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Boosting Public-Private Partnership for sustainable Waste Management in Metro City

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ABSTRACT
This paper discusses the urban waste management issues that many cities in developing countries face. Waste that is not properly managed has an impact on the quality of human health and the environment. This study takes a case study approach, with data collected through in-depth interviews, observation, and documentation. This case study was conducted in Metro City, an Adipura-winning city with waste management issues. Because the government has limited resources for waste management, involving the private sector and civil society is a viable option, according to the research findings. Waste management necessitates the collaboration of many parties, each with their own set of responsibilities, such as the government's regulatory and facilitation functions. Meanwhile, the private sector is split into two sections: waste management and waste management as a sponsor or donor. Furthermore, to strengthen partnerships between the regional government, the private sector, and the community through socialization and the implementation of the Waste Bank as a model for managing waste sourced from the market in order to improve waste management and achieve sustainable development...

Keywords: *Public-Private Partnership, Waste Bank, Sustainable Development*

1. INTRODUCTION

Increased trash production has a severe influence on the environment and human health, which is a global issue, particularly in emerging nations with inadequate technology and resources [1]. As a result of trash garbage, environmental contamination is becoming more of a concern [2] to protect the environment. Many researchers have undertaken efforts to decrease and manage waste, such as acquiring organic waste programs, processing garbage into compost or biogas, recycling sections of waste, and transforming waste into new energy [3]. Additionally, scavengers are involved in the rubbish collection procedure. Meanwhile, the problem of waste-related pollution in the ecosystem remains unsolved [3]. As a result, to effectively manage waste control efforts, numerous stakeholders (local governments, private parties, individuals, communities, and non-governmental organizations) must be involved [4]. A similar sentiment was echoed by [2], who stated that successful waste management depends on human resources, the environment, social, financial, technological, and technical knowledge, and public awareness and participation in environmental sustainability.

This research aims to explore waste management partnership prospects amongst various stakeholders in the city of Metro, which is located in the Indonesian province of Lampung. Metro City is one of Lampung's cities, with an astronomical location of 5°6' to 5°8' south latitude and 105°17' to 105°19' east longitude. Metro City is only 68.74 km2 in size and is located in the heart of Lampung Province. Metro City is bordered on the north and west by Central Lampung Regency and the north, south, and east by East Lampung Regency. Metro City has an alluvial plain as its terrain. This location has

an altitude of 50 to 55 meters above sea level and a slope of 00 to 30 degrees.

2. WASTE PROCESSING TECHNOLOGY

2.1. 4Rs Method

Implementing the 4Rs approach can help reduce waste generated at the source. Proper waste management can help to prevent pollution in the environment. Waste reduction can be accomplished through the application of the four R's, namely Reduce, Reuse, Recycle, and Replace [2], [3], [5], [6]. Meanwhile, waste management can be accomplished by sorting, collection, transportation, processing, and ultimate processing.

2.2 Integrated Waste Management Through RDF and PLTSa

Refused Derived Fuels (RDF) is a waste management strategy that converts garbage to fuel. RDF can minimize waste and become a co-firing fuel for industry and power plants by converting waste to fuel. While waste power plants(PTSD) is a method of transforming municipal waste into electrical energy [2], [4], [6]–[8], PTSD is capable of reducing waste by up to 80% in weight or 90% in volume.

2.3 Method of the Black Soldier Fly (BSF)

Bioconversion using bioconversion agents, specifically Black Soldier Fly (BSF) larvae or commonly referred to as maggots, was able to reduce organic waste by around 50% -70 % of total waste. As a bioconversion agent, there are at least three products that can be obtained with promising business opportunities, specifically by empowering BSF larvae as a bioconversion agent. The first product is larvae or pre-pupae BSF, which can be utilized as a source of protein in animal feed. The second product is a liquid coming from larval activity that acts as a liquid fertilizer. The third product is dry organic waste residue [9]–[13].

3. PUBLIC-PRIVATE PARTNERSHIP

Many scholars and practitioners have characterized public-private partnerships (PPPs) using diverse ways [5,6], and research has been conducted to evaluate the main success elements in their implementation [16]. PPP is defined as a contractual arrangement between the Government and the private sector in turning over some control over goods and services provided by the public sector [17]. Meanwhile, PPP features such as long-term contracts between the Government and the private sector or business persons, risk sharing, government backing, and investment returns can be discovered [18]. According to research [19], public-private partnerships (PPPs) are the best tool for achieving sustainable development if they are appropriately managed. The extent to which all stakeholders carry out their responsibilities is also critical to the success of any public-private cooperation [17]. As a result, the concepts of agreement and understanding between the partnering parties can improve the public-private partnership model [20].

4. MATERIAL AND METHODS

This study employs a case study research design using interview and observation methodologies for data collecting from April to August 2021. To collect circumstances and an overview of existing sources of trash to final disposal, interviews were held with the Government, in this case, the metro city's environmental agency, the community, and waste transport personnel. Interviews with waste bank managers, who act as third parties in purchasing and selling sorted garbage, were also undertaken. In order to supplement the findings of the interviewees, observations were made at different landfills, ultimate disposal locations, and waste banks.

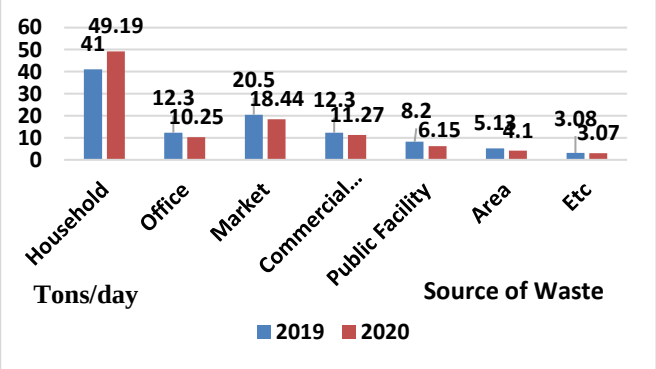

Figure 1 Total Waste Generation Based on Waste Sources in 2019 and 2020

According to Figure 1, the waste created decreased from 102.51 tons/day in 2019 to 102.47 tons/day in 2020. As a result, trash creation is reduced by 0.04 tons per day.

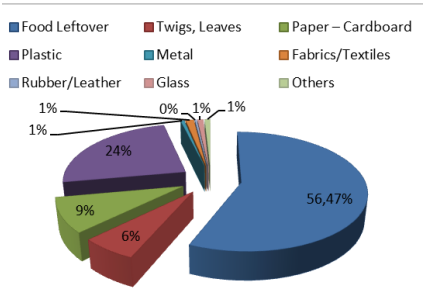

Figure 2 Composition of Waste by Material in 2019

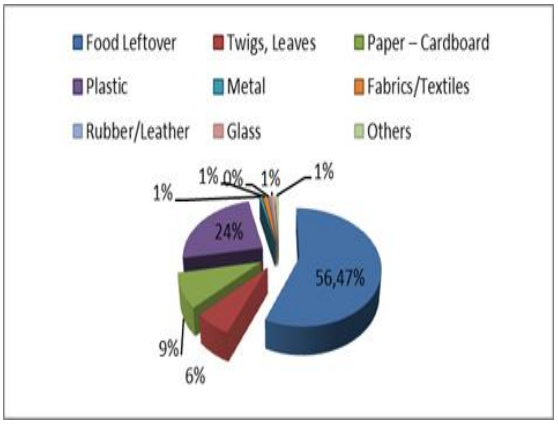

Figure 3 Composition of Waste by Material in 2020

Figures 2 and 3 reveals that food waste makes up the most considerable percentage of trash in 2019 and 2020, with a value of 56.47 percent. As a result, Metro City's waste stream is primarily comprised of food waste.

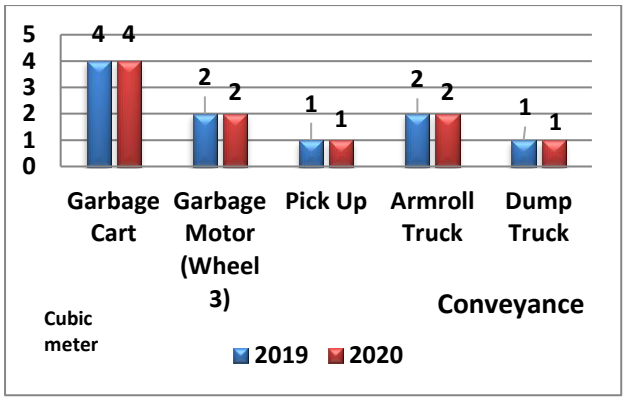

Figure 4 Facilities and Infrastructure Capacity in 2019 and 2020

According to figure 4, the most commonly utilized facilities and infrastructure in transportation equipment in 2019 and 2020 are garbage motorcycles (wheel 3) and dump trucks. According to the material for the districts/cities in 2019-2020, the waste with the highest composition is food waste. In 2019-2020, garbage generation fell by 0.04 tons per day. Garbage motorbikes and dump trucks were the most commonly used waste management infrastructure in 2019-2020. Metro City has 9 TPS (Trash Disposal Sites) located at City Terminal, Tejoagung Market, Margorejo Market, Ganjar Agung Market, Perum Prahsanti, Yosomulyo Residential, West Hadimulyo Village, East Hadimulyo Village, and Mega Mall Market, with one TPA (Final Disposal Site) located in Karangrejo Village. In 2019, the Metro City TPA/TPST managed 27,375.00 tons of garbage, while in 2020, it managed 24,692.25 tons. From 2019 to 2020, the TPA will receive 2,682.97 tons less garbage.

4.1 Waste Bank In Metro City

Metro Government can carry approximately 80 tons of garbage each day, which means that the waste in the Karangrejo final disposal site (TPA) will reach a height of approximately 7-10 meters with a yard area of approximately 5 hectares. Metro City collects garbage using bentor vehicles in each Ward, totaling 14 units and 20 containers, and 16 trucks. Containers are scattered throughout many housing developments and markets, including the city, integrated, Margo Rejo, and hospitals. Additionally, Metro City has two SOKLI (Waste Transporting program in the local area) units in Hadimulyo Village, one Prasanti unit, and one Imopuro unit. Metro City additionally contains four TP3R units located in the Yosorejo neighborhood, one Compost House unit, and two damaged units repurposed.

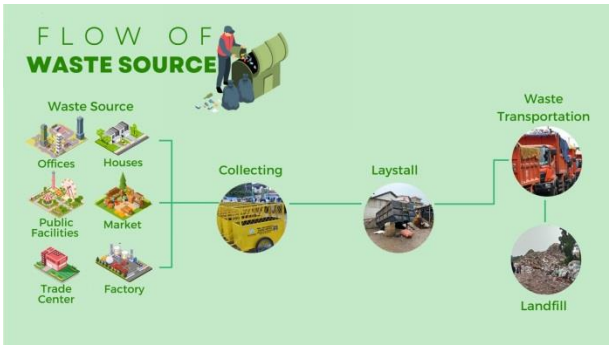

Figure 5 Flow of waste source

Individuals in Metro City manage waste through Waste Banks with aid from the Metro City government, State Electricity Company, Lampung Bank, University of Muhammadiyah Metro, and the Department of Environment. The help is not monetary but in waste management instruments, such as enumerators from PLN and Bank Lampung. This Garbage Bank may employ scavengers, and the community wishes to sell waste such as plastic that is still usable as plastic ware. Scavengers also earn a substantial amount of money, roughly $3-4.5 million per month.

Metro City has three active garbage banks in the Tejo Agung, Purwosari, and Karang Rejo districts. Wijaya Kusuma Garbage Bank in Tejo Agung is the largest waste bank in Metro City, having been operational since 2013 and generating approximately $20-30 million in monthly revenue.

5. FINDINGS AND DISCUSSION

Regulation 14 of 2021 of the Minister of Environment and Forestry requires the central Government, regional governments, and the community to manage waste in waste banks comprehensively and efficiently from upstream to downstream using a circular economy approach [21]. Regulation No. 14 of 2021 on Waste Management in Waste Banks defines waste as the solid residue of everyday human activities and natural processes. Trash management is the

systematic, comprehensive, and long-term reduction of waste.

5.1. Waste Bank is an innovative waste management system.

The waste bank program is a community-based dry waste management method that encourages active participation. This method collects, sorts, and distributes garbage with economic value to the Market, allowing the community to profit economically from waste reduction. The garbage bin is one of the waste management solutions as well as an economic driver, as the waste bank's plan for activities contributes to the realization of a circular economy in Indonesia, both through the sale of segregated waste and then through the waste that is converted into finished goods products worth selling.

The Waste Bank is a community-based dry waste management system that invites active participation. This system will collect, sort, and distribute waste with economic value to the Market, allowing the community to profit from waste reduction. Meanwhile, according to the Minister of Environment's Regulation No. 13 of 2012, a trash bank is a location for sorting and collecting waste that can be recycled and reused and has economic worth.

The waste bank is one of the community-level techniques for applying the 3Rs (reduce, reuse, and recycle) in waste management. In concept, establishing a trash bank is a form of social engineering designed to encourage individuals to sort their waste. By swapping garbage for money or other valuable commodities, When people are informed about the value of waste, they desire to sort rubbish.

5.2. Objectives, Benefits, and Strategies for a Waste Bank

The waste bank's mission is to assist in trash processing in Indonesia, educate people about the need for a healthy, neat, and clean environment, and recycle waste into something more valuable in society for crafts and other purposes. In other words, the trash bank is an attempt to empower the community in terms of garbage management or processing and environmental stewardship.

Garbage banks are a tactic for increasing public awareness and encouraging people to become friends with rubbish to reap direct economic benefits. Thus, waste banks cannot exist in isolation but must be integrated into the 3R movement to ensure that the immediate benefits are economical and contribute to creating a clean, green, and healthy environment. Garbage banks can also be used to help cities maintain clean and comfortable neighborhoods for their residents. Residents who follow this routine practice waste management discipline and earn additional revenue from the garbage they collect.

Indirectly, trash banks contribute to mitigating the effects of climate change. As is generally known, garbage contributes to the increase in greenhouse gas emissions in the atmosphere and other human activities such as energy production, forestry, agriculture, and animal husbandry.

5.3. Promoting Waste Bank for market waste from Market

Figure 6 Bank waste in Flow of waste source

A waste bank is a facility built and administered by a community, business, or local Government to manage waste following the 3R concept (Reduce, reuse, and recycle).

6. CONCLUSION

Waste management needs collaboration between numerous parties and a clear division of their separate responsibilities, such as the Government's regulatory and facilitation functions. Meanwhile, the private sector is separated into two segments: those engaged in private waste management and those involved in waste management as a funder or donor. Finally, but certainly not least, the community's involvement in promoting ecologically conscious and literate waste management behavior. The waste bank is a novel concept that plays a critical function in waste management. Unfortunately, Metro City's waste bank focuses exclusively on dry waste management; no one is concerned about wet waste management. Furthermore, thus far, Metro City's waste bank has been utilized exclusively to manage domestic waste. Due to the large volume of garbage generated by traditional markets, waste banks must also manage waste generated by these traditional marketplaces.

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