: biomass utilization, technology readiness of waste-to-energy systems, and inclusivity of digitalized public transportation. The objective is to understand how locally available resources, stakeholder conditions, and service design can support the overseas development of smart communities in Southeast Asia.

2. Research results in academic year 2025

(1) Relationship between food waste composition and anaerobic digestion performance

We analyzed how food waste composition affects anaerobic digestion performance using kinetic modeling, statistical assessment, and metagenomic analysis. The results show that substrate composition strongly affects digestion behavior, where fiber-rich compositions tend to support more stable degradation and higher methane productivity (Fig. 1). This suggests that feedstock characterization is important for improving the efficiency of biomass utilization systems [1].

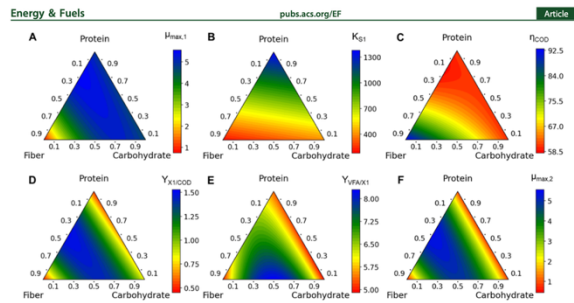


Figure 1. Ternary contour plots illustrating the effects of substrate compositions on (A) the maximum specific growth rate of hydrolytic-acidogenic biomass (μ_{max} , day⁻¹), (B) the saturation constant (K_d , g substrate g⁻¹ hydrolytic-acidogenic biomass), (C) percent COD removal (η_{COD} , %), (D) mass yield of hydrolytic-acidogenic biomass per gram COD (Y_{SLCOD} , g X_g⁻¹ COD), (E) mass yield of VFA per gram hydrolytic-acidogenic biomass (Y_{VFA} , g VFA g⁻¹ X_g), (F) the maximum specific growth rate of methanogenic biomass (μ_{max} , day⁻¹).

Figure 1 Food waste composition strongly affects anaerobic digestion performance and methane production.

(2) Social implementation and participation systems for sustainable waste management

We assessed the readiness of anaerobic digestion technology for biomass waste-to-energy deployment in Indonesia using a multistakeholder framework. The results show that the municipal organic waste case is relevant for community-based implementation, but further progress is needed in commercialization, market formation, and cost/risk conditions (Fig. 2). This indicates that practical deployment depends not only on technical maturity but also on institutional and stakeholder readiness [3].

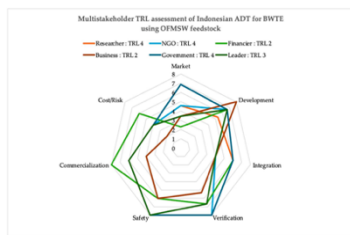


Figure 2. OFMSW-based biomass waste-to-energy in Indonesia shows moderate readiness but still faces commercialization and market challenges.

(3) Inclusivity of digitalized public transportation in Jakarta Metropolitan Area

We studied how digitalization in public transportation affects commuters in the Jakarta Metropolitan Area. The results show that digital transport behavior is associated with socio-economic and locational factors such as income, education, commuting duration, and place of residence (Fig. 3). This implies that smart mobility systems should be designed with attention to inclusivity [5].

3. Next year's research plan

In the next academic year, we will further study decentralized biomass utilization and smart community systems in Southeast Asia by considering

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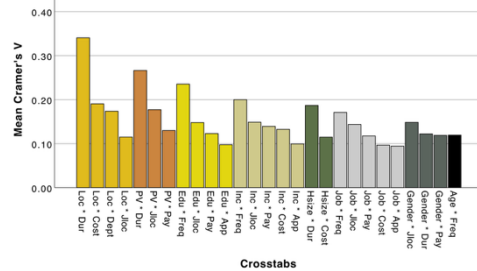


Fig. 4. Significant correlation variables according to Cramer's V effect sizes. Loc: Location, PV: Private vehicle ownership, Edu: Education, Inc: Income, Hsize: Household size, Gender: Gender, Job: Job, Age: Age, Dur: Commuting duration, Cost: Commuting cost, Depart: Departure time, Loc: Job location, Pay: Means of payment, Freq: Commuting frequency, App: Use of smartphone app.

Figure 3. Digital public transportation use in Jakarta is influenced by socio-economic and locational factors.

local infrastructure, stakeholder conditions, and socio-economic factors. We will also continue examining how low-carbon and digital systems can be introduced in a more inclusive manner.

4. Research Publications

- [1] (Scopus) K.N. Madani, H. Sudibyo, A. Suparmin, L. Marbelia, J. Koonthongkaew, A.H. Pandyaswargo, et al., "Linking Food Waste Composition to Anaerobic Digestion Performance Using Integrated Kinetic Modeling, Statistical Assessment, and Metagenomic Analysis," *Energy & Fuels*, 2026.
- [2] (Scopus) G. Kudo, A.H. Pandyaswargo, H. Onoda, "Development and Application of Breakdown T&BRL, a Novel Evaluation Framework for Social Implementation Assessment: A Case Study on Mobility Robot Devices," *International Journal of Automation Technology*, vol. 20, no. 1, pp. 4–23, 2026.
- [3] (Scopus) N.A. Noor, A.H. Pandyaswargo, M. Rumbayan, H. Onoda, "Technology Readiness of Biomass Waste-to-Energy in Indonesia: A Multistakeholder Assessment of Anaerobic Digestion of Palm Oil Mill Effluent and Municipal Organic Waste," *Energies*, vol. 19, no. 1, 255, 2026.
- [4] (Scopus) A. Ramdhan, A.H. Pandyaswargo, H. Onoda, "Green Hydrogen Development and Readiness Status in Indonesia: A Multistakeholder Perspective," *Energies*, vol. 19, no. 8, 1961, 2026.
- [5] (Scopus) A.H. Pandyaswargo, V. Kharisma, M.F.N. Maghfiroh, A.B.D.P. Swastika, A. Hanifa, B. Muhammad, M. Larasati, H. Onoda, "Inclusivity Assessment of Digitalizing Public Transportation in the Jakarta Metropolitan Area," *Journal of Public Transportation*, vol. 28, 100163, 2026.
- [6] (Scopus) A.H. Pandyaswargo, I. Rachman, M.F.N. Maghfiroh, V. Kharisma, H. Onoda, "Between Awareness and Action: Understanding Public Participation in Waste Sorting and Waste Bank Programs," *Indonesian Journal of Urban and Environmental Technology*, vol. 8, no. 2, pp. 305–323, 2025.
- [7] G. Kudo, A.H. Pandyaswargo, H. Onoda, "Breakdown Technology & Business Readiness Level Assessment: A Novel Evaluation Framework for Assessing Technology Social Implementation and Innovation Potential in the Field of Carbon Neutrality," *EcoDesign 2025*, Tokyo, Japan, November 12–14, 2025.
- [8] G. Kudo, A.H. Pandyaswargo, H. Onoda, "Application of Break-Down T&BRL to Mobility Devices Technology: A Case Study on Advancing Social Implementation Assessment," *EcoDesign 2025*, Tokyo, Japan, November 12–14, 2025.
- [9] A.H. Pandyaswargo, T. Cheng, H. Hu, H. Onoda, "Assessing the Readiness of Automated Waste Sorting Technologies for Advancing Circular Economy," *EcoDesign 2025*, Tokyo, Japan, November 12–14, 2025.
- [10] S. Wulandari, A.H. Pandyaswargo, M.F.N. Maghfiroh, B. Suwerda, H. Onoda, "Digitalization in Waste Banks: Implications for Customer Management and Operational Performance," *EcoDesign 2025*, Tokyo, Japan, November 12–14, 2025.