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Implementation of Inorganic and Organic Waste Reduction Methods to Improve Public Environmental Awareness

Ira Dwi Hertwi^{1*)}; Rosalendro Eddy Nugroho²⁾

¹⁾iradwihertwi@gmail.com, Universitas Mercu Buana, Indonesia

²⁾rosalendro.eddy@mercubuana.ac.id, Universitas Mercu Buana, Indonesia

^{*)} Corresponding Author

ABSTRACT

This study aims to determine the factors contributing to the suboptimal waste reduction in the neighborhood unit (RW) 04, North Tanjung Duren Village, Grogol Petamburan District, and to identify the actions and methods used to maximize waste reduction in the neighborhood unit (RW) 04. Focus Group Discussion (FGD) was used for data collection. Data analysis used the 3R method, referring to Governor Regulation Number 77 of 2020 concerning Waste Management within the Neighborhood Association (RTA). Root Cause Analysis (RCA) was used to analyze the factors causing the suboptimal waste reduction. The tools used in the Root Cause Analysis (RCA) are why-why analysis and fishbone diagrams. The 3R method (Reduce, Reuse, Recycle) is a useful strategy for efficient and more effective independent waste management within the neighborhood association (RTA). It adheres to the principles of environmental sustainability. Based on the research results, the neighborhood of RW 04, Tanjung Duren Utara Village, Grogol Petamburan District, has succeeded in reducing inorganic waste independently through the Rambutan RW 04 Waste Bank. However, the neighborhood of RW 04, Tanjung Duren Utara Village, Grogol Petamburan District, for reducing organic waste has not been done independently so that it still requires assistance from the RW 03 TDU Sub-district TPS Dipo Officer to manage organic waste from RW 04 using the BSF maggot bio-conversion method.

Keywords: *Constraining Factors to Waste Reduction; Waste Management; 3R method; Reduce; Reuse; Recycle; BSF Maggot Bioconversion.*

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INTRODUCTION

As the population of Jakarta increases, the amount of waste generated will also increase, making the waste problem in Jakarta a polemic environmental issue that is important to address. According to Law Number 18 of 2008 Article (1) concerning waste management, it is stated that waste comes from the remains of daily human activities or natural processes in the form of organic or inorganic materials in solid or semi-solid form that are decomposable or non-decomposable and are disposed of in an environment that is no longer used (Agina Naomi, 2020; Akhmad Affandi, 2015; Hendra Fridolin Ananda Sudater Siagian, 2022; and Nur Ismi, 2020). Based on data from the National Waste Management Information System (SIPSN), waste generation increases every year. The following table shows waste generation in West Jakarta in the last 3 years, namely 2022 to 2024:

Table 1. Data on Waste Generation in West Jakarta City Administration, which experienced an increase in 2022 to 2024

Year	Daily Waste Generation (tons)	Annual Waste Generation (tons)
2022	2,023.42	738,547.77
2023	2,049.69	748,135.30
2024	2,076.32	757,857.05

The table above shows an increase in waste generation in West Jakarta City during the 2022-2024 period. According to data from the National Waste Management Information System (SIPSN), food waste dominated the composition of waste in West Jakarta City in 2020, accounting for 69.77%. Therefore, this study focuses on waste reduction, focusing on the implementation of waste reduction methods to increase environmental awareness in the community. In practice, waste management, particularly in the Grogol Petamburan District, has not been optimally implemented. The following data shows waste reduction data from January to March 2024 from each TPS (landfill sites) in Grogol Petamburan District:

Table 2. Waste Reduction 2024

No.	Name TPS 3R	Quarterly 1		
		January	February	March
1	TPS Arjuna Rw. 02	13.01	13.01	13.01
2	TPS Makaliwe Rw. 07	8.35	8.35	8.35
3	TPS TDU Rw. 03	7.41	7.41	7.41
4	TPS TDS Rw. 07	12.08	12.08	12.08
5	TPS Indraloka Rw. 06	11.87	11.87	11.87

Based on the graph above, the waste generated by ADM City, West Jakarta, in 2023 was 2,049.69 tons/day. Therefore, it can be assumed that waste generation in each sub-district within ADM City, West Jakarta, in 2023 was approximately 256.21 tons/day.

Compared to the total reduction data at each TPS (landfill sites) in the Grogol Petamburan sub-district, which was 157.55 tons/day in the first quarter of 2024, the first quarter of Grogol Petamburan sub-district's waste reduction was almost equivalent to the assumed daily waste generation in 2023 of 256.21 tons. This is due to the less than optimal waste reduction efforts. The progress of waste reduction in Grogol Petamburan sub-district, however, is not significant. The graph above demonstrates the fluctuating trend, with increases and decreases. Raising public awareness of waste management offers a significant opportunity to reduce waste in the

environment, particularly in neighborhood association (RW) 04, North Tanjung Duren Village, using the "reduce, reuse, recycle" (3R) approach.

In accordance with Jakarta Gubernatorial Regulation No. 77 of 2020 concerning Waste Management within the Neighborhood Association (RW) scope, increasing active community participation in waste management at the source is crucial to achieving the target of reducing and managing household waste and household-like waste in the Special Capital Region of Jakarta.

The suboptimal waste reduction is evident in the management of organic waste (such as composting, bio-conversion with BSF maggots, etc.) and inorganic waste (such as having a waste bank) compared to the tonnage reduction achieved within the neighborhood association using the 3R method.

The 3R method is an effective way to manage waste. This principle aims to reduce the amount of waste generated and reuse recyclable waste. The 3R method is crucial in waste management. However, its implementation must be consistent and continuous. Thus, in addition to reducing waste using the 3R method and striving to increase environmental awareness in the community, this study also analyzed the factors contributing to the suboptimal reduction of organic and inorganic waste using root cause analysis. Root cause analysis includes why-why analysis and fishbone diagrams (Kuswardana, Mayangsari, & Amrullah, 2017).

LITERATURE REVIEW

Waste

According to Law Number 18 of 2008, Article (1) defines waste as the residue of daily activities produced by each person and/or natural processes that produce waste. According to Law Number 18 of 2008, Article (2), waste managed under this Law consists of:

1. Household waste originates from daily household activities, excluding feces and specific waste.
2. Household-like waste originates from commercial areas, industrial areas, special areas, social facilities, public facilities, and/or other facilities.
3. Specific waste includes waste containing hazardous and toxic materials, waste containing hazardous and toxic waste, waste resulting from disasters, building demolition debris, waste that cannot yet be processed technologically, and/or waste that is generated irregularly.
4. Residual waste is other types of waste that don't decompose easily and requires special management. Examples of this type of waste include Styrofoam, diapers, sanitary napkins, cigarette butts, and used tissue.

METHOD

Research Time

In this study, the authors took samples from RW 04, North Tanjung Duren Village, Grogol Petamburan District. The study was conducted from early January 2024 to December 2024.

Research Design

In this study, the author used a research design with a qualitative methodology. Qualitative research is descriptive research and tends to use an inductive analysis approach. Where in qualitative research, the process and perspective of the subject are more emphasized. While the theoretical basis in qualitative research is used as a guide so that the focus of the research is in accordance with the facts in the field, the theoretical basis is also useful for providing an overview of the background of the research and as material used in the discussion of the research results. The qualitative descriptive method is a method that describes, describes, and explains the actual events of the object being studied based on the situation and conditions when the research was conducted (Sugiyono, 2017).

Operationalization of Research Variables

An operational definition is a specification of the researcher's activities in measuring or manipulating a variable. An operational definition defines the meaning of a variable (Priadana & Sunarsi, 2021). The operationalized variables are all variables contained in this study, consisting of organic waste management, inorganic waste management, and waste management constraints. The operational definitions of these three variables are as follows:

1. Organic waste management is the main component of this study to maximize organic waste reduction at the neighborhood unit (RW) level and to optimize the reduction of organic waste generated. Furthermore, inorganic waste management is one of the main components of this study to maximize inorganic waste reduction at the neighborhood unit (RW) level and to optimize the reduction of inorganic waste generated. This is achieved through the RW 04 waste bank, specifically the RW 04 rambutan waste bank, which purchases scrap collected by residents. The scrap is then sold to the BSI (Main Waste Bank) provided by the West Jakarta Environmental Agency (Sudin Lingkungan Hidup), which has collaborated with a third party to manage (Recycle) the inorganic waste.
2. Obstacles to waste management that arise in the neighborhood after implementing inorganic and organic waste reduction activities. In this study, the dimensions used to measure obstacles to organic waste management and find solutions to these obstacles are limited to three dimensions: material, method, and environment. Likewise, obstacles to inorganic waste management and finding solutions to these obstacles are limited to three dimensions: man, machine, and environment.

Research Population and Sample

According to Sugiyono (2019), a population is a generalization of an area consisting of objects/subjects that have certain qualities and characteristics determined by the researcher to be studied and then conclusions drawn. The population in this study was all members of the waste management team in the RW 04 neighborhood of North Tanjung Duren sub-district. The sampling technique used in this study is purposive sampling. Purposive sampling allows researchers to focus on the groups or individuals most relevant to the research objectives, resulting in richer and more specific information. However, its highly subjective nature can make the results difficult to generalize. In this case, the researchers sampled four out of 20 individuals who were both members and customers.

Data Collection Technique

Data collection techniques using primer data and secondary data. Primer data is focus group discussion with using why-why analysis and fishbone diagram as well as secondary data is existing data of document and results of observations.

Data Analysis Methods

The data analysis techniques used in this research include:

1. Root Cause Analysis (RCA). The tools used in Root Cause Analysis (RCA) are why- why analysis and fishbone diagrams.
2. 3R Method, Referring to Gubernatorial Regulation Number 77 of 2020 concerning Waste Management at the Neighborhood Unit Level. According to Article (3) of Gubernatorial Regulation Number 77 of 2020 concerning Waste Management within the Neighborhood Association (RW) concerning the Scope of Management, the Waste Management Sector within the RW (RW) consists of the following activities:
 - a. Waste Reduction, namely by limiting waste generation (reduce), recycling, and reusing.
 - b. Waste Management, namely monitoring waste sorting, waste management, and waste residue collection. In this study, RW 04, North Tanjung Duren Village, has implemented waste reduction, particularly inorganic waste, using the 3R method. The explanation is as follows:
 - 1) Reduce (limiting waste generation): Residents of RW 04, North Tanjung Duren Village, have used eco-friendly bags when shopping at supermarkets and minimarkets to reduce plastic waste.
 - 2) Recycle (waste recycling), namely residents of RW 04, Tanjung Duren Utara Village have recycled by sorting inorganic waste and selling it to the Rambutan waste bank, then selling it back to the main waste bank provided by the West Jakarta Environmental Agency, which has collaborated with a third party to manage inorganic waste.
 - 3) Reuse (reuse), namely residents of RW 04, Tanjung Duren Utara Village have reused Le Minerale gallons turned into flower pots and used 5L paint buckets reused into trash cans.

RESULTS AND DISCUSSION

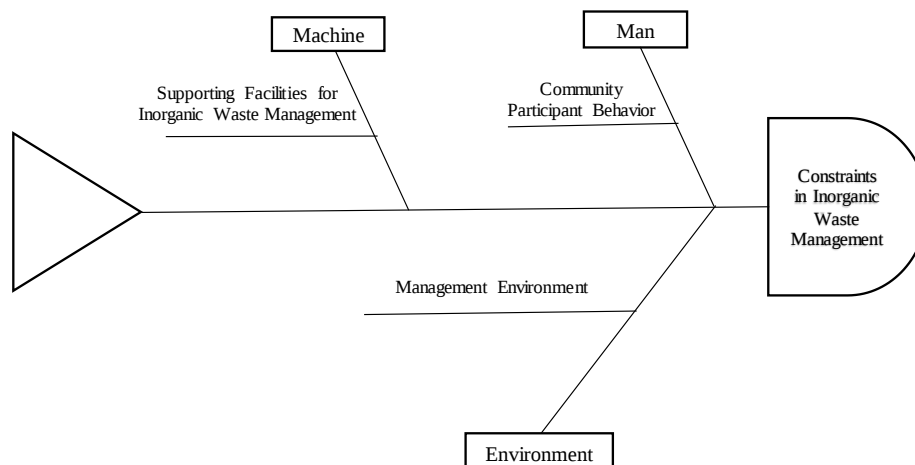
Results

Inorganic Waste Management

Inorganic waste management involves residents sorting waste that still has economic value, such as used bottles, cans, and so on. After collecting the waste, residents can exchange it at the Rambutan RW 04 waste bank. The waste is weighed and then exchanged for cash.

During direct field observations, obstacles to inorganic waste management in RW 04, Tanjung Duren Utara Village, Grogol Petamburan District, were identified, analyzed using the 5M + 1E principle. Based on the results of the field analysis conducted with parties involved in waste management in RW 04, only 2M + 1E principles were found; Men (Community Participatory Behavior), Machines (Supporting facilities for inorganic waste management) and Environment (Management environment).

Figure 1. Fishbone Diagram of Factors Contributing to Less than Optimal Inorganic Waste Reduction



The most significant sub-causes were then further analyzed using a why-why analysis, asking five questions to identify the root cause of the problem. The results of the why-why analysis can be seen in the table below.

Table 3. Results of Why-why Analysis on Factors Causing Less Than Optimal Reduction of Inorganic Waste

Sub-Cause	Why 1	Why 2	Why 3	Why 4	Why 5
Man	Community participation behavior	Residents are afraid of being ostracized when managing inorganic waste	Residents do not want to manage inorganic waste because they feel they have already paid cleaning fees.	Residents have not seen any real benefits in managing inorganic waste	
Machine	Supporting facilities for inorganic waste management	Resip'dents who feel burdened with waste management	The ignorance of inorganic waste management members that they can write (application letter)	Lack of communication with 3R officers from the Gropet task force (you can ask via WhatsApp during working hours)	
Environment	Management environment	Inadequate equipment and supplies such as scales, customer passbooks, trash sacks/plastic bags, etc.	Inorganic waste management area behind the RPTRA building	In RW 04, North Tanjung Duren Subdistrict is densely populated	

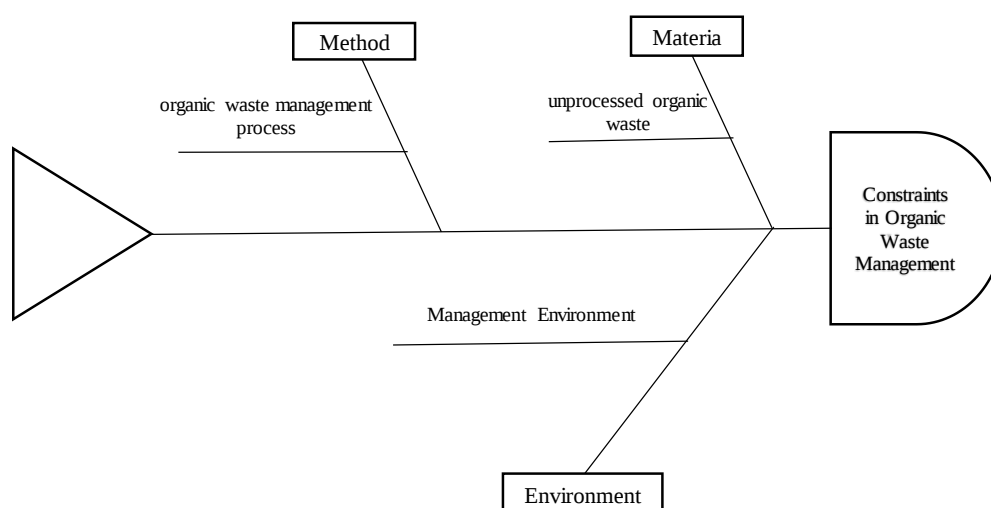
Organic Waste Management

Organic waste management involves residents sorting waste, such as food scraps and other easily biodegradable waste. These waste are then managed effectively through composting, eco-enzymes, biopores, BSF/maggot bioconversion, and other methods.

In this case, residents of RW 04, North Tanjung Duren Village, do not yet have an organic waste management system. However, they do sort their organic waste, which is then transported by cart operators to be disposed of or reused as maggot feed at TPS 3R, RW 03, North Tanjung Duren Village. Consequently, organic waste reduction is not yet effective. It would be more effective if RW 04 also had its own organic waste management system.

During direct field observations, obstacles to organic waste management in RW 04, North Tanjung Duren Village, Grogol Petamburan District, were identified, analyzed using the 5M + 1E principle. Based on the results of the field analysis with parties involved in waste management in RW 04, only 2M + 1E principles were found; Material (Processed Component), Method (Method used) and Environment (Management environment).

Figure 2. Fishbone Diagram of Factors Contributing to Less than Optimal Organic Waste Reduction



The most significant sub-causes were then further analyzed using a why-why analysis, asking five questions to identify the root cause of the problem. The results of the why-why analysis can be seen in the table below.

Table 4. Results of Why-why Analysis on Factors Causing Less Than Optimal Reduction of Organic Waste

	Sub-Cause	Why 1	Why 2	Why 3	Why 4	Why 5
Material	unprocessed organic waste	Organic wasterots easily	Organic waste contains water in it	Organic waste can produce leachate	Organic waste produces an unpleasant odor	

	Sub-Cause	Why 1	Why 2	Why 3	Why 4	Why 5
Method	Organic waste management process	The management process takes a long time	Complex management process	Requires regular monitoring and requires operational costs.		
Environment	Management Environment	There is no place to manage organic waste	In RW 04, North Tanjung Duren Subdistrict is densely populated			

Discussion

Inorganic Waste Management

After identifying the root causes of the three factors suspected of causing the suboptimal reduction of inorganic waste, corrective actions can be taken to address these issues and optimize future reductions. Some corrective actions that can be taken to address these root causes include:

1. Man

Community participation behavior: Members are more active in coordinating inorganic waste management so that residents can see the benefits of independently managing inorganic waste, such as additional income. This will motivate residents to manage their inorganic waste independently.

2. Machine

Supporting facilities for inorganic waste management: Members of the inorganic waste management committee can write to the Grogol Petamburan District Environmental Implementation Unit to detail what is needed, as the government provides several tools/equipment needed for inorganic waste management, such as scales and customer passbooks. For waste sacks or plastic bags, you can usually pick them up directly from the Main Waste Bank, as they will be returned by the supplier. Coordination with the 3R officers of the Gropet District Environmental Management Unit is essential.

3. Environment

Lack of available inorganic waste storage facilities: Sewing sacks into containers for inorganic waste and arranging them neatly can effectively utilize the limited space and inorganic waste management personnel can coordinate with 3R officers to schedule the collection of inorganic waste when it is full, to be sold to the Main Waste Bank (BSI) to free up storage space.

After repair inorganic waste management, with active and consistent members, can encourage greater participation from residents in RW 04, North Tanjung Duren Village, to manage inorganic waste independently. Residents who feel proud to manage inorganic waste independently are encouraged to participate.

Based on direct observations in RW 04, North Tanjung Duren Village, Grogol Petamburan District, inorganic waste management has been carried out consistently through the Rambutan

Waste Bank program. The following data shows inorganic waste reduction from January 2023 to December 2024:

Table 5. Inorganic Waste Reduction Data

	Month	Plastic	Paper	Metal	Mixed	Glass	Total	Total Revenue
2023	Januari	219	781	2	10	0	1012	Rp 2,180,800
	February				No weighing			
	March	378.5	622	55.2	66	90	1211.7	Rp 2,666,650
	April				No weighing			
	May				No weighing			
	Juni	291	653	19	16	73	1052	Rp 2,340,650
	July	268	489	28			785	Rp 1,780,000
	August	318	427	14	11	58	828	Rp 1,934,200
	September				No weighing			
	October	270	392	98	6		766	Rp 1,885,300
	November	309	358	62	12	75	816	Rp 1,890,150
	December				No weighing			
	Total/ Tahun	2054	3722	278.2	121	296	6471	Rp 14,677,750
	Month	Plastic	Paper	Metal	Mixed	Glass	Total	Total Revenue
2024	January	423.5	880	104	42	20	1469	Rp 3,822,300
	February	188	771	57	0	0	1016	Rp 2,634,900
	March	436	622	132	4	41	1235	Rp 3,625,950
	April				No weighing			
	May	232	502	104			838	Rp 2,542,200
	June	257	449	81	6	49	842	Rp 2,679,350
	July	190.5	357	71		10	629	Rp 2,083,500
	August	249.5	393.5	90			733	Rp 2,419,350
	September	321.5	498	74	2		896	Rp 2,938,700
	October	242	399	56		62	759	Rp 2,371,600
	November	277.5	321	77			676	Rp 2,524,200
	December	369.5	392	75	2		839	Rp 3,004,400
	Total/ Tahun	3187	5585	921	56	182	9930	Rp 30,646,450

Based on the table above, in the neighborhood of RW 04, North Tanjung Duren Village in 2024, the intensity of weighing to BSI was more routine than in 2023. And it has succeeded in increasing the reduction of inorganic waste in 2024 by 9,930 kg from 6,471 kg in 2023. And the neighborhood of RW 04, Tanjung Duren Utara Village succeeded in increasing the utilization or generating economic value from inorganic waste by Rp 30,646,450,- in 2024 from Rp 14,677,750,- in 2023.

Organic Waste Management

Organic waste management in RW 04, North Tanjung Duren Village, has not been carried out independently due to the lack of space or land to manage organic waste independently. However, most residents have already sorted organic waste at home. Therefore, even if organic waste is sorted at home, if it is not managed independently, organic waste reduction is not effective and efficient.

Some corrective actions that can be taken to address the root of this problem include:

1. Material

Unprocessed Organic Waste: After sorting, the organic waste is first drained to reduce the water content in the organic waste, thus reducing unpleasant odors. It is better to process the drained organic waste immediately, thereby significantly minimizing the production of unpleasant odors. Organic waste that produces unpleasant odors is caused by organic waste that is not properly processed.

2. Method

The processing process takes a long time: Residents can manage waste using the BSF maggot bioconversion method. This method, because 1 kg of BSF maggots can consume 2 to 5 kilograms of organic food waste per day, is suitable for implementation in the neighborhood unit (RW 04) of TDU Village due to its rapid organic waste processing process.

3. Environment

Lack of available storage facilities for inorganic waste: The neighborhood unit (RW) and neighborhood unit (RT) officials held discussions to select a suitable location for joint organic waste management.

Managerial Implications

Based on research data that has been processed using the 3R method and why-why analysis, which then obtained suggestions for improvements in the application of the 5W + 1H method, there are several implications that can be applied in relation to the improvements that have been suggested for the problem of less than optimal reduction of inorganic waste and organic waste in the RW 04 environment, North Tanjung Duren Village, some of which are presented in the table below.

Table 6. Managerial Implications of Applying the 3R Method and Root Cause Analysis in Optimizing the Reduction of Inorganic and Organic Waste

Objek	Before	After	Δ	Information
Inorganic Waste Management	Waste reduction	6.471 kg	9.930 kg	increased waste reduction by 3,459 kg
	Utilization Results	Rp 14.677.750	Rp 30.646.450	increase in utilization results by Rp. 15.968.700
Organic Waste Management	Waste reduction	-	-	-
	Utilization Results	-	-	-

Based on the table above, it can be seen that inorganic waste has increased in reducing inorganic waste in the RW 04 environment of Tanjung Duren Utara Village by 3,459 kg and is directly proportional to its utilization value of Rp. 15,968,700. However, there has been no change in

organic waste because in the RW 04 environment of Tanjung Duren Utara Village, they only sort without any independent organic waste management so that the reduction of organic waste in the RW 04 environment of Tanjung Duren Utara Village has not been maximized.

Table 7. Managerial Implications of Applying the 3R Method and Root Cause Analysis in Optimizing Inorganic Waste Reduction

	Objek	After
Man	Community participation behavior	Residents are willing to manage inorganic waste independently even though they have already paid cleaning fees because they have seen the benefits directly.
Machine	Supporting facilities for inorganic waste management	Communication between members of the inorganic waste management team in the RW and the 3R officers is well established so that the necessary needs can be met by writing letters and coordinating with the 3R officers.
Environment	Management environment	Members of the inorganic waste management team in the RW coordinate well with residents and 3R officers regarding the weighing schedule so that they can sterilize narrow road access and overcome limited space by arranging/organizing neatly so as to maximize the available space.

The application of the 3R method and why-why analysis as well as 5W + 1H to formulate possible corrective actions to be taken by the head of the RW waste management division can have a positive impact on the environment of RW 04, Tanjung Utara Village in the future. The application of the 3R method and carrying out independent management can optimize the reduction of inorganic waste and organic waste more effectively and efficiently when compared to not being processed independently. The why-why analysis method is able to find the root of the problem in the less than optimal waste reduction in the RW environment. Thus the head of the waste management division is able to formulate possible corrective actions to be taken based on the root of the problem that has been formulated.

CONCLUSION

Based on the analysis and discussion in the previous chapter, conclusions were drawn to answer the problem formulation, including: Conclusion should provide:

1. Factors suspected of contributing to the suboptimal reduction of inorganic and organic waste include:
 - a. Inorganic waste management: Some community participants still fear being ostracized when managing inorganic waste independently, supporting facilities for inorganic waste management, including equipment and supplies, and limited land/sites for inorganic waste management.
 - b. Organic waste management: Organic waste produces an unpleasant odor due to the water content, the organic waste management process takes a long time, and there is no place to manage organic waste.
2. Possible corrective actions to address these problems are as follows:
 - a. Inorganic waste management: After a change in more active members who see the benefits and are inspired by residents to manage inorganic waste independently, members can coordinate with 3R officers from the Gorpet District Environmental Unit

and implement a strategy by sewing sacks to store the inorganic waste and arranging them neatly.

- b. Organic waste management; After sorting the organic waste, it is drained to reduce the water content so as to minimize unpleasant odors, residents can manage the waste using the BSF maggot bio-conversion method, and the RW and RT officials hold discussions to choose a place to be used as a joint organic waste management site.

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