

The Role of Stakeholder in Municipal Solid Waste Management: A review

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Abstract: Municipal waste is still a big problem in Indonesia. Generally, the largest waste composition is dominated by organic waste, followed by plastic waste, and so on. Previous studies conducted in Salatiga Municipality show that cooperation between stakeholders, both from the formal and informal sectors, is needed in managing municipal waste. This paper will explore the extent of the role of stakeholders in waste management in Indonesia and the successful good practices in handling urban waste, aiming for actor identification, mapping, and opportunity for a collaboration. This research is library research carried out by collecting literature using several search engines, namely the Directory of Open Access Journals (DOAJ) and Research Gate. Data related to the role of stakeholders was collected over the last ten years. This study found several stakeholders who play an important role in city waste management, especially from the Integrated Sustainable Waste Management (ISWM) perspective. The role of each stakeholder is explained in this research, but what is more important is to develop collaboration among stakeholders to realize ISWM in the city waste management.

Keywords: *formal sector, informal sector, Integrated Sustainable Waste Management, stakeholder, synergistic collaboration*

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1. Introduction

The issue of waste is a problem at the global and national levels, as it is always produced by human activities wherever it is located. Globally, high-income countries produce 85 million tons/year of waste with the largest waste composition is paper (36%), while middle-income countries produce 34 million tons/year of waste with the largest waste composition is organic waste of about 58%. (Memon, 2019). The projection is that in 2025, middle-income countries will produce 111 million tons of waste with the composition of organic waste remaining the largest, i.e., about 50% (Memon, 2019). In Indonesia, there was 36,190,195 tons/year of waste generated in 2022, by around 64% of waste being managed or equal to 23,164,382 tons/year. When compared to the previous year, there was a reduction in waste of 5,385,995 tons/year or equal to 14.88%. According to the waste composition, food waste occupies the highest portion, for around 40.3%, and the waste is mainly discharged by households which occupies 38.3% of all waste producers. For the record, this data was collected from 310 districts/cities in Indonesia (Indonesian Ministry of Environment & Forestry, 2023).

The Integrated Solid Waste Management is a waste management model that covers all sources and all aspects, from waste production to final disposal (Memon, 2019). According to Guererro et al. (2013) ISWM involves three aspects, namely (1) the role of stakeholders; (2) waste disposal flow from the source to final disposal; and (3) analysis or monitoring system. Meanwhile, in preparing the ISWM plan, Memon (2019) believes that three aspects are required, they are (1) regulations, (2) technology, and (3) participation. Even though they do not explicitly state the role of stakeholders, these three aspects require the involvement of stakeholders in drafting and enforcing regulations, creating innovation, and encouraging participation in integrated waste management.

The author's previous study identified and explained the roles of stakeholders involved in plastic waste management in Salatiga (Septiani et al., 2019). The study was conducted by qualitative method using observation and in minimum around 40 minutes person to person in-depth interview to eleven informants representing a retailer or *pengepul*, three waste scavengers or *pemulung*, three plastic users, a waste bank staff representative, an informant from Final Processing Site or Tempat Pembuangan Akhir (TPA), and a staff of Environmental Services Agency of Salatiga Municipality (Septiani et al., 2019). The results of this research found at least several stakeholders involved in plastic waste management, i.e., (1) households; (2) scavengers; (3) waste bank; and (4) government. However, this study cannot explain to the extent the role of stakeholders in reducing plastic waste generation (Septiani et al., 2019). Therefore, this literature study was carried out to identify stakeholders involved in municipal waste management and to the extent the role of stakeholders has a positive impact on reducing municipal solid waste generation.

2. Materials and Method

Literature was collected from three search engines, i.e., Science Direct (SD), Directory of Open Access Journals (DOAJ), and Research Gate using the keywords "role of stakeholders in solid waste management in Indonesia". A search using the keyword produced 1,986 results from SD, which were then selected according to the "open access" criteria, resulting in 379 articles. The next selection was carried out manually by looking for articles containing the keywords "waste", "stakeholder", and "Indonesia". Articles containing at least two of these keywords were used as

references in this study, and finally eight suitable articles were obtained. Next, the search from DOAJ using the same keywords produced one article, while 24 articles were obtained from RG. The articles from RG were then selected again for relevance so that a total of 19 articles were obtained that could be used. Thus, in the end, 28 articles were obtained and could be used as references for the review. Considering that the number of articles is not too much, the publication year of the articles is not used as criteria, but the articles used as references are those published from 2013-2023. All the articles obtained are arranged in an Excel-based database matrix which is then analyzed, and the results are presented as a narration.

3. Results and Discussion

According to Mitchell et al. (1997), stakeholders have a role in determining the functioning of an institution or the implementation of a policy because of the three attributes they have, namely legitimacy, power, and urgency. Legitimacy indicates the relationship between stakeholders and/in the entity they are involved in, both legally and morally. Power shows how strong a stakeholder can exert influence on the entity in which he is involved or possibly also related to his involvement in making decisions for the entity with which he is involved. Furthermore, urgency indicates the extent to which claims made by stakeholders immediately elicit a response from the entity with whom they are involved. Furthermore, Mitchell (1997) categorized stakeholders as latent if they only have one attribute, expectant if they have a combination of two attributes, and definitive if they have all the three attributes.

The twenty-eight selected literatures are presented in Table 1. It is indicated that some of the literatures are of high relevance, and few others are of low relevance. The literature of high relevance is indicated by their capability to identify all or most of the stakeholders involved in the solid waste management and explain their role. Meanwhile, some less relevant literatures are those that able to identify the stakeholders involved in the solid waste management but failed to explain their role. Among twenty-eight articles, twenty-four articles are of relevance while the remaining four articles are less relevant because their ability to identify stakeholders involved in the waste management system is very limited.

Table 1. The identified stakeholders on solid waste management

No.	Findings	Reference	Relevant/ Less relevant
1.	A program called waste warrior program is a scheme proposed to solve carbon and waste issues in Bali. It was found that the citizen is identified as the crucial stakeholder who can identify innovative solutions to mitigate climate impacts and the study identified three groups of citizens based on their willingness to involve in the waste issue, i.e. (1) integrative adaptive seekers; (2) innovative seekers; and (3) non adaptive citizen. In addition, the program requires governmental support in the form of policy; and that the implementation requires the involvement of community in the decision-making process.	Suryawan & Lee (2023)	Relevant
2.	Based on the study in Uganda, the community becomes the main stakeholder to manage solid waste from its source. The government is another stakeholder whose support in the form of waste processing infrastructure is expected. The study also highlighted the important role of Non-Governmental Organization and the community to design the future of municipal solid waste management.	Lederer et al. (2015)	Relevant

No.	Findings	Reference	Relevant/ Less Relevant
3.	In the case of Food Loss & Waste (FLW) study conducted in Turkish FVSC, actors on supply chain are crucial stakeholders because of their salient stakeholder characteristics, i.e., legitimacy, power, and urgency. There are twenty-five identified actors, whom mostly are marketing unit (both of wholesaler, retail, to grocery seller). Other actors include the government, food producers, farmers, food providers or catering services, and households.	Surucu-Balci & Tuna (2022)	Relevant
4.	Actors involved in the municipal solid waste management could be divided as formal sector (the government, NGOs, private sectors, waste processors, and sortation center) and the informal sector (wase scavengers, labors, and households). The integration of scavengers to formal sectors is potential to reduce waste load in Final Processing Site.	Zisopoulos et al. (2023)	Relevant
5.	Based on SWOT analysis, it was found that the collaboration between the government and stakeholders in municipal waste management in Semarang is of highest strength, followed by national and local policy to reduce emission. In term of weakness, the local government and community's lacking technical capacity is the weakest aspect. However, the involvement of stakeholder in municipal solid waste management receiving the highest opportunity, while a rapid urban development is a potential threat.	Budihardjo et al. (2023)	Relevant
6.	The study on Surabaya's waste bank governance success was conducted. The identified stakeholders were (1) the government who initiates governance system; (2) the community as the central actor in integrated waste management; (3) corporate as the financial supporters; (4) media who connects the government and community as well as broadcasting public opinion; (5) NGOs who accompany the community; (6) waste bank to provide a space to bring all stakeholders together. The collaboration among all stakeholders in Surabaya could bring positive impact to the solid waste management.	Wijayanti & Suryani (2015)	Relevant
7.	The study focuses on the development of waste bank in Sleman Regency. The main stakeholder in community-based waste bank is the community and the government who bring financial support to the waste bank. Unfortunately, the article did not pay attention to other possible actors or stakeholders in waste bank or in solid waste management.	Indrianti (2016)	Less relevant
8.	A study was conducted to explore the household waste management, particularly on inorganic and hazardous waste in Indonesia. It was found that the stakeholders are the government (including inter-agency cooperation), the households, private sectors (the hazardous material-containing product manufacturers and industrial sector who able to treat the waste prior to disposal). Collaboration among actors is needed to provide facilities to collect the waste produced and tackle the waste.	Aprilia et al. (2013)	Relevant
9.	This article seeks to reflect the challenges faced by India's existing waste management framework to handle huge waste generation. Regarding medical waste, the potential stakeholders are the institution who handle the biomedical waste, the authority who tackle the pollution issue, as well as the government who provide the guidelines in managing medical waste during COVID pandemics.	Ganguly & Chakraborty (2019)	Relevant

No.	Findings	Reference	Relevant/ Less Relevant
10.	The stakeholders involved in PET bottle management are the government, informal sectors, private companies, waste bank, and retailer or <i>pengepul</i> .	Amirudin e al. (2023)	Relevant
11.	The article focuses on comparing the greenhouse gases emission from municipal solid waste management sector in Palembang. It was found that multi-stakeholder studies are required for a sustainable reduction of GHGs emission. Unfortunately, the article did not mention the possible stakeholders.	Alawiyah et al. (2023)	Less relevant
12.	In the case of solid waste management at higher education level, the stakeholders are the leaders of the university, as well as other members of university such as lecturer, students, and non-educational staffs, and cleaning services and canteen staffs. The role of the leaders is making policy regarding waste management, which is then implemented by all members of the university, while the cleaning service and canteen staffs are involved in waste sortation.	Rosilawati et al. (2023)	Relevant
13.	Effective communication between the government and residents in the Barangay, the Philippines, in the form of regular meetings to discuss waste management has supported the realization of waste management, although practice of waste separation and waste disposal are still poor.	Mendoza et al. (2022)	Relevant
14.	This study focuses on improving resident participation in municipal solid waste management in Bandung city. Three stakeholders involved in the study were identified, i.e., facilitators, local government, and educators (higher education).	Ghazali et al. (2021)	Relevant
15.	The identified stakeholder in household solid waste management in Bekasi is housewives. Unfortunately, this study did not identify other possible stakeholders involved in household solid waste management.	Kusumaningtiar et al., (2022)	Less Relevant
16.	The study was conducted to examine variables that affect the behavior of the stakeholders on the solid waste management in Ratchaburi, Thailand. It was found that the involved stakeholders are community business members, tourism entrepreneurs, community leaders, local organization members, and the government. This study found that stakeholders' mindset, servant leadership, wellbeing, and happiness are important aspects in encouraging community behavior on waste management.	Chongvisal (2018)	Relevant
17.	The study focuses on municipal solid waste in Indonesia, particularly based on the zero-waste concept. The stakeholders identified are the government who acts as policy makers, community, and private sectors.	Wikurendra et al. (2023)	Relevant
18.	Regarding the implementation of municipal solid waste management in Bandung city, two stakeholders were identified, i.e., the government and the community.	Muliawaty (2020)	Relevant
19.	The stakeholders identified in municipal solid waste management were the government, NGO, private sectors, educational institutions, formal organizations, informal sectors, and the community. The government needs to show a strong political will to realize sustainable waste management. In addition, the government also needs to collaborate with other stakeholders to find innovation or technology to manage the waste.	Susmono (2017)	Relevant

No.	Findings	Reference	Relevant/ Less Relevant
20.	In the effort to develop a community based solid waste management scenario in Surabaya, there were some stakeholders identified, i.e., the government, NGOs, financial donors, community (including housewives), and scavengers.	Praseyanti et al. (2014)	Relevant
21.	This study explores the stakeholder collaboration for solid waste management in a tourist destination of Koh Phayam, Thailand. It was identified stakeholders involved in the solid waste management, i.e., the government, NGOs, private sectors (companies), community, and tourist organization. The succeed of solid waste management is inhibited by some factors, i.e., (1) lack of motivation in managing the waste; (2) there is no financial incentives in managing the waste; (3) the bottom-up vs top-down policy; (4) lack of communication among stakeholders; (5) lacking reciprocal efforts in managing the waste.	Koiwanit & Filimonau (2023)	Relevant
22.	The paper seeks to classify stakeholders involved in the solid waste management in Cimahi, West Java. It was found that government is the main stakeholder who should responsible other elements because of its legitimacy, power, and urgency. However, the role of government is usually not optimal due to contradiction or sectoral ego among the government agencies. NGO is stakeholder who has legitimacy and power. However, the power is, in fact, normative because they need financial support from other party. The private sector like companies and formal recycling companies has a power, particularly in deciding the recycled goods. However, the private sector often still needs the support from the government and sometimes they get away from the urgency to manage the waste. Hence, the remaining attribute inherent to this stakeholder is the legitimacy. The community could be considered as the dominant stakeholder. Unfortunately, they become the discretionary stakeholder for their unwillingness to participate in waste management	Suherman et al. (2019)	Relevant
23.	The study seeks to examine the most feasible stakeholders' partnership program to handle the plastic waste issue and bring economics benefit in Central Jakarta. The stakeholders identified were the government, informal sector, private sector (corporation and plastic recycling companies and association), NGOs (including waste management consultants), and the community. In addition, reducing the use of raw materials, increasing the recycling rate, benefit-sharing, and positive communications among stakeholders are important.	Prabawati et al. (2023)	Relevant
24.	The study seeks to explore the implementation of waste-based circular economy in Karimunjava Islands District, including by interview to stakeholders as one of data collection techniques that had been used. The stakeholders in this study were the government, NGO, informal sector (waste scavengers), private sectors (donor institutions and companies' CSR), and the community. This study highlights the needs for technology to solve issue on waste.	Argo & Rahmawati (2020)	Relevant

No.	Findings	Reference	Relevant/ Less Relevant
25.	This study put evaluation on the effectiveness of multi-stakeholders' role in Indonesia and Korea in a comparison. The results indicated an ineffectiveness of optimizing the roles of multi-stakeholder in solid waste management. In addition, some problems identified in Indonesia were mis-coordination, lack of socialization, low enforcement, monitoring, and evaluation. In Korea, although ineffectiveness of policy implementation is indicated on minor issues, it is proven to be effective in building multi-stakeholder partnerships by opening the communication chain between stakeholders since the very beginning.	Dewi (2014)	Relevant
26.	This study explores the role of stakeholders in solid waste management in Makassar. It was identified stakeholders involved in the solid waste management, i.e., the government, NGOs and higher education, private sectors (companies), and community.	Agustang et al. (2023)	Relevant
27.	In this study, the good and correct management of waste banks is examined. The role of community as waste bank customers was highlighted. However, the possible stakeholders involved in the waste bank management were not clearly identified.	Putra et al. (2023)	Less Relevant
28.	In order to examine the social capital of urban communities regarding waste banks in Riau Islands, the research identified some stakeholders. The stakeholders were the manager, the customers, and the community, i.e., the stakeholders in the context of the waste bank.	Yudiatmaja et al. (2020)	Relevant

The results of the literature review show there are four categories of stakeholders involved in municipal waste management, namely the government, the private sector, the community (in this case representing households) and the media. The roles of the four stakeholders will be explained further. Based on the studies conducted, the government's role in waste management is (1) formulating policies through regulations or legislation (Suryawan et al., 2023; Laderer et al., 2015; Budihardjo et al., 2023; Koiwanit et al., 2023); (2) carrying out monitoring and control functions (Wijayanti & Suryani, 2015); (3) providing waste infrastructure (2); and (4) collaborating with other stakeholders (Zisopoulos et al., 2023; Budihardjo et al., 2023; Wijayanti & Suryani, 2015; Aprilia et al., 2013; Wikurendra et al., 2023; Susmono, 2017). According to Suherman et al. (2019) the government in this case is the definitive stakeholder (central government) because it has legitimacy, power, and urgency; and dominant (regional and local governments) because they have legitimacy and power. The private sector is divided into the formal sector and the informal sector. In the world of waste management, the formal sector consists of Waste Banks, TPS 3R, and NGOs (Non-Governmental Organizations), universities, as well as companies/producers and recycling industries (Anggraini et al., 2023). Meanwhile, the informal sector is represented by scavengers and collectors.

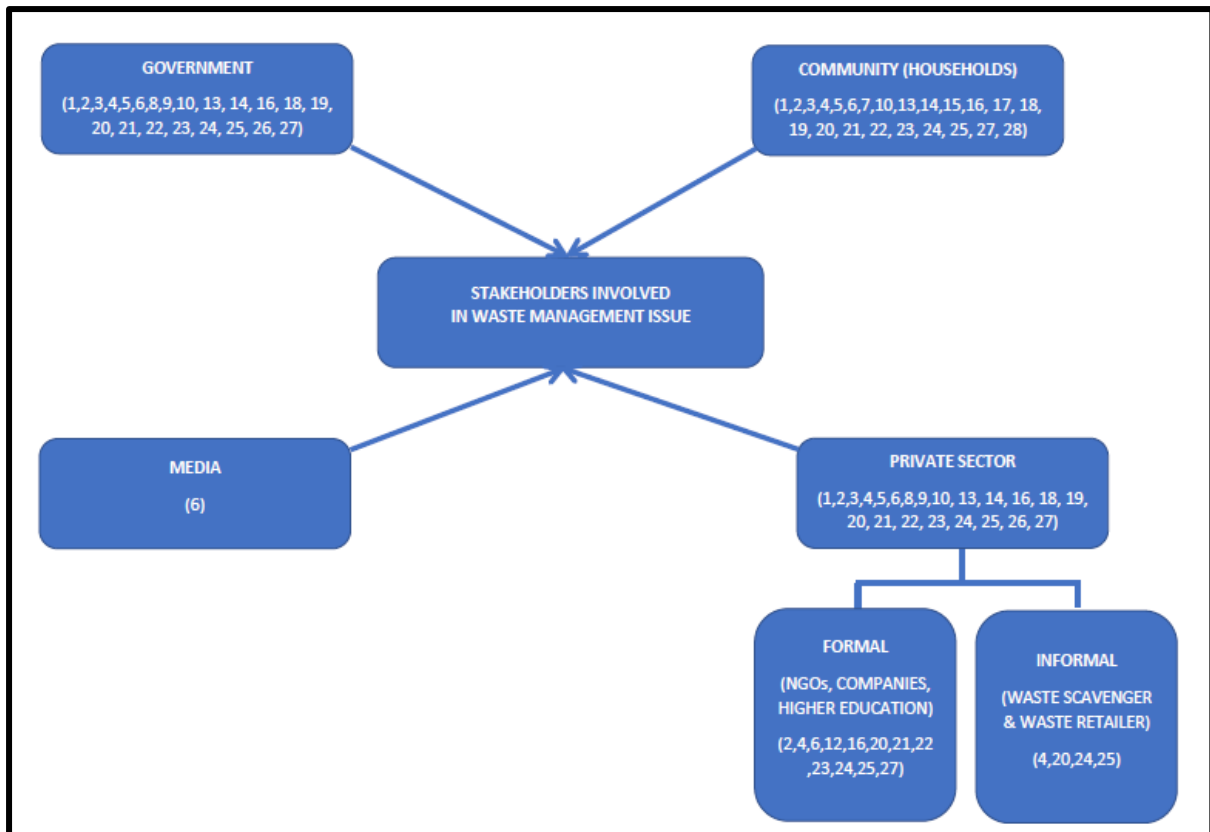


Figure 1. The stakeholder identified in municipal solid waste management

Furthermore, NGOs are non-governmental institutions that plays role in empowering the community to encourage people to participate in waste management (Agustang et al., 2023). The role of NGOs in waste management was also considered important by Lederer et al. (2015) through research conducted in Busia, Uganda, because they can assist the community in planning the future of waste management of the city. A study conducted by Suherman et al., (2019) using Mitchell's stakeholder theory shows that NGOs are expectant-dominant stakeholders because they have legitimacy and power, especially material power. This means that by its strength in terms of funding and knowledge, and legal recognition (legal-formal), NGOs can influence the community as parties assisted in waste management. However, in general NGOs do not have urgency (for example, control functions in the form of rewards and sanctions), so that the assistance provided cannot always be responded quickly by the community, unless the community considers that the advice from the NGO is urgent because it is in line to the interests of the community, will it be done immediately. Corporations and universities are formal sectors involved in municipal waste management through funding and research in finding waste management technology or innovation (Wijayanti & Suryani, 2015; Amirudin et al., 2023; Rosilawati et al., 2023; Koiwanit et al., 2023; Suherman et al., 2019; Agustang et al., 2023). Even though universities have a role in funding research, providing education to the community, and providing assistance to the community in the form of community service programs, universities are likely to be stakeholders of the same nature as NGOs. While Suherman et al. (2019) stated that corporations or the business world may be closer as latent-discretionary stakeholders because even though they have the three

attributes as stakeholders, they do not use the power and urgency they have, so what remains is legitimacy.

The informal sector is represented by scavengers and collectors and their role is quite important in the world of waste management, because they help the community in sorting waste (Septiani et al., 2019; 4, Prasetyanti et al., 2014; Suherman et al, 2019; Prabawati et al., 2023). According to Suherman et al (2019) they are latent-demanding stakeholders because they only have one attribute, namely urgency related to the waste collection they carry out. However, even though they do not have legitimacy and power, their existence is crucial and necessary to deal with waste (Suherman et al., 2019). A bit different from scavengers, the informal sector called collectors has power other than urgency because they are the ones who determine the purchase price of waste sold by the community or waste banks, so their position in the waste management network is expected-dangerous (Suherman et al., 2019). However, their role as collectors of recycled raw materials is considered weak enough to negotiate designs for recycling with packaging manufacturers. For example, recycling groups want large plastic bottle packages to make them easier to collect, but producer groups often use small plastic bottle packages for marketing purposes (Nurhadi et al., 2023a). This increasingly shows the urgency of integrating the formal and informal sectors in waste management in developing countries like Indonesia. As a formal community-based institution, the dualism of viewing waste at the Waste Bank and TPS 3R must be immediately harmonized (Nurhadi, 2023b), as well as the garbage collectors, scavengers, waste banks, TPS 3R, collectors and the recycling industry must be immediately integrated to ensure that waste management activities can be more equitable and sustainable.

Almost all studies show that communities (or households) are important stakeholders in waste management because they are the key point of ISWM, i.e., waste management started from the source (Suryawan et al., 2023, Wijayanti & Suryani, 2015; Indrianti, 2016; Mendoza et al., 2022; Ghazali, et al, 2021). The study conducted by Suryawan et al. (2023) indicates there are three groups, i.e., (1) adaptive integrative citizens who are actively involved in waste management and can adapt to the latest information; (2) innovative seeker is community members who are interested in looking for the latest innovations in waste management, practicing them, and sharing them with others; and the (3) non-adaptive citizens, they are community members who find waste management is difficult or they are not interested in participating in waste management activities, either independently or within the community. The study of Chongvisal (2018) show that community involvement in waste management is influenced by perspective, servant leadership, well-being, and happiness. It seems that a broad perspective, a willingness to serve, and a positive well-being will encourage people to learn and to be more willing to participate in waste management.

The role of multi-stakeholders is important in municipal waste management (Alawiyah et al., 2023). Based on a study conducted in Semarang City using SWOT analysis, the highest strength aspect is represented by government and stakeholder cooperation in waste management, followed by local and national policies in reducing emissions. Meanwhile, in terms of weaknesses, the lack of technical capacity of human resources in (local) government and society contribute to the lowest performance. Furthermore, stakeholder involvement in the waste management system has the greatest opportunity, followed by community interest in carrying out centralized waste processing. The existence of a community-based Waste Management

Institution initiative with the institutional form of a Waste Bank and TPS 3R is quite promising. The study of BINTARI foundation in 2017 recorded there were 205 Waste Bank organizations spread across 120 sub-districts in Semarang City. Meanwhile, Semarang City is developing 23 TPS 3R units until 2022, where TPS 3R Dadi Resik and TPS 3R Pedalangan are in an operationally active state (Nurhadi, 2023b). Regarding threats, residents are worried about the rapid development of the city (Budihardjo et al., 2023). It is understandable that very rapid development of cities is a concern for residents because the growth of population has the potential to the increase of waste generation, reducing land for settlement, as well as increasing pressure on the economic and social conditions of the community. Regarding the corridor for community participation in waste management through the Waste Bank and TPS 3R institutions, the synergy among parties need to be strengthened to increase the capacity of community governance in these two institutions, so that they become more resilient and adaptive in responding to the concerns and challenges of city development.



Figure 2. The proposed stakeholder with PRO who acts as intermediary. *Source: PREVENT Waste Alliance, 2023.*

In Surabaya, collaboration among the government, media and community leaders can build public trust so that the Waste Bank program released by the government is welcomed by the community and the community shows willingness to actively participate in it (Wijayanti & Suryani, 2015). Meanwhile, the study of Koiwanit et al. (2023) in Thailand found several obstacles to successful waste management, i.e., (1) lack of interest in managing waste; (2) no financial incentive to process waste; (3) bottom-up versus topdown policies; (4) lack of communication among stakeholders; (5) lack of reciprocity in waste management (for example, only one party is interested in implementing waste management innovations while the others are not of similar interest). Studies in the Philippines found that effective communication is needed among stakeholders, which in this case is represented by the government and

society (Mendoza et al., 2022). The government needs to hold meetings involving residents to convey information and exchange ideas regarding expected waste management. The government also needs to provide the waste infrastructure needed by residents. The community is obliged to play an active role in waste management, especially when various events are held, and if they do not do this, they will be subject to sanctions (Mendoza et al., 2022). The private sector, especially the producer group consisting of packaging manufacturers and brand owners, is also deemed to need to further develop their responsibility for packaging waste through the extended producer responsibility scheme EPR (Extended Producer Responsibility). It could be that packaging waste management in 514 regencies/cities in Indonesia is currently not optimal because it is not properly orchestrated by a PRO institution or Packaging Recovery Organization (PREVENT Waste Alliance, 2023). PRO institutions can be led by the government or a consortium of private parties who have a central role not only in waste management, but are also actively involved in consumer communication to increase participation, and design advocacy to producer groups, ensuring that as many resources as possible are maintained in the production cycle – consumption – recycling in accordance with the circular economy concept (Putra, 2023).

4. Conclusions

The stakeholders involved in municipal waste management are the government, the private sector, the community – RT, and the media. The role of stakeholders is related to regulatory and policy functions (government), innovation – technology – funding (private sector), and participation (society). The definition of roles mentioned above is certainly not intended to compartmentalize or limit the roles that may be carried out by the parties, but rather to understand and continue to explore spaces for possible synergies. The proposed synergy scheme for the parties indicating the roles of the government, private sector and society can be identified in more detail according to the chain of role requirements that adapt to current developments. This study recommends the presence of an institution that can orchestrate from upstream to downstream so that waste management activities can be better interpreted as circular economic activities that are more just and sustainable. Collaboration formed between stakeholders can build trust between stakeholders and can encourage community participation to be actively involved in city waste management.

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