

Performance evaluation of waste management in MRF-3R (case study Sukoharjo District)

by Sri Sumiyati

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Performance evaluation of waste management in MRF-3R (case study Sukoharjo District)

L S Wangi¹, S Sumiyati², A Sarminingsih²

¹Master Program of Environmental Engineering, Diponegoro University, Semarang, Indonesia

²Department of Environmental Engineering, Diponegoro University, Semarang, Indonesia

lisasekarwangi93@students.undip.ac.id

Abstract. Independent waste management system based on the community with the implementation of Material Recovery Facilities with reduce, reuse, recycle principles (MRF 3R) has been widely applied in various places, including Sukoharjo District. Based on data from DLH Sukoharjo District, currently in Sukoharjo District there are 6 MRF-3R. The current condition of MRF-3R still cannot be monitored optimally, so the performance of each MRF-3R is not yet known. This study aims to evaluate the performance of waste management in MRF-3R by taking a case study in Sukoharjo District. This research was conducted based on the 2017 MRF-3R Technical Guidelines. This study will evaluate aspects of supporting regulatory products and technical technology. Based on evaluation results of supporting regulatory product aspects, the final value for 5 MRF-3R can be categorized as medium. Meanwhile, evaluation results of technical and technology aspects of each MRF-3R have a different categorization result. Following are the technical and technology evaluation results from each MRF-3R, MRF-3R Gonilan is categorized as a medium, MRF-3R Gumpang is categorized as not good, MRF-3R Ngabeyan is categorized as good, MRF-3R Kwarasan is categorized as not good, and MRF-3R Sanggrahan is categorized as medium.

1. Introduction

The rapid population growth and multi-sectoral development activities in Sukoharjo District impact increasing the volume of waste generation [1]. UU No. 18 of 2008 concerning Waste Management states that one of the duties and authorities of the government and local governments is to facilitate, develop, and implement efforts to reduce, handle and utilize rubbish [2]. One way to overcome this problem is the Sukoharjo Government has promoted the 3R program in Sukoharjo and has built an inorganic and organic waste management infrastructure in the form of MRF-3R [3]. The MRF-3R itself, according to the 2017 MRF-3R's Technical Guidelines, is a pattern of approach to waste management on a communal or regional scale, involving the active role of the government and the community through a community empowerment approach [4]. Because centralized waste management may be able to cut costs and the resulting greenhouse gas emissions [5].

The community-based independent waste management system implementing MRF-3R has been widely applied in various places, including in Sukoharjo District. Based on data from DLH Sukoharjo



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District, currently in Sukoharjo District there are 6 MRF-3R. There are 6 MRF-3R in Sukoharjo, but based on the initial observations of MRF-3R, only 5 active MRF-3R and 1 inactive MRF-3R. The currently active MRF-3R are MRF-3R Ngabeyan, MRF-3R Gumpang, MRF-3R Sanggrahan, MRF-3R Gonilan, and MRF-3R Kwarasan. Meanwhile, the Kantil MRF-3R is not active. The capacity of the MRF-3R in Sukoharjo varies, with each processing capacity of 3 to 6.4 m³/day. The general description of the MRF-3R in Sukoharjo, at this time, is still not operating optimally and still found some problems in operation. The problems that occur are still not mapped and cannot be monitored. Departing from these problems, it is necessary to carry out an evaluation that aims to determine waste management performance in MRF-3R. Management performance evaluation referred to in this study includes management activities and management systems.

2. Methodology

This research was conducted based on the 2017 MRF-3R Technical Guidelines [4]. This study will evaluate 2 aspects, namely aspects of supporting regulatory products & technical technology [4]. The research method used is descriptive analysis to determine the condition or general description of the research location in the form of physical conditions (facilities and infrastructure) related to waste management at MRF-3R in the research area. Data collection in the form of primary data and secondary data. Primary data were obtained through direct field observations, interviews with the manager and administrator of TPS-3R, and waste generation calculation using the SNI 19-3964-1994 method [6]. Secondary data collection was obtained from the results of literature studies and data from related agencies. The locations selected as samples in this study were 5 active MRF-3R in Sukoharjo. The MRF-3R included MRF-3R Ngabeyan, MRF-3R Gumpang, MRF-3R Sanggrahan, MRF-3R Gonilan, and MRF-3R Kwarasan.

3. Result and discussion

3.1 Existing condition MRF-3R in Sukoharjo

Waste management is a systematic, comprehensive, and sustainable activity that includes waste reduction and handling [2]. Improper waste management will cause health aesthetic problems and potential environmental disasters. Therefore, one way to overcome this problem, the Sukoharjo Government takes steps through waste management with the application of the 3R system (Reuse-Reduce-Recycle) and the construction of waste management infrastructure in the form of a Waste Processing Site that applies the 3R system (MRF-3R) [7]. In Sukoharjo, waste management is technically carried out by the Environment Agency. However, for waste management at MRF-3R in Sukoharjo, there is an element of community involvement, namely the management by non-governmental groups (KSM).



Figure 1. Distribution map of MRF-3R in Sukoharjo District.

Figure 1 shows a map of the distribution of MRF-3R in Sukoharjo. In the picture, it can be seen that the 6 MRF-3R are spread over 2 sub-districts, namely Kartosuro and Grogol sub-districts. Based on field observations of 6 MRF-3R, only 5 MRF-3R are currently active. The following are general characteristics of 5 MRF-3R spread across Sukoharjo, as shown in table 1.

Table 1. General characteristics of MRF-3R.

General Characteristics	MRF-3R Gonilan	MRF-3R Gumpang	MRF-3R Ngabeyan	MRF-3R Kwarasan	MRF-3R Sanggrahan
Location	Gonilan Village, Kartasura Subdistrict	Gumpang Village, Kartasura Subdistrict	Ngabeyan Village, Kartasura Subdistrict	Kwarasan Village, Grogol Subdistrict	Sanggrahan Village, Grogol Subdistrict
Land Area (m ²)	700 m ²	500 m ²	500 m ²	400 m ²	400 m ²
Number of employees (people)	5	4	4	2	4
Service Target (KK)	600	500	450	370	400
Service Realization (KK)	530	435	435	300	380
Average Waste Input (m ³)	6.4	5.8	5	3	4.2
Waste Bank Function	Available	Not Available	Available	Not Available	Available

3.2 Evaluation of MRF-3R based on supported regulatory products

Evaluation according to the aspect of supporting regulatory products includes 2 indicators, the first indicator is the existence of regional regulations regarding MRF-3R and the second indicator is MRF-3R development plans [4].

Table 2. The total value of each supporting regulatory product aspect.

Indicator	MRF-3R Gonilan		MRF-3R Gumpang		MRF-3R Ngabeyan		MRF-3R Kwarasan		MRF-3R Sanggrahan	
	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value
The Existence of Regional Regulations Regarding TPS-3R	3	8	3	8	3	8	3	8	3	8
TPS 3R Development Plans	5		5		5		5		5	

Based on the evaluation results of the 3 parameters in the first indicator, it was found that each MRF-3R has an indicator score of 3. Based on the results of a literature study, the Sukoharjo Government has laws and regulations related to waste management and contains regulations for implementing 3R but not in detail. This regulation is contained in regional regulation no 57 of 2018 Regional Policies and Strategies in the Management of Household Waste and Types of Household Waste [8]. In addition, clause number 6 of the regulation also states that the waste reduction program includes reusing and recycling waste. However, each of these activities is not explained in detail.

Based on the evaluation results of the 3 parameters in the second indicator, it was found that each MRF-3R has an indicator score of 5. This is because clause number 9 of the Sukoharjo spatial plan for 2011-2031 has mentioned the plans for the MRF-3R development program in each sub-district and the development of the existing MRF-3R [9]. In addition, there have been revisions related to the waste work program in the sanitation strategy of Sukoharjo for 2016-2020, where items related to the development and maintenance plan of the existing MRF-3R have been added [10]. Based on the scoring results, it can be concluded that each MRF-3R has the same aspect value of 8. The total value obtained has the same value because this aspect examines the arrangements and development plans in the Sukoharjo area as a whole

3.3 Evaluation of MRF-3R based on technical and technology

According to the technical aspect of technology, evaluation consists of 6 assessment indicators, namely the volume of managed waste, condition of buildings and infrastructure, type of management, equipment, compost production, and volume of residue transported to the landfill [4].

Table 3. The total value of each technical and technology aspect.

Indicator	MRF-3R Gonilan		MRF-3R Gumpang		MRF-3R Ngabeyan		MRF-3R Kwarasan		MRF-3R Sanggrahan	
	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value	Indicator Value	Aspect Value
Waste Volume Managed	3		3		5		3		3	
Condition of Buildings and Infrastructure	3		3		5		3		5	
Management Type	5		1		5		1		1	
Equipment Condition		16		12		24		10		18
Compost Production	3		3		5		1		5	
Residual Volume Transported To Landfill	1		1		1		1		1	
	1		1		3		1		3	

Based on table 2, the volume of waste managed by MRF-3R in Sukoharjo is not optimal. It can be seen from the 5 existing MRF-3Rs, there are still MRF-3Rs that get a score of 3. This score means that the MRF-3R can only manage the waste of 60-80% of the planned service capacity. While a score of 5 for TPS 3R means >80% waste has been successfully managed according to the planned capacity.

Among several factors that influence the not yet optimal waste management are some management equipment in a damaged condition, equipment is not complete, and some buildings - infrastructure is damaged. The buildings and infrastructure that usually exist in the MRF-3R include landfills, sorting sites, enumeration sites, composting sites, compost maturation sites, compost warehouses, trash bins, offices, clean water facilities, and sanitation facilities [11]. MRF-3R Ngabeyan and MRF-3R Sanggrahan are relatively new; the condition of the buildings and infrastructure is relatively still functioning generally so that each gets a score of 5. A score of 5 means the condition of the buildings and facilities are functioning properly. MRF-3R Gonilan, MRF-3R Gumpang, and MRF-3R Kwarasan also received a score of 3 because the condition of the buildings and facilities only partially functioned. Some infrastructure buildings, such as the roof of the compost warehouse, leaked, and sanitation facilities were not functioning normally.

As for the equipment at MRF-3R, there are garbage carts/garbage motorbikes, organic waste chopping machines, compost filters, and inorganic waste processing equipment such as plastic press machines [12]. The management equipment at MRF-3R Ngabeyan and Sanggrahan is still in good condition, so both MRF-3R get a value of 5 according to table 1. While the condition of the organic waste counting equipment at MRF-3R Gonilan and Gumpang is in a problematic condition so that the organic waste management process is carried out manually and only got a score of 3. The enumeration equipment in this organic waste was damaged because it was rarely used and never cared for. The condition of the garbage motorbikes at the MRF-3R Gumpang is also damaged and needs repair; of the 5 active garbage motors, only 3 garbage motors.

The waste management process at MRF-3R Gonilan, Ngabeyan, Sanggrahan has been carried out by sorting and managing organic and non-organic waste to get a score of 5 according to table 3. Inorganic waste processing at MRF-3R is carried out in collaboration with local garbage bins to make some crafts from some plastic bottles. Meanwhile, the MRF-3R Kwarasan and Gumpang only scored 1 (according to table 1) because they separated organic and inorganic waste. The sorted inorganic waste will then be sold to third parties/collectors of paper, plastic, etc.

Because all MRF-3R are located in densely populated residential areas, the compost produced by each MRF-3R comes from organic waste generated by community activities at each TPS- 3R location. Not all MRF-3R can process the organic waste produced into compost products. The 3R TPS in Sukoharjo Regency only processes <70% of organic waste that is successful into compost so that all MRF-3Rs get a score of 1. The inhibiting factor in the management of organic waste into compost is because the number of trained workers is significantly less. In addition, the quality of the compost produced is difficult to compete with compost products from factories.

Most of the MRF-3R in Sukoharjo still leaves a large volume of waste residue to be disposed of in the TPA. This can be seen from the 5 existing MRF-3R, only 2 MRF-3R, namely MRF-3R Ngabeyan and Sanggrahan, which can leave a residual volume of only 38% of the total managed waste, so the two MRF-3R Rare can get an indicator score of 3 as shown in table 3. As for the other MRF-3R, the volume of residue transported to the TPA is >40% of the managed waste. So that other MRF-3R get a score of 1. The high residual volume in other MRF-3R is caused by several factors, including the number of damaged equipment and facilities and also the lack of sufficient and skilled human resources

3.4 Final score evaluation of supporting regulatory product aspects

Based on the assessment of 2 indicators from the Supporting Regulatory Product Aspects at each MRF-3R in Sukoharjo, the total indicator values with the percentage of each indicator are as follows.

Table 4. Total indicator values with the percentage of each supporting regulatory product aspect.

Indicator	MRF 3R Gonilan		MRF 3R Gumpang		MRF 3R Ngabeyan		MRF 3R Kwarasan		MRF 3R Sanggrahan	
	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)
The Existence of Regional Regulations Regarding TPS-3R	3	30	3	30	3	30	3	30,00	3	30
TPS 3R Development Plans	5	50	5	50	5	50	5	50	5	50
Total	8	80	8	80	8	80	8	80	8	80

Table 5. Total score and category of supporting regulatory product aspect.

Category	Total Value	Total Value with Percentage
	10	100%
Good	> 8	> 80 %
Medium	6 < N < 8	60% < N < 80%
Not Good	4 < N < 6	40% < N < 60%
Bad	< 4	< 40%

Based on table 4 the total indicator value obtained by the five MRF-3R spread across Sukoharjo is the same, namely 8 with a percentage of 80% of the total maximum value of 10. The total value obtained has the same value because this aspect examines the arrangements and development plans in the Sukoharjo area. To determine the category, it is necessary to calculate the equality. The total final score of all aspects is if it gets a maximum score, value is 10—the value of 10 means equal to 100%. The total value of each category is shown in table 5. The final score of the Supporting Regulatory Product Aspect of 5 MRF-3R in Sukoharjo is 8, with a percentage of 80%. Based on table 5, the supporting regulatory product aspect is in the medium category.

3.5 Final score evaluation of technical and technology aspects

Based on the assessment of 6 indicators from the Technical and Technology Aspects at each MRF-3R in Sukoharjo, the total indicator values with the percentage of each indicator are as follows.

Table 6. Total indicator values with the percentage of each Technical And Technology Aspect.

Indicator	MRF 3R Gonilan		MRF 3R Gumpang		MRF 3R Ngabayan		MRF 3R Kwarasan		MRF 3R Sanggrahan	
	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)	Indicator Value	(%)
Waste Volume Managed	3	10,0	3	10,0	5	16,7	3	10,0	3	10,0
Condition of Buildings and Infrastructure	3	10,0	3	10,0	5	16,7	3	10,0	5	16,7
Management Type	5	16,7	1	3,3	5	16,7	1	3,3	1	3,3
Equipment Condition	3	10,0	3	10,0	5	16,7	1	3,3	5	16,7
Compost Production	1	3,3	1	3,3	3	10,0	1	3,3	1	3,3
Residual Volume Transported To Landfill	1	3,3	1	3,3	1	3,3	1	3,3	3	10,0
Total	16	53,3	12	40,0	24	80,0	10	33,3	20	60,0

Table 7. Total score and category of technical and technology aspect.

Category	Total Value	Total Value with Percentage
	30	100%
Good	> 19	> 63,33%
Medium	14,3 < N < 19,0	48% < N < 63,33%
Not		
Good	9,5 < N < 14,3	31% < N < 48%
Bad	< 9,5	< 31%

Based on tables 6 and 7, the total indicator value obtained by MRF-3R Gonilan is 16 with a percentage of 53.33% of the total maximum value of 30 and can be categorized as medium. The total indicator value obtained by MRF-3R Gumpang is 12 with a percentage of 40% of the total maximum value of 30 and can be categorized as not good. The total indicator value obtained by MRF-3R Ngabeyan is 24 with a percentage of 80% of the total maximum value of 30 and can be categorized as good. The total indicator value obtained by MRF-3R Kwarasan is 10 with a percentage of 33.33% of the total maximum value of 30 and can be categorized as not good. The total indicator value obtained by MRF-3R Sanggrahan is 16 with a percentage of 60.00% of the total maximum value of 30 and can be categorized as medium.

4. Conclusion

From the results of the research, currently, in Sukoharjo District, there are 6 TPS-3R. There are 6 MRF-3R in Sukoharjo, but based on the initial observations of TPS-3R, only 5 active MRF-3R and 1 inactive TPS 3R. The currently active MRF-3R are MRF-3R Ngabeyan, MRF-3R Gumpang, MRF-3R Sanggrahan, MRF-3RGonilan, and MRF-3R Kwarasan. Meanwhile, the Kantil MRF-3R is not active. The capacity of the MRF-3R in Sukoharjo varies, with each processing capacity of 3 to 6,4 m³/day.

Based on evaluation results of 0supporting regulatory product aspects, the final value of the evaluation results for 5 MRF-3R is 8 with a percentage of 80% and can be categorized as medium. The total value obtained can be of the same value because this aspect examines the arrangements and development plans in the Sukoharjo area. Based on evaluation results of technical and technology aspects, each MRF-3R has a different categorization result. This difference in results is influenced by several indicators: volume of managed waste, buildings, infrastructure, type of management, equipment, compost production, and volume of residue transported to the landfill. Following are the technical and technology evaluation results from each MRF-3R; MRF-3R Gonilan is categorized as medium with a total percentage of 53.33%, MRF-3R Gumpang is categorized as not good with a total percentage of 40 %, MRF-3R Ngabeyan is categorized as good with a total percentage of 80%. MRF-3R Kwarasan was categorized as not good with a total percentage of 33.33%, and MRF-3R Sanggrahan was categorized as medium with a total percentage of 60 %.

References

- [1] Wulandari R 2015 *Skripsi Universitas Sebelas Maret Surakarta*.
- [2] Indonesia 2008 UU Nomor 18 Tahun 2008 tentang Pengelolaan Sampah.
- [3] Badan Perencanaan Pembangunan Daerah 2017 Laporan Akhir Perencanaan Masterplan Persampahan Kabupaten Sukoharjo
- [4] Kementerian Pekerjaan Umum 2017 Petunjuk Teknis Tempat Pengolahan Sampah 3R
- [5] Hadiwidodo M, Samadikun B P, Putri A I, Sumiyati S and Ramadan B S 2020 *IOP Conf Ser: Mater Sci Eng* **909** 012078
- [6] Badan Standarisasi Nasional 2008 SNI-19-3964-1994 *Dewan Standardisasi Indonesia* (Jakarta)
- [7] Marlina 2020 *Journal of Infrastructure & Facility Asset Management* **3** 211-218
- [8] Kabupaten Sukoharjo 2018 Peraturan Daerah Kabupaten Sukoharjo Nomor 57 Tahun 2018 tentang Kebijakan dan Strategi Daerah Dalam Pengelolaan Sampah Rumah Tangga Dan Sampah Sejenis Sampah Rumah Tangga
- [9] Kabupaten Sukoharjo 2018 Peraturan Daerah Kabupaten Sukoharjo Nomor 1 Tahun 2018 tentang Rencana Tata Ruang Wilayah Kabupaten Sukoharjo Tahun 2011-2031
- [10] Badan Perencanaan Pembangunan Daerah 2015 Strategi Sanitasi Kabupaten Sukoharjo 2016-2020
- [11] Armanda E 2015 *Skripsi Universitas Sumatera Utara: Enviromental Engineering*
- [12] Kementerian Pekerjaan Umum Republik Indonesia 2016 Kementerian Pekerjaan Umum Direktorat Jenderal Cipta Karya: Jakarta (ID).

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