

Analysis of Plastic Waste Management Methods in the Recycling Industry: A Case Study-Dili Subdistrict, Beduku Comoro Village

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Abstract

Plastic waste management has emerged as a critical global environmental crisis, particularly in developing countries such as Timor-Leste, which is currently undergoing rapid urbanization and economic growth. The daily increase in municipal solid waste (MSW) volume in Dili reaches hundreds of tons, with a significant portion disposed of at the Tibar Landfill, which operates with minimal environmental safeguards. Reliance on a linear "take-make-dispose" economic model has led to massive plastic waste accumulation, posing serious threats to ecosystems and human health. Although the government has initiated recycling efforts, such as converting plastic waste into paving blocks through entities like Caltech, the scale of the problem far exceeds the available solutions. This study analyzes the reverse logistics flow model in plastic waste management in Dili City, identifying key factors along the supply chain from consumers to recycling facilities and evaluating the effectiveness of source-level waste sorting and its critical points. Data reveal that household waste dominates the total waste generation in Dili (231.9 tons), with plastic contributing a significant portion. Waste separation at the source remains highly ineffective, as evidenced by the prevailing public behavior of indiscriminate waste disposal. The primary bottlenecks include a lack of awareness, insufficient public outreach, and the absence of formal integration for informal sectors such as scavengers and waste banks. However, there is notable potential in converting organic waste into electrical energy (estimated at 0.06 MW from methane emissions) and transforming inorganic waste into paving blocks.

Keywords

Plastic Waste Management, Recycling, Reverse Logistics, Dili, Timor-Leste

Biographies

Ermelinda Sofiana da Silva Andrade is a graduate student in the Master of Infrastructure and Environmental Engineering Program at Warmadewa University, Denpasar, Bali, Indonesia. With a strong academic background and a deep commitment to addressing environmental challenges in developing regions, she focuses her studies on sustainable waste management systems, environmental engineering practices, and the development of green infrastructure. Originally from Timor-Leste, Ermelinda brings valuable contextual insight into the unique environmental and infrastructural issues faced by emerging economies. Her academic journey reflects a dedication to finding practical, community-oriented solutions for pressing problems such as urban waste, plastic pollution, and the

impacts of rapid urbanization. In her recent research, she has examined plastic waste management systems in Dili, with particular emphasis on reverse logistics and the role of informal sectors in recycling practices.

Putu Ika Wahyuni is a lecturer in the Master of Infrastructure and Environmental Engineering program at Warmadewa University, Indonesia focusing on construction management and environmental studies. She has several important works and publications, including “A Study of Rainfall Thresholds for Landslides in Badung Regency Using Satellite-Derived Rainfall Grid Datasets,” published in the International Journal of Advances in Applied Sciences. Additionally, she authored “Risk Analysis on the Use of Heavy Equipment with the HIRARC Method,” included in the AIP Conference Proceedings, as well as “Performance of High-Resolution Satellite Rainfall Datasets in Developing Rainfall-Duration Thresholds for Landslide Incidents Over Badung Regency,” published in the IOP Conference Series: Earth and Environmental Science. With her extensive experience and research, Putu Ika Wahyuni significantly contributes to the advancement of knowledge in the fields of construction and the environment.

I Putu Ellsa Sarassantika is a lecturer and researcher in the field of civil and structural engineering at the Department of Civil Engineering, Warmadewa University, Denpasar, Bali, Indonesia. He is currently pursuing his doctoral studies in structural engineering at National Central University, Taiwan, where his research focuses on seismic evaluation, structural retrofitting, and advanced modeling of reinforced concrete systems. With a strong academic background and professional experience, he is actively involved in applied research that addresses the structural integrity and resilience of buildings in earthquake-prone regions, particularly in Southeast Asia. Beyond academia, he is dedicated to mentoring students and fostering interdisciplinary collaboration in civil infrastructure development. Through his contributions in both education and research, he continues to advance knowledge in structural engineering and contribute to the sustainable development of resilient infrastructure in Indonesia.