Empowering Relationships and Connections in Waste Chain Management: A Study of Community-based Waste Management in Ponorogo Regency, Indonesia

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Abstract. The waste issue is a global challenge requiring effective and efficient management. It is important to achieve the *Sustainable Development Goals*. Ponorogo Regency, one of the regions in East Java Province, Indonesia, still faces some problems in waste management, as indicated by the less optimum connection between actors and the weak relationship between stakeholders. This research aims [1] to describe and analyze connections in the waste management value chain in Ponorogo Regency and [2] to describe and analyze the empowering relationship in the waste management value chain in Ponorogo Regency. This study is descriptive research using a qualitative approach. Data was collected through interviews, observation, documentation, and Focus Group Discussion (FGD). The research results show that community-based management in Ponorogo Regency still faces some constraints in terms of connections and empowering relationships. Connections established between actors and stakeholders in waste management do not work well. Similarly, empowering relationships has not been implemented optimally yet. The application of Information and Communications Technologies (ICT) allows improving access to information so that connections and empowering relationships can be created better.

Keywords: empowerment, connections, relationship, value chain, waste management

1. Introduction

About 13.3 % of food lost & food waste was produced globally in 2020 [1]. It excludes 53 million tons of electronic waste (e-waste) produced worldwide in 2019 [2]. People (community members) are essential actors in the waste management value chain, recalling that the average waste produced worldwide is 7 billion tons per year [3]. Nevertheless, the community's ability to manage this huge waste production is very low. This condition can be seen in only 17% of recyclable electronic waste [2]. Ironically, a large quantity of waste is disposed of in the sea and river [4].

The Plastics Management Index (PMI) 2021 studied the waste management attempts made in many countries, viewed from the perspectives of governance, systemic capacity, and stakeholder engagement [5]. Germany ranks first in the best plastic waste management index at the global level overall, with a score of 87.4. Furthermore, the indicator of stakeholder engagement in this survey repositioned Germany onto the first rank. Indonesia is in the eighth position in the assessment of stakeholder engagement indicator. This figure is still far below the score achieved by other Asian states such as Malaysia and Japan. Such a condition indicates that

AICOBPA 2023, November 01, Malang, Indonesia

DOI 10.4108/eai.1-11-2023.2355337

waste management in Indonesia still needs more serious attention, particularly regarding stakeholder engagement.

The Indonesian government still faces this waste management problem. Data from the National Waste Management Information System (Indonesian: *Sistem Informasi Pengelolaan Sampah Nasional*, thereafter called SIPSN) indicates the increase in waste production in Indonesia in 2019-2022. In 2019, the volume of waste in Indonesia was 28.725.366,30 tons/year. This figure kept increasing to 29,005,278.37 tons/year in 2020. In 2021, the waste production in Indonesia increased to 29,446,146.21 tons/year, and it will increase to 35,803,483.85 tons/year in 2022. Over the years, the increase in waste production indicates that waste management has not run optimally yet in Indonesia.

One of the regions in Indonesia with a significant increase in waste production over the years is Ponorogo Regency. In 2020, the waste production in Ponorogo Regency was 127,432.45 tons/year. This figure increased to 141,540.58 tons/year in 2021. Ironically, the waste management index in Ponorogo Regency instead decreased over the years. The waste management index in Ponorogo Regency was 95,180.68 tons/year in 2020. This figure decreased to 84,671.97 tons/year in 2021. This implies that waste management performance in Ponorogo has decreased over the years. The data on waste production and its management in Ponorogo Regency in 2020-2021 can be seen in Table 1.

Table 1. Waste production and its management in Ponorogo regency in 2020-2021

Year	Daily Waste Production (ton/day)	Annual Waste Production (ton/year)	Total Amount of Waste Handling (ton/year)
[1]	*[2]*	*[3]*	*[4]*
2020	349,13	127.432,45	95.180,68
2021	387,78	141.540,58	84.671,97

Source: Processed from *Sistem Informasi Pengelolaan Sampah Nasional* (SIPSN), 2022

The decline in waste management in Ponorogo Regency, among others, indicates weak community empowerment. Ponorogo Regency Environmental Service (Indonesian: *Dinas Lingkungan Hidup*, thereafter called DLH)'s Work Plan Document wrote that the community's role in waste management in Ponorogo Regency is quite low in 2021. Public participation is still low in waste management; it can indicate less optimum community empowerment. Meanwhile, the community's capacity and ability highly determine how to collaborate with other stakeholders in the waste management value chain.

Researchers from diverse disciplines have conducted previous studies on waste management. Previous studies related to waste management have been conducted using an ecological approach by [6] [7] and [8]. The researchers of social sciences, such as [9] [10] and [11] also made waste management a topic interesting to analyze. Viewed from the economics discipline, waste management has been studied by [12] [13] [14] This waste management research does not escape from the attention of Public Administration Scholars such as [15] [16] [17].

These previous studies are highly beneficial in enriching their study on waste management. Nevertheless, no previous study addresses community-based waste management, focusing on empowering *relationships* and *connections*. Meanwhile, community-based waste management needs adequate connections between actors engaging within it [18]. On the other hand, this community-based waste management should be supported by good *empowering relationships*

to create empowerment [19]. This research offers novelty by focusing on *empowering relationships* and *connections* in the *waste value chain*.

Connections between actors highly determine the success of the waste management value chain [18]. These connections between actors are indicated not to run well in the community-based waste management in Ponorogo Regency. This condition can be seen from the weak connectivity between the organizer of TPS 3R PEKA and the organizer of TPS Tempuran. Although the two waste management facilities are located in the same region, Kelurahan Paju (Paju Village), connections between organizers do not work well. It results in conflict between the two, leading the value chain of waste management not to work well. It does not align with Barnes (2020), stating that an *empowering relationship* highly determines a successful empowerment process. Departing from the aforementioned problem, this research aims to study *empowering relationships* and *connections* in the value chain of community-based waste management. The aspects of *empowering relationships* [19] and *connections* [18] will be used to analyze the phenomenon related to community-based waste management in Ponorogo Regency, Indonesia.

2. Methods

This study is descriptive research with qualitative approach. This research describes the phenomenon related to community-based waste management in Ponorogo Regency, Indonesia, particularly in *empowering relations* and *connections in the waste value chain*. This study focuses on [1] describing and analyzing connections in the waste management value chain in Ponorogo Regency and [2] describing and analyzing *empowering relationships* in the waste management value chain in Ponorogo Regency.

This research occurred in Ponorogo Regency, East Java Province, Indonesia. The author chose Kelurahan Paju, Sambit Village, and Plosojenar Village as the research sites. The three locations were selected because they have different characteristics of community-based waste management facilities.

The data collection techniques used in this study were interview, observation, documentation, and Focus Group Discussion (FGD). The unstructured interview was preferred in this study, referring to the interview guide constituting the outline of problems to be questioned [20]. Furthermore, this research used participatory observation by observing the behavior and activity of the informant directly [21]. Documentation was used to confirm the data of research, including the Document of National Waste Management Information System (SIPSN) of 2021-2022 and the Living Environment Service (DLH) of Ponorogo Regency's Strategic Plan (*Renstra*) Document in the Fiscal Year of 2021-2026. FGD was held with several target groups, particularly community, government, and industry.

3. Results and Discussion

3.1. Waste Management Facilities in Ponorogo Regency, Indonesia

Waste management attracted the Government of Ponorogo Regency's attention, recalling that Ponorogo Regency failed to achieve the Adipura Award for over nine successive years. The Adipura Award was last achieved by Ponorogo Regency in 2013. Then, this regency failed to achieve the award in 2014-2022. Meanwhile, the Adipura Award is an instrument to supervise the regional government's performance in terms of environmental governance, including waste management. The less optimum public participation in waste management is indicated to be a factor making Ponorogo Regency fail to achieve the Adipura Award [22]. This importance of

adequate waste management encourages the Government of Ponorogo Regency to establish several facilities. The facilities of waste management are, among others: Temporary Shelter (Indonesian: *Tempat Penampungan Sementara* or TPS, TPS 3R (Waste Management site with Reduce, Reuse, and Recycle), Waste Bank, Compost House, and Final Processing Site (Indonesian: *Tempat Pemrosesan Akhir* or TPA).

Relationships and connections between key actors in this facility organizer are absolutely needed to achieve efficient and effective waste management. Connectivity between organizers of TPS, TPS 3R, Waste Bank, Compost Bank, and TPA is the determinant of successful waste management. Furthermore, the organizer of waste management facilities should establish good relationships with other stakeholders. [18] put "*connections*" as an important waste management value chain indicator. On the other hand, Barnes (2020) also puts "*empowering relationship*" as a basic empowerment aspect. Good connections between actors in the waste management value chain are expected to encourage the achievement of community empowerment through *empowering relationships*.

3.2. Connections in Community-Based Waste Management

Connection between waste management facility organizers is desirable to achieve better performance. Achieving the optimal waste management value chain from upstream to downstream is important. This waste management value chain connects all stakeholders to recyclable waste resources [23]. *Connections* are important in the waste management value chain, recalling the importance of connecting waste producers, collectors, sorters, and recyclers to the recycling industry [18]. Nevertheless, the actual condition shows that the conflict between organizers still inhibits the connection between actors. It can be seen from the waste management conducted in TPS 3R and TPS in Kelurahan Paju in Ponorogo Regency.

Kelurahan Paju has some waste management facilities: TPS 3R PEKA, TPS Tempuran, Bank Sampah Manunggal Karso, and Bank Sampah Putri Songgolangit. TPS Tempuran was also located in the same region. Both organic and non-organic wastes produced by each household are collected periodically by the organizer of TPS 3R PEKA. This waste collection is conducted three times in a week. On the other hand, the organizers of Manunggal Karso and Putri Songgolangit Waste Banks also collected the waste sorted by the people in Kelurahan Paju, particularly non-organic waste that can be recycled into certain craft products. The wastes that Manunggal Karso and Putri Songgolangit Waste Banks cannot be recycled will be disposed of to TPS 3R PEKA. Meanwhile, the organizer of TPS 3R PEKA routinely sorts the waste by classifying the waste with added value and the residue.

Ideally, residues collected in TPS 3R PEKA will be disposed of later to TPS Tempuran, and then TPS Tempuran will continue the processing in TPA Mrican. Nevertheless, the actual condition shows that the organizer of TPS 3R PEKA is not allowed by that TPS Tempuran to dispose of residues in their facilities. It is because there is no good connectivity between the two. This condition contradicts the importance of *connections* in waste management value, representing horizontal cooperation between actors in the waste management value chain and partnership network in waste management [18]. Meanwhile, good cooperation and partnership between waste management actors are desirable [6]. Collaboration between stakeholders is desirable in achieving the optimal waste management value chain [7].

The organizer of TPS Tempuran obliged the organizer of TPS 3R PEKA to pay a routine amount of money each time they dispose of waste residues in the facilities they organize. Nevertheless, recalling the inadequate financial condition of TPS 3R PEKA, the organizer of TPS 3R PEKA decided not to dispose of waste residues in TPS Tempuran. On the other hand, the disposal of waste residues from TPS 3R PEKA to TPA is impossible, recalling that waste-

transporting motor vehicles need a lot of fuel to go to the TPA location. Finally, the organizer of TPS 3R PEKA applied to collect waste residues by garbage truck the DLH of Ponorogo Regency has. Waste residues collected in the containers belonging to TPS 3R PEKA will be taken by the garbage truck twice a month to be disposed of directly in TPA Mrican. Unfortunately, the collection of residues by the government's garbage truck generates operational costs, so the organizer of TPS 3R PEKA should pay IDR 30,000 for one collection. Meanwhile, waste management is an integrated system in which, if only one part of the value chain can be solved, the remaining obstacle will potentially generate other problems [24]. This condition contradicts the importance of cooperation between upstream and downstream waste organizers in the waste management value chain [25]. The connection to the waste recycling chain is very desirable, as it determines the income of waste collectors and the achievement of Sustainable Development Goals (SDGs) [26]. The connection in the waste management value chain in Kelurahan Paju can be seen in Figure 1.

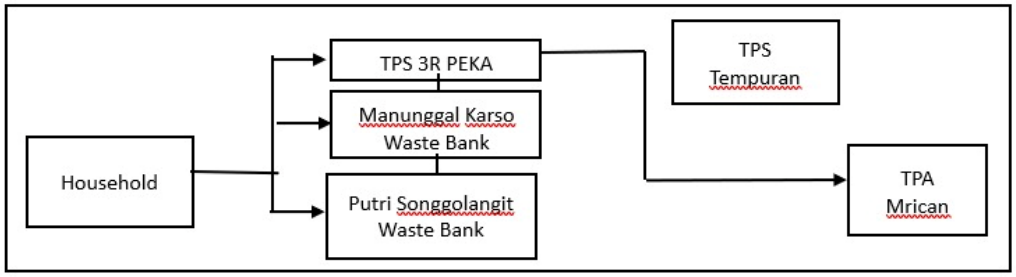

Figure 1. Waste management value chain connection in Paju village, Ponorogo regency
Source: processed from research results, 2023

Furthermore, the result of the research shows that the connection has run well in the community-based waste management in Sambit Village. Sambit Village has a community-based waste management facility called TPS 3R Sumur Wolu. TPS 3R Sumur Wolu officers collect the waste from the household members on Tuesday, Thursday, and Sunday. A fee of IDR 15,000 per house is imposed on each program member. The waste management value chain in Sambit Village is more straightforward in that domestic waste was collected by the organizer of TPS 3R Sumur Wolu. Then the waste residues were collected in the container. These residues will be delivered periodically to TPS Mrican. This delivery generates routine expenses to pay the vehicle rent along with the driver. The cost spent for vehicle rental is IDR 100,000.00 plus the driver's fee. Connections and waste management value chain in Sambit Village can be seen in Figure 2.

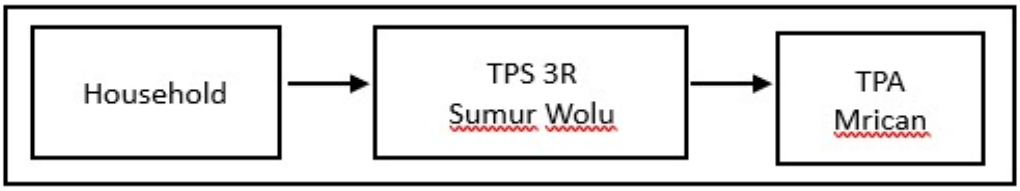

Figure 2. Waste management value chain connection in Sambit village, Ponorogo regency
Source: Processed from research results, 2023.

On the other hand, the connection in the waste management value chain in Plosojenar Village has run well. Maesojenar Compost House in Plosojenar holds a Waste Collection Program collectively using procedures different from TPS 3R PEKA or TPS 3R Sumur Wolu. People affiliated with Maesojenar Compost House collect and sort organic waste from their households. Then, the organizer of Maesojenar Compost House will take the sorted and collected non-organic waste according to the members' request.

The organizer of Maesojenar Compost House deliberately provides non-organic waste collection for free for its members. It is done by the organizer recalling that the people in Plosojenar Village are still in the stage of improving their awareness of not disposing of waste haphazardly. The research results show that the organizer worries that the imposition of fees on the Collective Waste Collection Program members will generate agitation in the community. On the other hand, waste cannot be taken once in several days from door-to-door like that in both TPS 3R PEKA and TPS 3R Sumur Wolu, recalling the limited personnel in Maesojenar Compost House. Therefore, the organizer designs the program by considering the condition of the community and the organizer's capacity. The connection in the waste management value chain in Plosojenar Village can be seen in Figure 3.

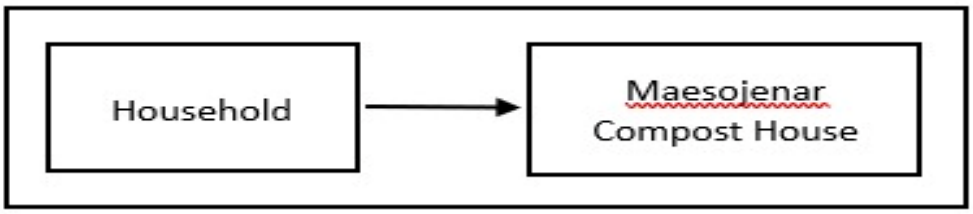

Figure 3. Waste management value chain connection in Plosojenar village, Ponorogo regency
Source: Processed from research results, 2023.

3.3. Empowering Relationship: As a Key Element

The community-based waste management in Ponorogo Regency can be seen from how the *empowering relationship* is established between individual actors and stakeholders. Manunggal Karso Waste Bank in Kelurahan Paju knows the importance of collaborating with other stakeholders by formulating a Cooperation Agreement (Indonesian: *Perjanjian Kerjasama* or PKS). The result of the research shows that there are 3 (three) PKSs established by Manunggal Karso Waste Bank and parties such as SD Negeri 1 Paju, rubbish collectors, and Putri Songgolangit joint venture group (now called Putri Songgolangit Waste Bank). It aligns with reinforcing the relationship between various actors in empowerment [19]. Community development needs a good connection or relationship with various parties [27].

Cooperation between Manunggal Karso Bank and the First State Elementary School of Paju (SD Negeri 1 Paju) is put into PKS. This PKS is manifested in the waste management education program held by the organizer of Manunggal Karso Waste Bank for the students of SD Negeri 1 Paju. Furthermore, another form of cooperation is the collection of sorted waste by the students in the school to be deposited later to the organizer of Manunggal Karso Waste Bank to be processed into handicraft products.

Another form of cooperation can be seen from PKS and Manunggal Karso Waste Bank and rubbish collector. This PKS is manifested in the cooperation in selling the sorted waste collected by Manunggal Karso Waste Bank members to the rubbish collector. The two actors in this waste management benefit from each other. The rubbish collector benefits from obtaining the sorted waste, while Manunggal Karso Bank benefits from the nominal money resulting from

the sale of sorted waste. It aligns with the importance of community empowerment to encourage partnerships benefiting each other [28].

Manunggal Karso Waste also establishes good relationship with Putri Songgolangit Joint Venture Group. Putri Songgolangit Joint Venture Group. It is a joint venture group under Manunggal Karso Waste Bank's guidance, then developed into Putri Songgolangit Waste Bank. The relationship between Manunggal Karso Waste Bank and the organizers of Putri Songgolangit Waste Bank is established well. Both of them are coordinating with each other in waste management in Kelurahan Paju. It represents the importance of social relation network built by emotion that can integrate the strengths in improving public participation [17]. PKSs established between Manunggal Karso Waste Bank and other stakeholders can be seen in Table 2.

Table 2. Cooperation agreement between Manunggal Karso Waste Bank and other stakeholders

No.	Cooperation Agreement	Year	Stakeholders
[1]	*[2]*	*[3]*	*[4]*
1.	PKS No. 074/01/405.30.1.1/2014	2014	Manunggal Karso Waste Bank with Rubbish Collector
2.	PKS No. 074/02/405.30.1.1/2014	2014	Manunggal Karso Waste Bank with SD Negeri 1 Paju.
3.	PKS No. 074/03/405.30.1.1/2014	2014	Manunggal Karso Waste Bank with Kelompok Bersama Putri Songgolangit.

Source: Processed from Manunggal Karso Waste Bank documents, 2023.

The research results show that neither the organizer of TPS 3R Sumur Wolu in Sambit Village nor the organizer of Maesojenar Compost House in Plosojenar Village have been aware of the importance of PKS. This condition contradicts the importance of building good connections and relationships with many parties in community development [27]. Meanwhile, good relations or connections between actors of empowerment are desirable, recalling that community empowerment needs all stakeholders' commitment to the people's ownership in making decisions related to the program [29]. Nevertheless, the organizer of TPS 3R Sumur Wolu has established a good relationship with Village Government.

On the other hand, the organizer of Maesojenar Compost House also has established good relationships with some stakeholders: Kindergarten (Indonesian: *Taman Kanak-Kanak* or TK) Dharma Wanita Plosojenar, Family Welfare Program Activating Team (TP-PKK) Group, Cadre of Integrated Service Post for Under-Five Year Old Children (*Posyandu Balita*) and cadre of Integrated Service Post for Elders (*Posyandu Lansia*). The organizer of Maesojenar Compost House gives education about waste management to the students of TK Dharma Wanita Plosojenar. Socialization related to waste management is also conducted by the organizers of Maesojenar Compost House in the TP-PKK group, *Posyandu Balita*, and *Posyandu Lansia*.

3.4. Information & Communications Technologies in Empowerment

Connections and *empowering relationships* in community-based waste management in Ponorogo Regency need to be optimized through Information and Communications Technologies (ICT). It has begun to be initiated by the organizer of Maesojenar Compost House in Plosojenar Village by utilizing the WhatsApp (WA) application. The organizer of Maesojenar House created a group through the WA application aiming to facilitate access to waste management-related information in Plosojenar Village. An effective and efficient

communication flow from the organizer to the people can encourage successful community-based waste management [30]. People with adequate information will access various services and opportunities more easily, use their rights, have negotiating ability, and be held accountable [31].

The organizer of Maesojenar Compost House often provides information related to the waste management programs in Plosojenar Village through the WA group application. For example, the information related to training programs. On the other hand, this WA application facilitates the members of Maesojenar Compost House in delivering information to the organizer. The people's adequate access to information can determine how far public participation is in the development [12]. Furthermore, accessibility to this information plays an important role in waste management, particularly in creating people's awareness of the importance of waste management [13].

The members of Maesojenar Compost House use this WA application to inform the organizer if the sorted wastes have accumulated in their house and been ready to be sent to the Compost House. The organizer is very responsive to the information sent by the members so that they will take the sorted wastes immediately to the location informed. In addition, this ICT implementation establishes more optimal connections between waste management actors. More harmonious and intimate relationship is also established through the WA group application, recalling that light conversation and joke are often shared in the application.

The research results show that ICT implementation in waste management is limited to using communication tools through the WA application. The waste organizer at the village level has not used the National Waste Management Information System (SIPSN) developed by the Republic of Indonesia's Ministry of Living Environment and Forestry (KLHK RI). The organizer uses a computer only to write the report of the activity. In the future, community-based waste management should be encouraged to implement ICT in other aspects. It is important to grow community empowerment, particularly in strengthening access to information and connecting with other national and global waste organizers. It is important to recall that the community's ability to manage waste is expected to improve through adequate information access [32]. Information and Communications Technologies (ICT) play an important part in connecting people to various information so that they can be connected to each other [31].

The optimization of WA group regarding waste management in Sambit Village and Kelurahan Plosojenar has not yet been done. The organizers of community-based waste management facilities in these two regions have not used the WA group yet to connect information between organizers and members. The WA application is still limited to calling or chatting between organizers.

4. Conclusion

The community-based waste management in Ponorogo Regency is still inhibited by *connections* and *empowering relationships*. The connection established between various actors and stakeholders in community-based waste management seems not to run well in Ponorogo Regency. It can be seen from the disconnection of one management facility to another. The less harmonious relationship between organizers worsens this bad connection. It generates conflict between the two, leading to the less optimal performance of waste management.

Implementing Information and Communications Technologies (ICT) can be an opportunity to improve access to information so that *connections* and *empowering relationships* in this community-based waste management can be created better. This use of ICT can

encourage more effective and efficient community-based waste management. The targeted community can be informed better with various waste management programs. On the other hand, the organizer of waste management facilities disseminates information more easily related to the community-based waste management program. In the future, *empowering relationships* and *connections* in the waste management value chain should be optimized to improve access to information through ICT use.

Acknowledgment

The author thanks all parties that supported this study. This study is funded by Indonesia Endowment Funds for Education (LPDP), Center for Higher Education Funding (BPPT), Center for Education Financial Services (PUSLAPDIK), and Indonesia Education Scholarships (BPI).

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