



## The social capital strengthening and its development alternatives of waste banks in Java

Heru Subaris Kasjono<sup>1</sup>, Bambang Suwerda<sup>2</sup>, Sri Haryanti<sup>3</sup>,  
Tengku Mohammad Ariff Bin Raja Hussin<sup>4</sup>, Prayudhy Yushananta<sup>5\*</sup>

<sup>1,2,3</sup> Politeknik Kesehatan Kementerian Kesehatan Yogyakarta

<sup>4</sup> University Sultan Zainal Abidin, Trengganu, Malaysia

<sup>5\*)</sup> Politeknik Kesehatan Kementerian Kesehatan Tanjung Karang

### ARTICLE INFO

#### Article history:

Received 21 January 2023  
Accepted 1 April 2023  
Published 10 June 2023

#### Keyword:

Social capital  
Waste bank  
Management  
Institutional  
Capital  
Marketing

### ABSTRACT

The waste bank (WB) is a government program encouraging community participation in managing waste with social engineering principles. Since its establishment in 2008, only 5% of active customers remain. This study evaluates the management of WB sustainably and the most optimal future alternatives. The research is qualitative and quantitative with a sequential exploratory approach. Data from 35 WB in four provinces (East Java, Central Java, West Java, and DI Yogyakarta) involved 680 respondents. The data was analyzed using the Analytic Network Process (ANP) and Multi-Criteria Decision Analysis (MCDA) to select the optimal alternative. This study found that the three main problems in WB management are institutional (community proactiveness, training, outreach, and capacity building), waste bank capital (triple helix, youth education, and communication forums), and marketing (old selling products, price fluctuations, and market access). Strengthening social capital-based institutions is the main topic of improvement and sustainability, especially networks and trust. The role of government, NGOs, and the community is needed to encourage the sustainability of the WB. The main strategy for solving the problem is strengthening social capital-based institutions, especially networking and value (trust, convenience, and relationships). Assistance is needed from the government or NGOs in managing WB by prioritizing institutional strengthening based on social capital. In addition, encourage all parties to develop an independent waste bank model with reinforcements, especially in institutions, capital, and marketing.

This open access article is under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



#### Kata kunci:

Modal Sosial  
Bank Sampah  
Pengelolaan  
Kelembagaan  
Modal  
Pemasaran

#### \*) corresponding author

Prayudhy Yushananta, SKM, MKM

Politeknik Kesehatan Kementerian Kesehatan Tanjung Karang  
Jalan Soekarno-Hatta No 6, Bandar Lampung, Lampung-Indonesia

Email: prayudhyyushananta@gmail.com

### ABSTRAK

Bank sampah merupakan program pemerintah untuk mendorong partisipasi masyarakat dalam mengelola sampah dengan prinsip rekayasa sosial. Sejak didirikan pada tahun 2008, saat ini hanya tersisa 5% nasabah yang aktif. Studi ini mengevaluasi pengelolaan bank sampah secara berkelanjutan dan alternatif masa depan yang paling optimal. Penelitian bersifat kualitatif dan kuantitatif dengan pendekatan eksplorasi sequential. Penelitian bersifat kualitatif dan kuantitatif dengan pendekatan eksplorasi sequential. Data diperoleh dari 35 Bank Sampah di empat provinsi (Jawa Timur, Jawa Tengah, Jawa Barat, dan DI Yogyakarta), dan melibatkan 680 responden. Data yang terkumpul dianalisis menggunakan Analytic Network Process (ANP) dan Multi-Criteria Decision Analysis (MCDA) untuk memilih alternatif yang optimal. Studi ini menemukan bahwa tiga permasalahan utama pengelolaan bank sampah adalah kelembagaan (proaktif masyarakat, pelatihan, sosialisasi, dan peningkatan kapasitas), modal bank sampah (triple helix, forum komunikasi dan edukasi golongan muda), dan

DOI: 10.30604/jika.v8i2.1984  
Copyright 2023 @author(s)

pemasaran (produk laku lama, fluktuasi harga dan akses pasar). Penguatan kelembagaan berbasis modal sosial menjadi topik utama perbaikan dan keberlanjutan, terutama jejaring dan kepercayaan. Peran pemerintah, LSM, dan masyarakat sangat diperlukan untuk mendorong keberlangsungan Bank Sampah. Strategi utama untuk menyelesaikan masalah adalah penguatan kelembagaan berbasis modal sosial, terutama aspek jaringan (networking) dan nilai (trust, convenience and relationships). Diperlukan pendampingan dari pemerintah atau LSM dalam pengelolaan bank sampah dengan mengutamakan penguatan kelembagaan yang berbasis modal sosial. Serta mendorong semua pihak untuk mengembangkan model bank sampah mandiri dengan penguatan-penguatan, terutama pada kelembagaan, permodalan dan pemasaran.

This open access article is under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



## INTRODUCTION

In many developing countries, the issue of survival is still the main concern of government policies. So Municipal Solid Waste Management (MSWM) is not included in public concern (Fedotkina et al., 2019; Kubota et al., 2020; Wilson, 2007). However, MSW has become a concern in several other countries because it is related to increasing public awareness of climate change and environmental protection issues (Kubota et al., 2020), in addition to stricter international regulations (Bruno et al., 2021).

The two main problems with MSWM are the way it is collected and processed (Priti & Mandal, 2022; Xiao et al., 2020). Both pose challenges such as no segregation at source, complicated collection processes, and open landfills (Fedotkina et al., 2019; Kubota et al., 2020). Several factors affect the quality of waste management services by the Government, including the need for government strategic policies, coordination, financial support, low private participation, inefficiency, and low public awareness. These factors contribute to low levels of service (Kubota et al., 2020; Kurniawan et al., 2021; Meidiana, 2010).

Waste is a complex and multidimensional problem because it deals with society's social and economic aspects (Leder et al., 2020; F.-M. Tsai et al., 2021; Xiao et al., 2020). The yearly increase in the amount of waste generated is a phenomenon that needs serious handling. Waste management needs to be carried out comprehensively and integrated from upstream to downstream so that it provides economic benefits, is healthy for the community, is safe for the environment, and can change people's behavior (Kementerian Lingkungan Hidup dan Kehutanan, 2012; Leder et al., 2020; F.-M. Tsai et al., 2021).

One of the best practices that can be carried out that leads to sustainability is the waste bank (WB) system (Fatmawati et al., 2022; Ulhasanah & Goto, 2018). The WB provides benefits for collectors and administrators who can guide and motivate the behavior of all members of the waste bank. The administrators can also capture positive cooperation with the Government and other agencies in achieving sustainability goals (Fatmawati et al., 2022; Kristina, 2012; Ulhasanah & Goto, 2018; Wulandari et al., 2017).

A WB is a place for sorting and collecting recyclable or reusable waste with economic value (Fatmawati et al., 2022; Ulhasanah & Goto, 2018). Reduce, reuse, and recycle (3R) activities are all activities to reduce everything that can generate waste, reuse activities waste that is fit for use for the same function or other functions, and activities to

process waste for made into a new product (Kementerian Lingkungan Hidup dan Kehutanan, 2012).

The development of WB in Indonesia shows an increase every year. In 2016 there were 4,280 units recorded, increasing to 5,244 (2017) and 8,036 (2018) throughout Indonesia. This growth is expected to help control waste production, especially from domestic (Kementerian Lingkungan Hidup dan Kehutanan, 2022; Medcom.id, 2021).

WB provide economic benefits as well as social impacts for the community. Moreover, it acts as a social engineering process in waste management. WB are an option for implementation in the future (Fatmawati et al., 2022; Mitchell, B., Setiawan, B., dan Rahmi, 2007; Ulhasanah & Goto, 2018; Wulandari et al., 2017). The handling of WB is based on applying social capital, including trust, norms, networks, reciprocity, and values (Pargal et al., 1999; Yudiatmaja et al., 2021). Social capital and informal values provide opportunities for community involvement in solving waste problems. Social capital is an informal value that the community can achieve for collective purposes. Informal values are the glue that can maintain the cohesiveness of group members collectively. According to Kristina (2012), the maintenance of a community empowerment system by stakeholders is a key factor in the sustainability of the waste bank system.

Social capital is the relationships created and the norms that shape the quality and quantity of social relations in society in a broad spectrum, namely as a social link that keeps members of the community (nation) together (Anggraeni & Saikhu, 2021; Frick, JE., Eriksson, LT., Hallen, 2012; Fukuyama, 2000; Jones et al., 2011; Pargal et al., 1999, 2000; T. H. Tsai, 2008; Wulandari et al., 2017; Yudiatmaja et al., 2021). Social capital is transmitted through cultural mechanisms, such as religion, tradition, or historical customs (Fukuyama, 2000). The concept of social capital has been considered by research in various (multidisciplinary) fields in the last few decades. Social capital is a link in creating norms and trusts in network structures (Frick, JE., Eriksson, LT., Hallen, 2012). The implementation of community (economic) empowerment in many countries, including Indonesia, places too much emphasis on the role of natural capital and modern economic capital (such as human-made capital goods, technology, and management) but often ignores the social capital, such as institutions. In the case of social capital that relies on trust and expectations, someone who is considered honest and has a good reputation will be easier to get respect than individuals who do not have credibility, for example, in terms of getting credit (Mawardi, 2007).

Before there was a waste bank, the community had already developed a management system, namely TPS3R (Reuse, Reduce, and Recycle Waste Management Site). However, about 50% of TPS3R needs to run optimally (Kementerian Pekerjaan Umum, 2016). The presence of a WB creates an alternative option for reducing waste transported to landfill. The WB focuses on inorganic waste management, while the TPS3R focuses on organic waste. Future development should include self-management of inorganic and organic waste (Type 1), TPS3R (Type 2), and the merger of waste banks into TPS3R (Type 3).

Each alternative must be studied for its feasibility and implications regarding regulation, operations, technical institutions, financing, and public acceptance (Iswanto, 2016). The most optimal alternative is determined by Multi-Criteria Decision Analysis (MCDA), a decision-making method used to analyze the best alternative based on certain criteria/aspects (Kusumadewi, S., Hartati, S., Harjoko, A., 2006). The criteria to determine priority options include compliance with applicable regulations, availability of institutions/interested parties, technical operations, service efficiency, and community acceptance.

This study aims to determine the WB management problems related to its sustainability. It is used to regulate the main priorities and strategies needed to solve problems in WB management and the most optimal w development alternatives to be applied in the future.

## METHODS

This study is mixed-method research with a sequential exploration approach. It starts with a qualitative method followed by the quantitative one, and ends with an interpretation. The subjects used are 35 WB randomly selected from East Java, Central Java, West Java, and D.I. Yogyakarta. Primary data were obtained through in-depth interviews. The secondary data were from literature, scientific publications related to the WB, and related agencies such as the Cooperative and MSMEs and the Environmental Service.

This study uses the Analytic Network Process (ANP) because it allows easy identification, classification, and arrangement to influence output or decisions and allows interaction and feedback of elements inside and outside the cluster. According to Chen et al (2019), ANP is the most effective method for making multi-criteria diversity decisions. ANP is a mathematical theory that can analyze the influence of the assumption approach to solve complex problems (Chen et al., 2019; Kheybari et al., 2020; Niemira & Saaty, 2004). ANP technical analysis uses pairwise comparisons of project alternatives and criteria (Ascarya & Yumanita, 2011; Chen et al., 2019; Niemira & Saaty, 2004; Rusydiana & Devi, 2013). In the ANP network, the levels in AHP are called clusters which can have criteria and alternatives in them.

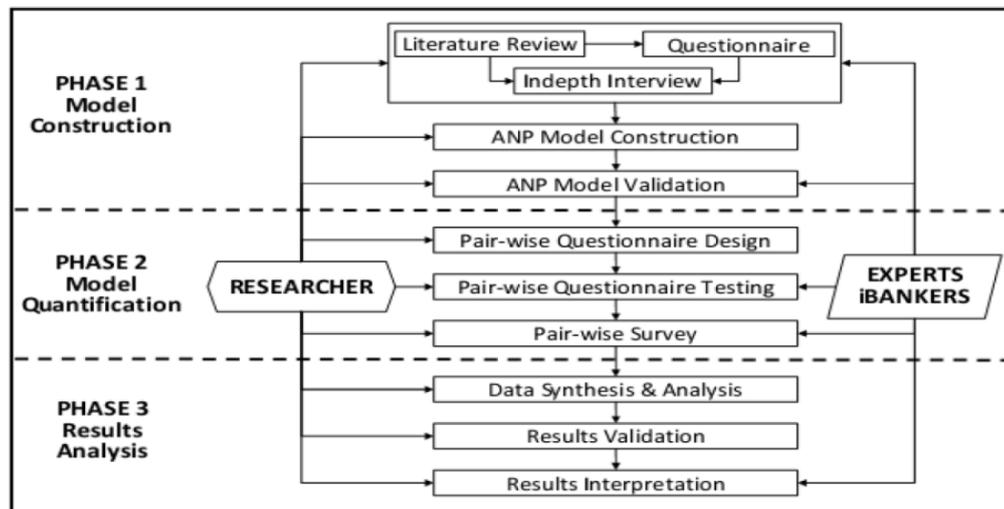


Figure 1. ANP steps (Ascarya & Yumanita, 2011; Rusydiana & Devi, 2013)

The three phases carried out in ANP are model construction, model quantification, and analysis of the results. Model construction includes 1) Literature review to review related literature. By this understanding, the literature review functions as a literature review on related issues; 2) In-depth interviews are the process of obtaining information for research purposes, with or without using an interview guide; 3) Questionnaires are data collection activities carried out by providing a set of questions or written statements to respondents; 4) Construction of the ANP model, compiled based on a review of theoretical and empirical literature and questions posed to experts and practitioners.

The quantification stage of the model uses questions in the ANP questionnaire in the form of pairwise comparisons

between elements in the cluster against respondents. The prepared questionnaire was then surveyed in advance by experts or practitioners to ensure the questions were fit for purpose. An expert is widely regarded as a trusted source of a particular technique or expertise whose gift is to judge and decide things correctly, precisely and understand the rules. This questionnaire's distribution is intended to determine which of the two has greater influence (more dominant) and how big the difference is through a numerical scale of 1-9. The third phase (synthesis and synthesis) brings all the parts together. The synthesis process is appropriate for generating decisions within the information constraints.

Community-based, government- and private-based sustainable waste bank development alternatives are assessed using the backcasting method. Each alternative is

assessed for feasibility from regulatory, institutional, technical, financing, and community acceptance. Select the most optimal development alternative using MCDA with the Simple Additive Weighting (SAW) method. The steps taken are:

- 1) Identifying goals and sets of decision alternatives. If there are n number of alternative decisions, then alternative data is written as  $A = \{A_i | i=1,2,\dots,n\}$
- 2) Identify a set of criteria (attributes). If there are k criteria, and can be written  $C = \{C_i | i=1,2,\dots,k\}$ . Then give the decision weight (w) on each criterion.
- 3) Develop a decision matrix and determine the suitability rating of each alternative on each criterion.

$$x = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \vdots & \vdots & & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{bmatrix}$$

; where  $X_{ij}$  is the rating of the I-th alternative criterion against the jth criterion

- 4) Carry out the ranking process by determining the preference value for each alternative ( $V_i$ ) using the equation:

$$V_i = \sum_{j=1}^n W_j r_{ij}$$

; where  $r_{ij}$  is the normalized performance rating of alternative  $A_i$  on  $C_i$  criteria;  $i = 1, 2, \dots$ , and  $j = 1, 2, \dots, n$

- 5) Choose the most optimal alternative based on the greatest  $V_i$  value.

## RESULTS AND DISCUSSION

### 1. Characteristic

This study was conducted in WB in East Java, Central Java, West Java, and D.I. Yogyakarta, with 35 waste banks with active (n=18) and inactive status (n=17).

Table 2 shows that the occupation of WB customers (N=680) is dominated by housewives (51.8%). The others are self-employed, civil and private employees, freelance, housemaids, farmers, retirees, traders, laborers, and teachers. WB customer education is dominated by customers with high school education (55.6%). Meanwhile, 26.4% finished elementary and junior high school, and 18.0% graduated from university. Based on income, most (57.1%) of WB customers have an income of less than 1 million.

**Table 1.**  
Waste Bank by located

No	Province	Inactive n (%)	Active n (%)	Total N (=35)
1	East Java	5 (50)	5 (50)	10
2	Central Java	6 (50.4)	5 (45.6)	11
3	DI Yogyakarta	5 (50)	5 (50)	10
4	West Java	2 (50)	2 (50)	4

**Table 2.**  
Waste bank customer characteristic

Profession	Inactive n (%)	Active n (%)	Total (N=680) n (%)
<b>Occupation</b>			
Self-employed	40 (14.1)	28 (7.1)	68 (10.0)
Civil and private employees	36 (12.7)	100 (25.3)	136 (20.0)
Housewife	156 (54.9)	196 (49.5)	352 (51.8)
Freelance	0 (0.0)	16 (4.0)	16 (2.4)
Housemaid	0 (0.0)	4 (1.0)	4 (0.6)
Farmer	24 (8.5)	8 (2.0)	32 (4.7)
Retires	0 (0.0)	24 (6.1)	24 (3.5)
Traders	8 (2.8)	8 (2.0)	16 (2.4)
Laborer	8 (2.8)	4 (1.0)	12 (1.8)
Teacher	12 (4.2)	8 (2.0)	20 (2.9)
<b>Education</b>			
Elementary school	40 (14.1)	34 (8.6)	74 (10.9)
Junior High School	46 (16.2)	60 (15.2)	106 (15.6)
Senior High School	176 (62.0)	202 (51.0)	378 (55.6)
Diploma	0 (0.0)	4 (1.0)	4 (0.6)
Bachelor	22 (7.7)	92 (23.2)	114 (16.8)
Masters	0 (0.0)	4 (1.0)	4 (0.6)
<b>Income</b>			
<1 million	2202 (71.1)	186 (47.0)	388 (57.1)
1-2 million	448 (16.9)	102 (25.8)	150 (22.1)
2-3 million	118 (6.3)	42 (10.6)	60 (8.8)
>3 million	116 (5.6)	66 (16.7)	82 (12.1)

## 2. Problem priority

The WB problem priority (Table 3) in the production facilities of an active waste bank is the limited access to sales of products, use of raw materials, and limited availability by 66.1%, 46.4%, and 19.6%, respectively. Meanwhile, inactive WB main priority problem is the limited availability of land, access to sale products, and raw materials used by 69.8%, 49.1%, and 30.2%.

Regarding marketing for active WB, limited market access occupied the greatest problem at 55.4%, followed by high price fluctuations and old unsold products at 44.6% and 25%. For inactive WB, limited market access, and unsold old

products, each occupied the main problems at 45.3%. The active WB capital shows a business relationship of 71.4%, followed by financial assistance and available manpower by 51.8% and 19.6%. Meanwhile, the priority problem for the inactive WB social capital component is the existence of financial assistance by 75.5%, followed by limited manpower and the existence of business relationships by 41.5% and 20.8%. For institutions, the priority problem is that the initiative of group members still needs to be higher at 41.1%, with weak managerial and inexperienced workers at 33.9% and 32.1%, respectively. Meanwhile, managerial weakness, low initiative, and lack of experience for inactive WB were 26.4%, 30.2%, and 79.2%.

**Table 3**  
**Waste bank problem priority**

No	Indicator	Active		Not Active	
		Yes n (%)	No. n (%)	Yes n (%)	No. n (%)
A	Production facilities				
	Are there any limited access to Sales ?	74 (66.1)	38 (33.9)	27 (50.9)	26 (49.1)
	Is the available land limited?	22 (19.6)	90 (80.4)	16 (30.2)	37 (69.8)
	Are the raw materials used limited	52 (46.4)	60 (53.6)	37 (69.8)	16 (30.2)
B	Marketing				
	Is market access limited?	62 (55.4)	50 (44.6)	29 (54.7)	24 (45.3)
	Are price fluctuations high?	50 (44.6)	62 (55.4)	31 (58.5)	22 (41.5)
	Is the old product not selling well?	28 (25.0)	84 (75.0)	29 (54.7)	24 (45.3)
C.	Waste Bank Capital				
	Is the available manpower limited?	22 (19.6)	90 (80.4)	22 (41.5)	31 (58.5)
	Is there financial assistance?	58 (51.8)	54 (48.2)	40 (75.5)	13 (24.5)
	Is there a business relationship?	80 (71.4)	32 (28.6)	11 (20.8)	42 (79.2)
D	Bank Institution				
	Is managerial still weak?	38 (33.9)	74 (66.1)	14 (26.4)	39 (73.6)
	Is experience and expertise still lacking?	36 (32.1)	76 (67.9)	42 (79.2)	11 (20.8)
	Is the initiative of group members still low?	46 (41.1)	66 (58.9)	16 (30.2)	37 (69.8)

## 3. Solution priority

Production facilities at an active WB indicate a joint product development (organic fertilizer) of 57.1%, provision of quality raw materials, and land in good condition by 73.2% and 26.8%. Meanwhile, in the inactive WB, product development (organic fertilizer) was 26.4%, the land was in good condition by 35.8%, and the provision of quality raw materials was 28.2%.

The priority of solutions inactive WB marketing is the existence of networks and information on the market by 73.2%, the handling of raw materials by 85.7%, and increased marketing to improve product quality and development by 76.8%. Inactive waste bank marketing indicates the existence of networks and information on the market by 41.5%, the handling of raw materials by 41.5%, and increased marketing product quality and development by 60.4%.

The priority of solutions for active WB capital shows that there is education for young people with a percentage of 85.7%, forming a Communication Forum by 80.4%, and creating a triple helix relationship between academics, business, and government at 76.8%. Meanwhile, in inactive WB, there is education for young people by 41.5%, with the Formation of Communication Forum by 39.6%, creating a triple helix relationship between academia, business, and government by 41.5%.

The priority of solutions in an active WB institution shows an increase in management capacity (ability) by 83.9%, which provides training and outreach to the workforce and the surrounding community by 89.3%.

Institutions increase the proactive action of the WB group members by 82.1%. Meanwhile, in an inactive WB, there was an increase in management capacity by 39.6%, training and workforce socialization in the surrounding community by 60.4%, with an increase in the WB group members' proactive action by 64.2%.

## 4. Strategy Priorities

The WB strategy priority (Table 5) shows the existing process used to strengthen production facilities, marketing, social capital, WB capital, and WB institutions by 82.1%, 80.4%, 82.1%, and 86%. Meanwhile, inactive WB have a strategy to strengthen production, marketing, WB capital and WB institutions by 28.3%, 32.1%, 41.5%, and 34%, respectively.

## 5. The weighting of the Waste Bank Solution

The results of the weighting of the WB solutions (Table 6) show that the main problems of the WB (sequentially) are institutions, capital, marketing, and production facilities. Three criteria in the institutional cluster (largest weight) are weak group initiative with a weight of 0.18 (rank 1), lack of experience and expertise with 0.18 (rank 2), and managerial weakness with 0.13 (rank 3).

The weights on the three criteria for the WB capital cluster (second largest) are business relationships (0.12), financial aid (0.08), and unlimited employment (0.06). The weights on the three marketing criteria are old-selling

products (0.05), price fluctuation (0.07), and market access (0.05). The smallest weight is in the production facilities

cluster, namely limited land (0.03), the raw material (0.03), and sales access (0.01).

**Table 4**  
**Waste bank solutions priority**

No	Indicator	Active	Not Active	Active	Not Active
		No. n (%)	Yes n (%)	No. n (%)	Yes n (%)
A	Production facilities				
	Is there a joint product development (organic fertilizer)?	48 (42.9)	64 (57.1)	39 (73.6)	14 (26.4)
	Is there a supply of quality raw materials?	40 (35.7)	72 (64.3)	28 (52.8)	25 (28.2)
	Is the land in good condition?	30 (26.8)	82 (73.2)	34 (64.2)	16 (35.8)
B	Marketing				
	Is there a network and information about the market?	30 (26.8)	82 (73.2)	31 (58.5)	22 (41.5)
	Is there any raw material handling?	16 (23.2)	96 (85.7)	31 (58.5)	22 (41.5)
	Can marketing improve product quality and development?	26 (23.3)	86 (76.8)	21 (39.6)	32 (60.4)
C	Waste Bank Capital				
	Is there education for young people?	16 (14.3)	96 (85.7)	31 (58.5)	22 (41.5)
	Is there a Communication Forum Establishment	22 (19.6)	90 (80.4)	32 (60.4)	21 (39.6)
	Is creating a triple helix relationship between academia, business and government.	26 (23.2)	86 (76.8)	31 (58.5)	22 (41.5)
D	Institutional				
	Is there an increase in management capacity (ability)?	18 (16.1)	94 (83.9)	32 (60.4)	21 (39.6)
	Does management provide training and socialization to the workforce and the surrounding community?	12 (10.7)	100 (89.3)	21 (39.6)	32 (60.4)
	Can institutions increase the proactive actions of members of the Waste Bank group?	20 (17.9)	92 (82.1)	19 (35.8)	34 (64.2)

**Table 5**  
**Waste bank strategy priority**

No	Indicator	Active		Inactive	
		No	Yes	No	Yes
		n (%)	n (%)	n (%)	n (%)
1	Is there a strategy to strengthen the means of production with social capital?	20 (17.9)	92 (82.1)	38 (71.7)	15 (28.3)
2	Is there a strategy to strengthen marketing with social capital ?	22 (19.6)	90 (80.4)	36 (67.9)	17 (32.1)
3	Is there a strategy to strengthen waste bank capital with social capital?	20 (17.9)	92 (82.1)	31 (58.5)	22 (41.5)
4	Is there a strategy to strengthen waste bank institutions with social capital?	26 (23.2)	86 (76.8)	35 (66.0)	18 (34.0)

**Table 6.**  
**The weighting of the Waste Bank Solution**

Cluster	Criteria	Value Weight	Rank
Production facilities	Sales access	0.01	12
	Raw material	0.03	11
	Limited land	0.03	10
Marketing	Market access	0.05	9
	Price fluctuation	0.07	8
	Old selling products	0.05	7
WB capital	Unlimited employee	0.06	6
	Financial aid	0.08	5
	Business relationship	0.12	4
Institutional	Weak manager	0.13	3
	Lack of Experience and Expertise	0.18	2
	Low group initiative	0.18	1

## 6. Aspects of Social Capital

We grouped each aspect of social capital into two categories. Furthermore, statistical analysis (Chi-square) was carried out to determine the relationship between social capital aspects and WB's status (active and inactive). The

analysis results (Table 7) show a significant relationship between network aspects and the activity of the WB (p-value = 0.0001). Likewise, the value aspect shows a significant relationship (p-value = 0.0001). Meanwhile, the other three aspects (trust, morality, and reciprocity) did not show a significant relationship.

**Table 7**  
**Aspects of Social Capital in Strengthening Waste Bank**

Aspects of Social Capital		Inactive n (%)	Active n (%)	p-value
Trust	Believe	264 (93.0)	347 (87.6)	0.510
	Unbelief	20 (7.0)	49 (12.4)	
Norm	Good	128 (45.1)	228 (57.6)	0.199
	Bad	156 (54.9)	168 (42.4)	
Network	A little	216 (76.1)	92 (23.1)	0.0001
	Much	68 (23.9)	304 (76.8)	
Reciprocity	Good	128 (45.1)	200 (50.5)	0.649
	Bad	156 (54.9)	196 (49.5)	
Value	Good	8 (2.8)	356 (89.9)	0.0001
	Bad	276 (97.2)	40 (10.1)	

**Table 8.**  
**Rule of institutional development**

Type I
a. Regulations are made by waste bank managers
b. The WB manager determines the institutional WB and is not integrated with TPS3R.
c. The infrastructure to support the WB is independent of TPS3R management.
d. The waste bank manager bears WB financing.
e. The manager carries out increasing community participation in the WB.
Type II
a. WB managers make TPS3R regulations.
b. The TPS3R institution follows the institutions made by the WB manager.
c. TPS3R infrastructure and activities are part of the WB management.
d. The WB manager bears the financing for TPS3R and the waste bank.
e. Increasing community participation in TPS3R and the WB is the responsibility of the WB manager.
Type III
a. The TPS3R manager makes the WB regulations.
b. The institutional WB follows the one made by the TPS3R manager.
c. The infrastructure and activities of the WB are part of the TPS3R management.
d. The TPS3R manager bears the financing for the WB and TPS3R.
e. Increasing community participation in TPS3R and the WB is the responsibility of the TPS3R manager.

**Table 9.**  
**Customer response to institutional development strategy**

Category	WB type I		WB type II		WB type III	
	Inactive n (%)	Active n (%)	Inactive n (%)	Active n (%)	Inactive n (%)	Active n (%)
Strongly Disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	1 (1.9)	0 (0.0)	3 (5.7)	14 (12.5)	1 (1.9)	28 (25.0)
Uncertain	9 (17.0)	2 (1.8)	12 (22.6)	14 (12.5)	33 (62.3)	38 (33.9)
Agree	32 (60.4)	86 (76.8)	35 (66.0)	74 (66.1)	17 (32.1)	36 (32.1)
Strongly agree	11 (20.8)	24 (21.4)	3 (5.7)	10 (8.9)	2 (3.8)	10 (8.9)

**7. Customer response to institutional development strategy**

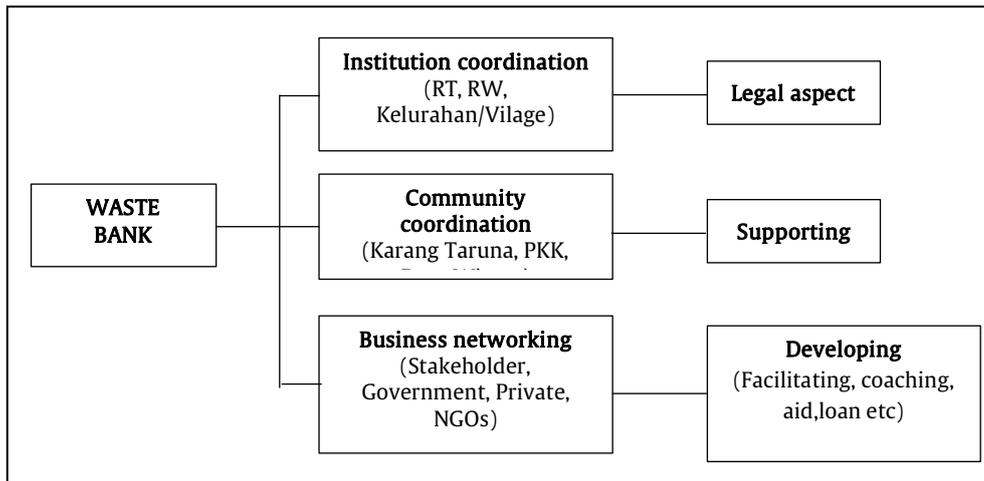
Customer response was assessed for three types of WB, namely independent WB (Type I), TPS3R part of WB (type II), and WB part of TPS3R (Type III). While the rules that will be applied in institutional development are presented in Table 8.

Type I, the results of active WB customers' assessment of rule points are agreed (81.2%), doubtful (17.0%), and disagree (1.9%). Meanwhile, WB active customers responded in agreement (98.2%) and undecided (1.8%). Most active and inactive WB customers agree with Type II development, amounting to 71.7% and 75.0%.

Different results were seen in responses to the development of WB type III. Inactive WB, 35.9% agreed, 62.3%

were undecided, and 1.9% disagreed. Active WB subscribers agreed (41.0%), doubted (33.9%), and disagreed (25.0%).

Generally, waste banks are established as associations and still need legal status. Therefore, efforts must be made to comply with established regulations for development. According to the Regulation of the Minister of Environment Number 13 of 2012, every WB must be a legal entity. Legal entities can take the form of cooperatives or foundations. Independent waste management (such as a waste bank at the village level) needs to be established according to the community's wishes through a mutual agreement. Furthermore, coordination was carried out with government agencies, the community, and the business networking to create integrated waste management (Fig 1).



**Figure 1: Waste Bank Coordination Flow with Others Institutions**

The WB was developed to change the behavior of residents in managing waste (including burning, littering, collection, and disposal) into a system that sorts and stores waste. Social capital needs to be continuously developed to impact all levels of society to improve waste management broadly. According to Winarso & Larasati (2011), in the early stages of the innovation cycle, the situation in community groups still needs to improve, so large external support is needed for the initiators of these innovations.

Social capital started from the community. Meanwhile, developing a waste bank requires financing to ensure its sustainability. Funding can come from the government or the private sector. So to ensure the sustainability of the waste bank, three pillars of cooperation are needed: the community with its social capital, the government, and the private sector.

Apart from providing services to save waste from the community, recycling is also implemented in handicraft products. Some of the obstacles faced are limited market access. Thus, it is necessary to strengthen the production process through recycled crafts for development.

To increase existing production, waste banks need infrastructure. The product produced by the waste bank at the research location is segregated waste stored by the community. Based on the interview results, it is known that waste management is limited to inorganic products due to the limited number of machines used to process organic waste. According to Suwerda et al (2019) and Handoyo et al (2020), the potential for reducing waste with waste banks is still small, both in urban areas (7%) and rural areas (5%). Limited production facilities influence the low level of waste management.

The results of this study indicate that managers and customers need to form independent waste banks in the future. Its development is an alternative solution to Indonesia's waste problem, carried out by the community as the leading actor.

From a technical point of view, the waste bank manager conducts counseling on waste sorting and storage. At the same time, the independent ones need sufficient capital to run a community-based waste bank management scheme. Furthermore, to implement an independent waste bank, it is appropriate to produce two zoning systems: independent waste banks in rural and urban areas.

## CONCLUSIONS AND SUGGESTIONS

There are three main problems in waste bank management, namely institutional (proactive community, training, outreach, and capacity building), capital (triple helix, youth education, and communication forums), and marketing (product sales, fluctuating prices, and market access). For this reason, countermeasures are needed through social capital-based institutional strengthening strategies, especially in networking and trust. The involvement of the government and NGOs is needed to improve waste bank management and encourage the development of an independent waste bank model through institutional strengthening, capital, and marketing.

## ACKNOWLEDGMENT

The authors would like to thank Badan Pengembangan dan Pemberdayaan SDM Kesehatan Kementerian Kesehatan, facilitators, all participants, and those involved in this research.

## ETHICAL CONSIDERATIONS

### Funding Statement

This study was funded by Badan Pengembangan dan Pemberdayaan SDM Kesehatan Kementerian Kesehatan.

### Conflict of Interest Statement

The authors declared that they have no conflict of interests.

## REFERENCES

Anggraeni, I. J., & Saikhu, M. (2021). The Effect of Social Capital on the Sustainability of the Waste Bank Program in Bondowoso Regency. *Natural Volatiles and Essential Oils*, 8(5), 2305–2316.

- Ascarya, A., & Yumanita, D. (2011). Determinan Dan Persistensi Margin Perbankan Konvensional Dan Syariah di Indonesia. *JEBI: : Jurnal Ekonomi Dan Bisnis Islam*, 1(1), 1–33.
- Bruno, M., Abis, M., Kuchta, K., Simon, F.-G., Grönholm, R., Hoppe, M., & Fiore, S. (2021). Material flow, economic and environmental assessment of municipal solid waste incineration bottom ash recycling potential in Europe. *Journal of Cleaner Production*, 317, 128511. <https://doi.org/10.1016/j.jclepro.2021.128511>
- Chen, Y., Jin, Q., Fang, H., Lei, H., Hu, J., Wu, Y., Chen, J., Wang, C., & Wan, Y. (2019). Analytic network process: Academic insights and perspectives analysis. *Journal of Cleaner Production*, 235, 1276–1294. <https://doi.org/10.1016/j.jclepro.2019.07.016>
- Fatmawati, F., Mustari, N., Haerana, H., Niswaty, R., & Abdillah, A. (2022). Waste Bank Policy Implementation through Collaborative Approach: Comparative Study–Makassar and Bantaeng, Indonesia. *Sustainability*, 14(13), 7974. <https://doi.org/10.3390/su14137974>
- Fedotkina, O., Gorbashko, E., & Vatolkina, N. (2019). Circular Economy in Russia: Drivers and Barriers for Waste Management Development. *Sustainability*, 11(20), 5837. <https://doi.org/10.3390/su11205837>
- Frick, J.E., Eriksson, L.T., Hallen, L. (2012). Effects of Social Capital on Processes in A Regional Strategic Network. *Management Industrial Marketing* 41, 800–806.
- Fukuyama, F. (2000). *Social capital and Civil society*.
- Handoyo, E., Setyowati, D. L., & Nurkomalasari, D. (2020). Social capital contribution and community-based waste management in the city of Cirebon. *International Journal of Innovation, Creativity and Change*, 11(2), 93–113.
- Iswanto. (2016). *Identifikasi Sampah Bahan Berbahaya Beracun (B3) Rumah Tangga dan Alternatif Pengelolaannya di Kabupaten Sleman*. Sekolah Pasca Sarjana Universitas Gadjah Mada Yogyakarta.
- Jones, N., Halvadakis, C. P., & Sophoulis, C. M. (2011). Social capital and household solid waste management policies: A case study in mytilene, greece. *Environmental Politics*, 20(2), 264–283. <https://doi.org/10.1080/09644016.2011.551032>
- Kementerian Lingkungan Hidup dan Kehutanan. (2012). *Peraturan Menteri Negara Lingkungan Hidup Republik Indonesia Nomor 13 Tahun 2012 Tentang Pedoman Pelaksanaan Reduce, Reuse, Dan Recycle Melalui Bank Sampah* (Vol. 53, Issue 9).
- Kementerian Lingkungan Hidup dan Kehutanan. (2022). *Sistem Informasi Pengelolaan Sampah Nasional*. <https://sipsn.menlhk.go.id/sipsn/>
- Kementerian Pekerjaan Umum. (2016). Kebijakan dan Strategi Penanganan Sampah dengan Konsep 3R (Reduce-Reuse-Recycle) Berbasis Masyarakat. *Disampaikan Pada Kegiatan Penguatan Kapasitas (TOT) Pendukung TPS 3R*.
- Kheybari, S., Rezaie, F. M., & Farazmand, H. (2020). Analytic network process: An overview of applications. *Applied Mathematics and Computation*, 367, 124780. <https://doi.org/10.1016/j.amc.2019.124780>
- Kristina, 2012. (2012). *MODEL KONSEPTUAL UNTUK MENGUKUR ADAPTABILITAS BANK SAMPAH DI INDONESIA*.
- Kubota, R., Horita, M., & Tasaki, T. (2020). Integration of community-based waste bank programs with the municipal solid-waste-management policy in Makassar, Indonesia. *Journal of Material Cycles and Waste Management*, 22(3), 928–937. <https://doi.org/10.1007/s10163-020-00969-9>
- Kurniawan, T. A., Avtar, R., Singh, D., Xue, W., Dzarfan Othman, M. H., Hwang, G. H., Iswanto, I., Albadarin, A. B., & Kern, A. O. (2021). Reforming MSWM in Sukunan (Yogyakarta, Indonesia): A case-study of applying a zero-waste approach based on circular economy paradigm. *Journal of Cleaner Production*, 284, 124775. <https://doi.org/10.1016/j.jclepro.2020.124775>
- Kusumadewi, S., Hartati, S., Harjoko, A., & W. (2006). *Fuzzy Multi-Attribute Decision Making (Fuzzy MADM)*. Graha Ilmu.
- Leder, N., Kumar, M., & Rodrigues, V. S. (2020). Influential factors for value creation within the Circular Economy: Framework for Waste Valorisation. *Resources, Conservation and Recycling*, 158, 104804. <https://doi.org/10.1016/j.resconrec.2020.104804>
- Mawardi. (2007). Peranan Sosial Capital Dalam Pemberdayaan Masyarakat Komunitas. *Jurnal Pengembangan Masyarakat Islam, Volume 3 N*.
- Medcom.id. (2021). KLHK: Pengelolaan Sampah Indonesia Berkembang Signifikan. *Medcom*. <https://www.medcom.id/nasional/peristiwa/eN4Z6r2k-klhk-pengelolaan-sampah-indonesia-berkembang-signifikan>
- Meidiana, C. (2010). Development of Waste Management Practices in Indonesia. *European Journal of Scientific Research*, 40(2), 199–201.
- Mitchell, B., Setiawan, B., dan Rahmi, D. H. (2007). *Pengelolaan Sumberdaya dan Lingkungan*. Gadjah Mada University Press.
- Niemira, M. P., & Saaty, T. L. (2004). An Analytic Network Process model for financial-crisis forecasting. *International Journal of Forecasting*, 20(4), 573–587. <https://doi.org/10.1016/j.ijforecast.2003.09.013>
- Pargal, S., Huq, M., & Gilligan, D. (1999). *Social Capital In Solid Waste Management: Evidence From Dhaka, Bangladesh* (No. 16; Social Capital Initiative, Issue 16). <http://www.worldbank.org/socialdevelopment>,
- Pargal, S., Huq, M., & Gilligan, D. (2000). *Private Provision of a Public Good: Social Capital and Solid Waste Management in Dhaka, Bangladesh*. Washington, DC: World Bank, Latin America and the Caribbean Region, Private Sector Cluster, [2000]. <https://doi.org/10.1596/1813-9450-2422>
- Priti, & Mandal, K. (2022). Review on evolution of municipal solid waste management in India: practices, challenges and policy implications. *Journal of Material Cycles and Waste Management*, 24(5), 2088–2088. <https://doi.org/10.1007/s10163-022-01444-3>
- Rusyiana, A. S., & Devi, A. (2013). Challenges in developing Baitul Maal Wat Tamwil (BMT) in Indonesia using analytic network process (ANP). *Business and Management Quarterly Review*, 4(2), 51–62.
- Suwerda, B., Hardoyo, S. R., & Kurniawan, A. (2019). Pengelolaan Bank Sampah Berkelanjutan di Wilayah Perdesaan Kabupaten Bantul. *Jurnal Sains & Teknologi Lingkungan*, 11(1). <https://doi.org/10.20885/jstl.vol11.iss1.art6>
- Tsai, F.-M., Bui, T. D., Tseng, M.-L., Lim, M. K., Wu, K.-J., & Mashud, A. H. M. (2021). Assessing a hierarchical sustainable solid waste management structure with qualitative information: Policy and regulations drive social impacts and stakeholder participation. *Resources, Conservation and Recycling*, 168, 105285. <https://doi.org/10.1016/j.resconrec.2020.105285>
- Tsai, T. H. (2008). The impact of social capital on regional waste recycling. *Sustainable Development*, 16(1), 44–55. <https://doi.org/10.1002/sd.326>

- Ulhasanah, N., & Goto, N. (2018). Assessment of citizens' environmental behavior toward municipal solid waste management for a better and appropriate system in Indonesia: a case study of Padang City. *Journal of Material Cycles and Waste Management*, 20(2), 1257–1272. <https://doi.org/10.1007/s10163-017-0691-4>
- Wilson, D. C. (2007). Development drivers for waste management. *Waste Management & Research: The Journal for a Sustainable Circular Economy*, 25(3), 198–207. <https://doi.org/10.1177/0734242X07079149>
- Winarso, H., & Larasati, A. (2011). *Dari Sampah Menjadi Upah: Inovasi Pengolahan Sampah di Tingkat Akar Rumput Kasus Program Bank Sampah 'Sendu' Di Kelurahan Pasar Minggu Jakarta Selatan*. 18(1), 43–59. <https://doi.org/https://doi.org/10.22146/jml.18435>
- Wulandari, D., Utomo, S. H., & Narmaditya, B. S. (2017). Waste Bank: Waste Management Model in Improving Local Economy. *International Journal of Energy Economics and Policy*, 7(3), 36–41.
- Xiao, S., Dong, H., Geng, Y., Francisco, M.-J., Pan, H., & Wu, F. (2020). An overview of the municipal solid waste management modes and innovations in Shanghai, China. *Environmental Science and Pollution Research*, 27(24), 29943–29953. <https://doi.org/10.1007/s11356-020-09398-5>
- Yudiatmaja, W. E., Edison, Samnuzulsari, T., Yudithia, Rezeki, S. R. I., Suyito, Akbar, D., & Alfiandri, A. (2021). Reducing solid waste through waste banks: an empirical study in Kepulauan Riau, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 755(1), 012076. <https://doi.org/10.1088/1755-1315/755/1/012076>