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Developing Community-Based Solid Waste Management (CBSWM) Model: Case of West Nusa Tenggara, Indonesia

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Abstract

The second largest food waste and plastic waste producer in the sea, Indonesia is faced with serious challenges when it comes to waste management. Nusa Tenggara Barat (NTB) is a province in Indonesia that urgently prioritizes waste management. Community-Based Solid Waste Management (CBSWM), a solid waste management system with many proven benefits, is popularly used in many developing countries including Indonesia. Aimed at developing the CBSWM model in NTB, this study was conducted by collecting the primary data through the FGD process as well as the secondary data. This study found that although the local communities had the motivation and willingness to manage their solid waste, they had limited knowledge and skills. The CBSWM model is expected to accelerate the solid waste management activities in NTB.

Keywords
community-based solid waste management; solid waste management; community participation

I. Introduction

The second largest food waste producer and the second largest ocean plastic waste producer, Indonesia is undoubtedly faced with a complicated waste issue (Bisara, 2017; Satria, 2018). This relentless issue begins from the production of waste itself until the disposal of such waste. A few issues, of which have also caught the worldwide attention, faced by Indonesia are the overwhelming plastic waste and the overcapacity of the Bantar Gebang Integrated Waste Management (TPST Bantar Gebang) (Warsono, 2020).

Mahyudin (2014) believed that the cause of the solid waste management issue was community mindset and paradigm. This corresponds with the results of other studies which state that environmental awareness and motivation is crucial in maintaining a good waste management system (Alavi Moghadam et al., 2009; Marshall & Farahbakhsh, 2013; Vitasurya, 2014). Furthermore, one common cause of the waste issue in developing countries is the lack of proper facilities/infrastructures (Nurkomalasari, 2014; Van de Klundert & Anschutz, 2001). The availability of proper facilities and infrastructures determines the sustainability of a solid waste management system (Utami et al., 2008).

Community-Based Solid Waste Management (CBSWM) is a system that requires an active involvement of the community in managing solid waste. The community here refers to households, community-based organizations, and micro- and small-enterprises which have genuine concerns over the solid waste issue (Muller et al., 2001). This is a bottom-up approach where in the process of implementation an activity in a certain location, the local community plays an active role in identifying problems, making decisions, and designing solutions for the identified problems (World Health Organization, 2002).

There are many benefits in CBSWM system as it is more flexible, informal and economical (Van de Klundert & Anschutz, 2001) and the community will benefit from

implementing community-based solid waste management. In her study in Sleman and South Jakarta, Utami et al. (2008) found that community-based solid waste management successfully reduced more than 50% of the total waste, reduced more than 20% of the cost, and improved relationship among all parties involved in the system. In addition, the CBSWM approach was also good for areas which were out of the government/organization's reach (Van de Klundert & Anschutz, 2001) since it had more autonomy and therefore, suited Indonesia's geographical landscape with remote islands and isolated areas. The CBSWM concept was done applied in many developing countries such as Thailand (Mongkolnchaiarunya, 2005) and Vietnam (Richardson, 2003).

CBSWM has also flourished in Indonesia (Firmansyah et al., 2016; Nurkomalasari, 2014; Putri et al., 2012; Setiadi, 2015; Utami et al., 2008). The community involvement in solid waste management may lead to independent solid waste management. Putri et al. (2012), who focused her research in Seminyak Bali Traditional Community, shows that this bottom-up approach led to more than 70% community participation in solid waste management activities. Vitasurya (2014) mentioned that this system played an important role in the management and preservation of tourism spots in Pentingsari Village, Yogyakarta. She also developed a solid waste management model by dividing waste management into three important stages: separation, management, and use. In other areas, the local community also independently initiated a waste mitigation program such as Paguyuban Masyarakat Bukit Kencana Jaya (Pagarwaja) in Semarang (Sekito et al., 2013).

Nusa Tenggara Barat (NTB) is a province in Indonesia that prioritizes on the improvement of the provincial solid waste management system. This can be seen from its current government program which is to become a zero waste province (Pemerintah Provinsi NTB, 2019). A good solid waste management system gives positive effects not only on environmental preservation and public health (World Health Organization, 2002), but also economic values for the community. NTB has one out of the 15 Special Economy Zone (Kawasan Ekonomi KhususKEK) in Indonesia (Dewan Nasional KEK, 2021), which is KEK Mandalika. Mandalika is expected to become the leading tourist destination in NTB and it is predicted that that development of KEK leads to the increase of the number of holidaymakers to the area. CBSWM, therefore, is expected to help preserve the area, to help the community benefit from the empowerment of their capacity and to help the community benefit economically from the use and sale of the waste products. Considering these benefits and the characteristics of CBSWM, this study aimed at developing a community-based solid waste management model in NTB and analyzing the roles of the stakeholders involved in the CBSWM process.

II. Review of Literature

2.1 Community-based Solid Waste Management (CBSWM)

The Community-Based Solid Waste Management (CBSWM) involves an active participation of the community in managing solid waste. The community here refers to groups of households, community-based organizations, and micro- and small-enterprises which have genuine concerns over the waste issue (Muller et al., 2001). The CBSWM concept is done applied in many developing countries such as Thailand (Mongkolnchaiarunya, 2005) and Vietnam (Richardson, 2003). In this system, the solid waste management requires more involvement of the informal sector and is suitable for communities with high social capital such as those in Indonesia (Yulaika, 2018). Also, this approach is also good for areas which are out of the government/organization's reach (Van de

Klundert & Anschutz, 2001) since it has more autonomy and therefore, suits Indonesia's geographical landscape with remote islands and isolated areas.

2.2 CBSWM in Indonesia

In Indonesia, the involvement of the community in solid waste management are varied. A few of the CBSWM systems that have been implemented in Indonesia have been managed by Waste Banks or Community-based Organizations (CBO), traditional communities and individual initiatives. The process and the types of solid waste management are also varied. For example, most recycling CBSWM centers directly sell the solid waste which have gone through the process of separation while others upcycle the waste into saleable products (Raharjo et al., 2015; Vitasurya, 2014).

The studies conducted by Raharjo et al. (2015) and Firmansyah et al. (2016) both discuss CBSWM's Waste Banks. Raharjo et al. (2015), who used Padang in West Sumatera as the location of his study, found that the recycling activities were mostly done by the informal sector. The Waste Bank system were able to reduce the volume of the waste and increase the amount of recycled materials. One benefit of this system was that it allowed the community to "save waste" and to earn money by separating their solid waste.

Sekito et al. (2013), who used Semarang in Central Java as the sample of his study, discusses CBSWM managed by a CBO namely Paguyuban Masyarakat Bukit Kencana Jaya (Pagarwaja) which were also discussed by Vitasurya (2014). Sekito et al. (2013) found that this CBSWM divided the solid waste into three categories: organic, non-organic and hazardous waste. Pagarwaja, as the CBO, then collected and sold the organic and non-organic waste which have gone through the separation process done by the households to plant sellers or recycling businesses. The hazardous waste, meanwhile, was disposed to the final disposal. The CBO then used the profits earned from the sale for the operational costs of the system.

Utami et al. (2008) in her study in Sleman and South Jakarta compared CBSWM initiated by the local residents in all stages of the solid waste management process: separation, treatment, collection, transport, and disposal and found several differences between the two cities. First, the actors behind CBSWM were different. In Sleman, the main actors were the garbage collectors while in South Jakarta, they were households, garbage collectors, and the regional government. The composition of organic waste was also different: 67% in Sleman and 55.4% in South Jakarta. The remaining was the an-organic waste. However, there is a similarity between the two cities: both turned most organic waste into compost.

Furthermore, Vitasurya (2014) explained that CBSWM done by a group of local residents namely Pentingsari Tourism Waste Manager (Pengelola Sampah Wisata Pentingsari/Sawitri) in Pentingsari Village, Yogyakarta. The CBSWM model applied in this village aimed at not only preserve the environment but also luring tourists and becoming a part of tourist attraction.

For the result of her study, Utami et al. (2008) found that the community-based solid waste management was able to reduce more than 50% of the total solid waste, to reduce more than 20% of the operational cost and to improve relationship among the parties in the system. There was also a positive change in the behavior of the community who participated in CBSWM. The habits of burning and littering decreased significantly (Raharjo et al., 2015; Sekito et al., 2013). According to Raharjo et al. (2015), CBSWM could also be integrated in the local solid management by improving the technical design, organization, and several non-technical aspects and hence, the solid waste management system becomes more effective and efficient.

The following is the comparison of the CBSWM framework done in several regions in Indonesia.

Table 1. The Comparison of CBSWM Framework in Various Regions in Indonesia

Author / Observed Variables	Raharjo et al. (2015)	Sekito et al. (2013)	Utami et al (2008)	Vitasurya (2014)
Location	Padang (West Sumatra)	Semarang (Central Java)	Sleman (Yogyakarta) and South Jakarta (DKI Jakarta)	Pentingsari (Yogyakarta)
Solid waste management Process	Separation, Collection, Transportation, Recycling and Compost, Disposal	Separation, Recycling and Compost, Transportation, Sale	Separation, Treatment, Collection, Transfer Transportation, Disposal	Separation, Management, Use
Initiator of CBSWM Activities	Not mentioned	BINTARI (Non-governmental organization/NGO)	Individual	Wisata Pentingsari Solid waste management Group/Sawitri (CBO)
The Main Actor in Solid waste management	Waste Bank	Paguyuban Masyarakat Bukit Kencana Jaya/Pagarwaja (CBO)	Households, Garbage Collectors and Regional Governments	Sawitri (CBO), Village-Guided University Students
Types of Waste	Organic and An-organic	Organic, An-organic, Hazardous Waste	Organic and An-organic	Organic and An-organic

III. Research Methods

This study used a qualitative approach for the methodology. The primary data are collected using Participatory Rural Appraisal (PRA) approach where a Focus Group Discussion (FGD) are conducted with the community in Lingsar District in West Lombok. The Lingsar District was chosen as the location of the study since it had already had an organic waste management program (Pemerintah Provinsi NTB, 2020) and is one of the provincial strategic regions as mentioned in the Governor Regulation No. 14 Year 2020 on the Policies and Strategies of Household and Similar Waste Management Region (Jakstrada) of NTB Province. The total participants of the FGD are 34 participants (25 males and 9 females). The FGD group was divided into 4 groups, which are consist of farmer group (8

participants), entrepreneur group (9 participants), youth group (9 participants) and housewife group (8 participants). The group are chosen based on the job classification in the area. The aspects inquired from the participants of FDG included the knowledge, motivation, and willingness to do solid waste management.

To compliment the primary data, this study also collected secondary data from various sources such as The Environment and Public Hygiene Regional of Office (DISLHK) of NTB Provincial Government and conducted a literature review of previous studies related to community-based solid waste management.

IV. Discussion

4.1 Results

a. The Result of *Focus Group Discussion* (FGD)

The FGD with the local community resulted in a few important points:

- Albeit limited, the community had the knowledge on the negative impacts of unmanaged waste. This knowledge, however, was not accompanied with the environmental awareness or concrete actions seen from their habits of burning their garbage and disposing them in public places such as on the sides of the streets, on riverbanks, or directly into the rivers.
- The lack of proper facilities and infrastructures worsened this open dumping practice.
- The people in the community stated that they had the motivation to manage their solid waste better but felt that they did not have the availability and enough knowledge to do it. They were interested in participating in activities that would give them the knowledge and skills in solid waste management especially the skills to recycle the solid waste that would give them an additional income/an added value to the solid waste.
- For household-scale solid waste management, mostly women played an important role in separating, disposing, and transporting recycled waste to the Waste Banks.

b. The Result of Secondary Data

According to DISLHK NTB (2019), the estimation of the waste occurrence in NTB province in year 2013 – 2018 is as follows:

Table 2. The Estimated amount of Waste in NTB Province

Year	The estimated amount of waste (ton/day)
2015	1579.3
2016	1600.31
2017	1619.93
2018	1639.1

According to DISLHK NTB (2020) data, the number of Waste Bank under the guidance of NTB Province in 2018 is 54 groups with the following distribution:

Table 3. The Number of Waste Banks under the Guidance of NTB Province in 2018

Regencies/Cities	The Number of Waste Bank
Mataram City	3
West Lombok	16
Central Lombok	13
East Lombok	17
North Lombok	5
Total	**54**

In term of regulations, NTB Provincial government had issued Governor Regulation No. 14 Year 2020 that regulates the regional policies and strategies in solid waste management for Year 2020-2025. Programs included in this regulation which are relevant to this study are:

- The Regional Government has the budget in waste reduction whose amount is adjusted to the planning and affordability of the regional finance.
- The implementation of training of trainer for waste reduction.
- The formation and expansion of provincial waste bank operational data and TPS3R network which will be integrated with the Environment Information System (*Sistem Informasi Lingkungan Hidup/SILH*) in NTB Province.
- The promotion of community-based waste recycling and reusing activities.
- Community education through mobile libraries, training for Family Welfare Empowerment Groups (PKK), and education centers.
- Determination of monitoring and evaluation system in solid waste management activities.
- The campaigns for community's willingness to pay for the solid waste management service fee.
- The strengthening of the community/group capacity in solid waste management.

4.2 Discussion

The result of this study indicates that even though most members of the community had the knowledge on the negative impacts of poor solid waste management, they had not applied this knowledge in their daily life. Most still conducted incorrect solid waste management practices such as burning their garbage and *open dumping* in public places. Most believed that this happened not because they wanted to but because they did not have the option since there were no proper and accessible facilities and infrastructures. Fortunately, most were willing to participate the solid waste management activities. Therefore, the Regional Government had to provide the much needed facilities and infrastructures and to create coaching programs and/or trainings/workshops in increasing the community awareness and knowledge in the correct ways to manage their waste. Waste management system that is not in accordance with the technical standards is due to the system of waste management that hasnot functioned optimally and the lack of concern of residents in waste management is one of the causes of the system has not run well (Tobing, 2021). The waste was significantly influenced by the socio-demographic characteristics of the households such as gender, age, income and residency (Huho, 2020).

The FGD also found that women played an important role in managing household-scale waste since they were the ones who separated, treated, and disposed the solid waste. This is consistent with the result of the study from GA Circular (2019) which also found that women played a role in making household expenditure and daily solid waste management decisions. They also had more interest in learning about the solid waste management system. The men, on the other hand, were more interested in activities which required more physical power such as in doing the solid waste management with the help of machinery and transporting the waste with vehicles. Men were also more keen on more formal solid waste management works (GA Circular, 2019). Therefore, to optimize the gender roles in CBSWM, the government needs to create tailored training/workshops which may accommodate these different needs.

In terms of regulation, NTB Provincial Government had prepared a complete guidance in the Governor Regulation No.14 Year 2020 on *Jakstrada Persampahan* NTB 2020 – 2025. This regulation includes the obligation to provide the budget for regional solid waste management, implementation system, and the planning for solid waste management integration. To accelerate these programs, NTB Provincial Government needs to accompany them with strong law enforcement.

On the other hand, according to the data from DISLHK (2020), there are many waste banks found in this province. The number of Waste Banks under the guidance of NTB Provincial Government in 2013 – 2017 was 99 Waste Banks and in 2018, there were 54 Waste Banks. The government could use these waste banks as driver agents which play the role of CBOs such as the CBSWM model proposed by Raharjo (2015). Therefore, these Waste Banks could implement and improve a large scale of solid waste management system in NTB. The government could also create a mapping and accelerate knowledge exchange where Waste Banks could share their experiences in solving problems in their own areas. Tschirhart et al. (2016) stated that the local community was more receptive to information and solutions given by other local communities.

Furthermore, the identification and the division of roles of all stakeholders involved in the CBSWM process is also crucial. Darwati & Anggraini (2012) conducted a study to explain the division of stakeholders' roles in the solid waste management in Probolinggo and found that there were three stakeholders: the community, the community organizations (CBOs), and the Government. Van de Klundert & Anschutz (2001) mentioned that the identification of this roles was important as basic information in deciding how a solid waste management system could become better and more integrated. Therefore, a CBSWM model with a clear division of roles among its stakeholders involved was needed.

The role of the government is important in the implementation of a good solid waste management system. Based on Jati (2013), the government played a role in supporting CBSWM process which is as the service provider or the provider of the required facilities and infrastructures. The facilities and infrastructures can be in the form of solid waste management locations, training and workshop organizer, and monitoring and evaluation. This is because the majority of the community do not have the financial capacity to provide these facilities and infrastructures.

CBO also plays an important as the driver and executer of the CBSWM process (Suryani, 2014). CBO had to decide on the suitable system that can be done by the local community starting from the solid waste reduction, separation, treatment, and use. Each process had to suit the conditions of the local community including the resources and the capability and suit the types of solid waste and the main activities of the residents. In executing this role, CBO needs the support and cooperation of the locals. Anschutz (1996) stated that one of the causes of CBSWM's failure is the lack of active participation from the

community. Therefore, the active role of the community becomes important so that the established CBSWM system may run smoothly and sustainably.

Moreover, for increase effectiveness and efficiency in CBSWM process established by the CBO and community, the government may integrate this system with the regional- and provincial-level solid waste management system. According to Raharjo et al. (2015), this can be done by improving the technical design, organizational design, and several non-technical aspects. With the integration, CBSWM system may run according to the system implemented by the government either from the solid waste management system side or regional/provincial economic growth agenda side.

Based on the previous analysis, the following the proposed solid waste management model:

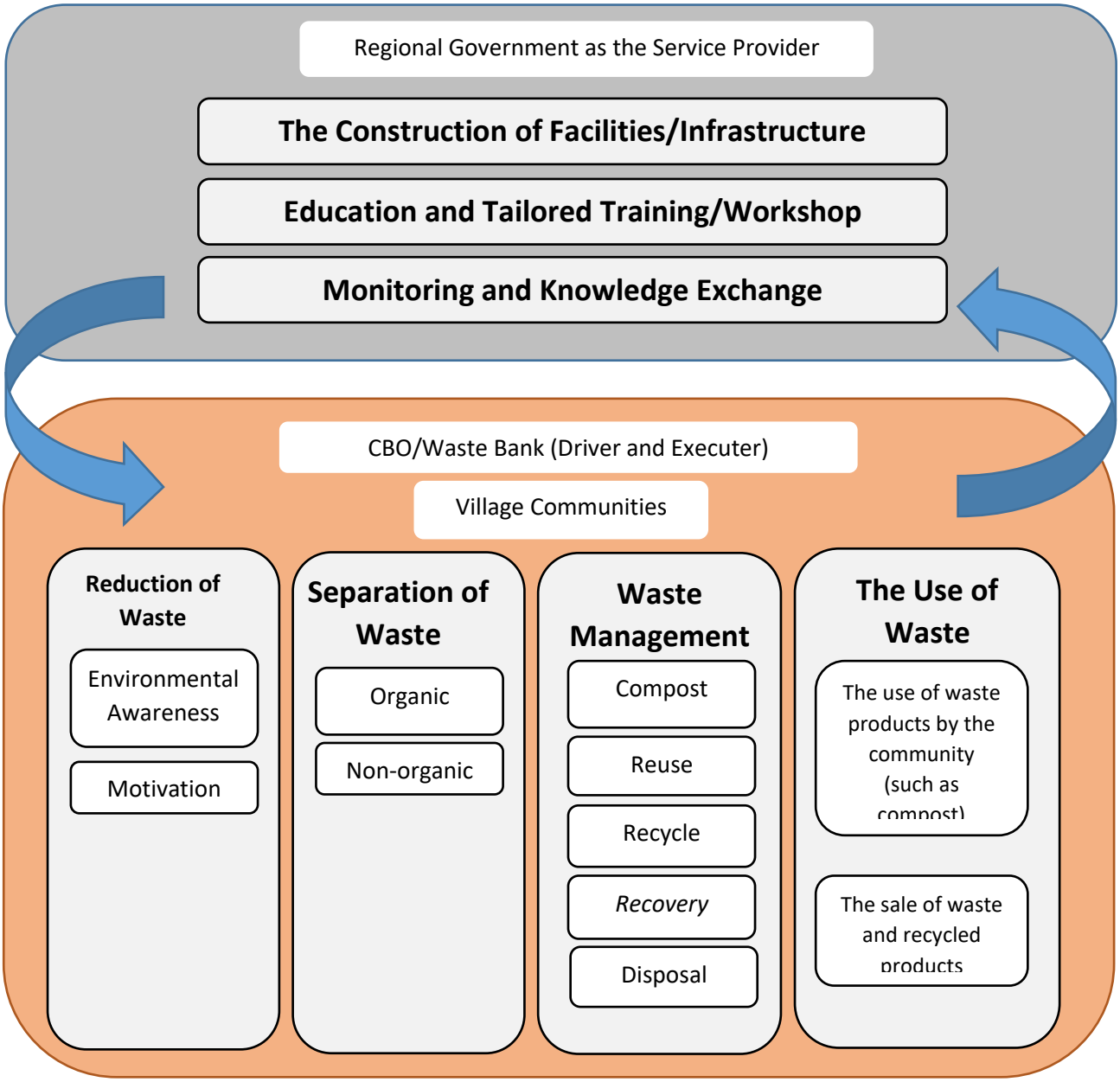

Figure 1. *The Proposal for Community-Based Solid Waste Management Scheme*
Source: The Research Analysis and Adaptation of Solid Waste Management Model by Vitasurya (2014)

The Community-Based Solid Waste Management (CBSWM) program increases participation, reduces the costs of transportation and treatment, and creates a good relationship among its stakeholders. This program divides roles for its main stakeholders: first is the CBOs such as community organizations, *Paguyuban* (community groups), and the Waste Banks which become the driver and the executer of the system. Second is the local community which plays an active role in supporting the system. Last is the Government that facilitates the solid waste management system by providing not only the facilities and the infrastructure but also the trainings/workshops for the soft skills such knowledge and capacity building for the community. This division of roles is important to create synergy among the stakeholders.

V. Conclusion

The result of the primary and secondary data analysis concluded that:

- The community had the motivation and willingness to manage their solid waste, but their knowledge and skills were currently limited. Also, they needed the support of the Regional Government to provide the required facilities and infrastructures.
- Women played a bigger role in the household solid waste management process which are the separation, management, and disposal of the waste while the men dominated on more physical activities. Therefore, tailored trainings/workshops to accommodate these different needs and skills are needed in the solid waste management system.
- The Regional Government regulation on solid waste management had been prepared well, but bigger law enforcement is needed to accelerate the improvement of the solid waste management system.
- Since there are plenty of Waste Bank spread across NTB, the knowledge exchange activities can be implemented by the local community to help solve the problems and accelerate the solid waste management activities.
- The division of roles in CBSWM is important so that each party understands their roles clearly and so that the solid waste management system may run smoothly and sustainably.
- To improve the effectiveness and efficiency of the CBSWM process, the Government should integrate the solid waste management system at the regional and provincial level by improving the technical and non-technical designs as well as the organizational design.

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