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Sustainability Analysis of Waste Management in Kupang City Using MDS Rapfish Analysis

Handrianus Josef Hae Jami[1], Alfred O. M. Dima[2], Roddialek Pollo[3]
Universitas Nusa Cendana, Kupang, Indonesia
Email: nunungwulandari003@gmail.com

*Correspondence

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ABSTRACT

The research on the sustainability of waste management in the city of Kupang aims to analyze the current status of waste management sustainability in the city. The primary objective of this study is to evaluate the sustainability status of the waste management system and identify the factors that influence its sustainability. This research employs sustainability analysis using the Multi-Dimensional Scaling (MDS) technique through the RAPFISH (Rapid Assessment Technique for Fisheries) approach. The data collection techniques in this study include observation, Questionnaires, and Interviews. Field data collection will be conducted from July to November 2023. The research results indicate that the waste management system in Kupang City, in terms of reduction and handling, is not optimal, with a sustainability status of waste management in Kupang City having an average index value of 46.17, placing it in the 'Less Sustainable' category. The conclusion of this study emphasizes that waste management in Kupang City still requires improvement, particularly in terms of regulations, facility and infrastructure enhancements, and community engagement. The implications of this study are the need to transition the landfill system from open dumping to a sanitary landfill, enhance education and socialization programs, and allocate a larger budget for more sustainable waste management.

Introduction

The national target for waste management is to reduce greenhouse gas emissions. This is because the impact of climate change has been felt very strongly by various countries worldwide. (Amran et al., 2016; Ariadi, 2023). It turns out that various climate change problems come from people's daily lives, including waste management. (Ruzuqi et al., 2023). Indonesia has ratified the Paris Agreement through Presidential Regulation Number 61 of 2011 concerning the National Action Plan for Reducing Greenhouse Gas Emissions. The target is to reduce greenhouse gas emissions by 29 percent by 2030, with international support of 41 percent. (Hulu et al., 2024; Leontinus, 2022; Patrianti et al., 2020).

Most greenhouse gas (GHG) emissions are produced from waste. Waste significantly contributes to the increase in greenhouse gas emissions because the accumulation of untreated waste releases methane (CH4) gas. Every 1 ton of solid waste produces 50 kg of methane gas. (Rarasti, Anggita Dhiny:2007) . Therefore, to reduce greenhouse gas (GHG) emissions, it is necessary to manage waste in accordance with national standards and/or the mandate of the Waste Management Law.

According to the law's mandate, a good waste management system is environmentally sound. (Al-Hammouri et al., 2023; Sulistiyono, 2022). Law of the Republic of Indonesia No. 18 of 2008 concerning Waste Management explains that waste management is a systematic, comprehensive, and sustainable activity that includes waste reduction and handling. (No, 18 C.E.). The most effective way to address the waste problem is to reduce both the quantity and toxicity of the waste produced. However, with the increasing desire for a better standard of living, humans are becoming more likely to consume more and make more waste. Consequently, the community must seek effective waste management methods and strategies to reduce the amount of garbage that needs to be disposed of in landfills. (Lingga et al., 2024; Mahyudin, 2014; Wardhani & Harto, 2018).

Several studies have analyzed the causes of problems in waste management in Indonesia. The problems include a lack of firm law enforcement commitment, inadequate waste disposal sites, insufficient effort in composting, and inadequate landfill management with the right system. (Aparcana, 2017).

Furthermore, Sri Bebassari from the Indonesian Waste Forum (IWF) in Asrori & Yudiyanto, (2019) Said that overcoming waste management problems must be comprehensive and handled from multiple perspectives, including environmental, legal, institutional, community participation, socio-cultural, funding, economic, and technological aspects.

Related to the above, a study conducted by Sukwika & Noviana, (2020) With the title' Sustainability Status of Integrated Waste Management at TPST Bantargebang Bekasi: Using RAPFISH with R Statistics,' it is fascinating because it examines the sustainability status of its management from several aspects or dimensions, namely Management Engineering, Business Economics, Social Welfare, Institutional Regulations, Environmental Management, and Clean Production. The results indicate a sustainability status that managers and local governments can use to determine the next management policy strategy.

Waste management in the city of Kupang, East Nusa Tenggara, is a growing concern for the local government. The city of Kupang, as the capital of East Nusa Tenggara Province, has been declared the dirtiest city for two consecutive years in the Adipura assessment by the Ministry of Environment and Forestry (The Asian Parent.com, June 3, 2022).

The research conducted so far is still partial, expressly limited to the scope of pollution, social problems, and the issue of expanding the landfill area. The management aspect is not comprehensive, so the results have not provided a strategic solution to the

problems faced ultimately. Therefore, considering the existing literature gap on waste management, the author is interested in researching the sustainability status of the waste management system in Kupang City.

This research specifically examines the sustainability of the waste management system in Kupang City using the Multi-Dimensional Scaling (MDS) approach in conjunction with the RAPFISH (Rapid Assessment Technique for Fisheries) method. The variables studied encompass six main dimensions: environment, economy, management, law and institutional, social and cultural, and facilities and infrastructure. Using this method, the research aims to assess the sustainability status of waste management and provide strategic recommendations for the government to develop more effective policies.

The novelty of this study lies in its comprehensive approach to assessing the sustainability status of waste management, which considers various dimensions that interact with one another. Most previous studies have focused solely on pollution and social aspects, without considering a multidimensional approach in sustainability analysis. Therefore, this study offers a new perspective on assessing the effectiveness of waste management systems through a more systematic and data-driven analysis.

The urgency of this research stems from the increasing volume of waste and its detrimental impact on the environment and public health in Kupang City. By understanding the sustainability status of waste management, local governments can develop more effective strategies to mitigate the negative impacts of suboptimal management systems. Additionally, this research can serve as a reference for other regions facing similar challenges in managing waste sustainably.

This study aims to analyze the sustainability status of the waste management system in Kupang City using the MDS-RAPFISH method, identify factors that affect the sustainability of the waste management system, and provide strategic recommendations that local governments can apply to increase the effectiveness of waste management. The benefits of this research are expected to make academic and practical contributions. Academically, this research can enrich the study of waste management sustainability in Indonesia through a multidimensional approach. Practically, the results of this study can serve as a basis for local governments to formulate more effective and sustainable policies in addressing waste problems, particularly in Kupang City. Thus, this research can contribute to efforts to create a cleaner, healthier, and more sustainable environment for the community.

Method

The research method employed in this study is quantitative, with a descriptive approach. This approach aims to analyze data systematically to understand the patterns, relationships, and influence of variables in the research. This research was carried out intensively in the city of Kupang, specifically at the Kupang City Environment and Hygiene Agency (DLHK) and the Waste Final Processing (TPA) site in Kupang City, East Nusa Tenggara Province (NTT), from June to December 2023.

Data Collection Techniques

Field data is obtained through informants, respondents, documentation, or observation. (Lenaini, 2021). Secondary data is obtained from reports, journals, and study results from various related agencies located at and outside the research site. The data collection techniques in this study consist of: Observations made by the author at the Alak landfill, interviews and questionnaires given to primary data sources, namely the Kupang City government in this case DLHK as a waste manager, Kupang City Bapeda, Kupang City PDAM, Village Head in Alak District and scavenger communities. In addition, the author conducts a literature review related to theoretical studies and other relevant references, which will be examined to gather data that supports the research.

Data Analysis Techniques

In this study, the researcher conducted a Sustainability Analysis of Waste Management in Kupang City using the Multi-Dimensional Scaling (MDS) technique, which was applied through the RAPFISH (Rapid Assessment Technique for Fisheries) approach developed by the Fisheries Center at the University of British Columbia. (Alexander, 2023; Boucetta et al., 2014).

The preparation of sustainability attributes of Waste Management in Kupang City is based on an approach of 6 (six) sustainability dimensions, namely: (1) environmental dimensions; (2) economic dimension; (3) management dimensions; (4) legal and institutional dimensions; (5) social and cultural dimension and (6) facility and infrastructure dimension.

The assessment stage of each attribute on the ordinal scale is based on the sustainability criteria of each dimension, coordination analysis based on the multidimensional scaling (MDS) method, index preparation, and the sustainability status of waste management in the current conditions that are studied both in general and in each dimension (Anida, 2024; Permana Putra et al., 2021; Putra et al., 2021).

In this study, four categories of sustainability status Susilo et al., (2010) They were categorized as follows: 0-25 (poor), 26-50 (moderate), 51-75 (adequate), and 76-100 (good). Kavanagh & Pitcher, (2004) It was stated that to determine the error value, a Monte Carlo analysis was carried out 25 times using the RAPFISH method. Leverage analysis is conducted to identify which attributes are most sensitive to each sustainability dimension.

The Stress value can measure how close the two-dimensional distance value is to the multidimensional distance value. The stress value, denoted by S, and the determination coefficient (R^2) are used to measure the quality or effectiveness.

From the Multi-dimensional Scaling (MDS) analysis, Rapfish will give birth to 3 analyses, namely:

1. The result of the Ordination (RAPFISH Ordination) is a circular image, representing an anchor or boundary. The further to the right, the better the value. A good model is characterized by an S-Stress value of less than 0.25. Stress is a measure of error; the lower the Stress value, the smaller the analysis error. However, if the Stress value is

high, then it can be concluded that the data is not suitable for use in the analysis process. The coefficient of determination (R^2) measures how well the data matches the actual conditions. A good R^2 value is close to 1 or 100%, meaning that the data used truly represents the actual conditions. The model is tested to see if it needs to be altered to more accurately represent the original condition (Mahida et al., 2019).

2. Monte Carlo was used to determine the precision level of the results. Furthermore, the difference between the MDS and Monte Carlo results shows the confidence interval of the Rapfish results. If the difference between MDS and Monte Carlo is less than 1, then the resulting index is more than 90% accurate. The small error index between the two methods shows that: (1) the error in scoring each attribute is small, (2) the variety of scoring each small attribute, (3) the analysis process carried out repeatedly has good stability, (4). Data entry errors can be avoided (Nawangsaria & Ismailia, 2022).
3. Leverage shows ordination changes due to removing attributes one by one. In other words, leverage also indicates sensitivity analysis. The length of the "bar" for each attribute suggests the magnitude of the attribute's influence in the bad-good ordination. The longer the "bar", the lower the attribute's score/value and rating, meaning that the attribute is more dominant in influencing sustainability (Fauzi, 2019).

This research variable is an attribute, trait, or value of people, objects, or activities that is determined in the study, and conclusions are drawn from it. For more details, please see the table below:

Results and Discussion

Sustainability status of waste management in Kupang City

Analyzing the sustainability of waste management in this study is seen from the results of several dimensions, including:

Environmental Dimensions

Based on the results of the RAPFISH analysis, which was strengthened by the MONTE CARLO analysis, the coordinate value of the sustainability status reviewed from the Environmental dimension was 34.48.

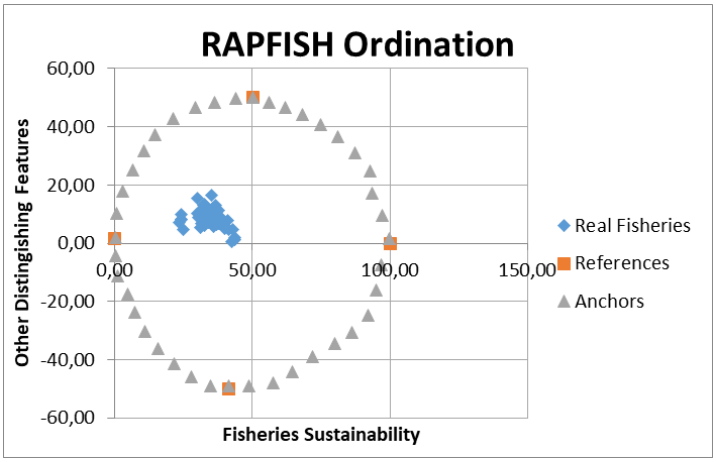

Figure 1. Results of RAPFISH analysis of Environmental Dimensions

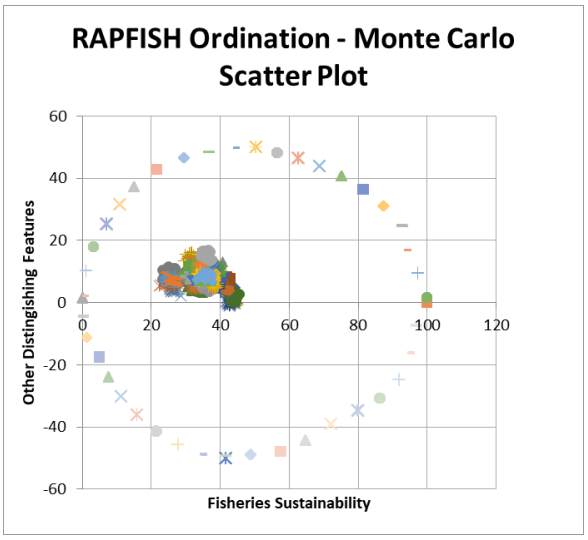

Figure 2. Monte Carlo Environmental Dimension Analysis Results

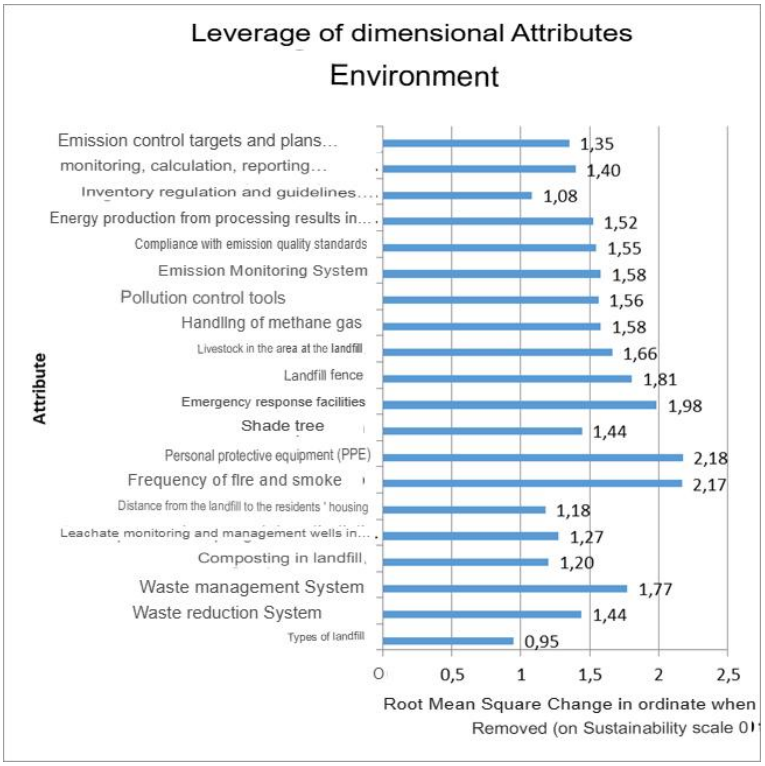

Figure 3. Leverage of the Dimensional Attributes Environment

This can be interpreted as indicating that its management's sustainability status falls into the less sustainable category. This data's coefficient of determination (R^2) is 0.945957, or 94%. This means that 94% of the data variation is explained by the factors included in the model. Examining the results of stress and R^2 values, it can be concluded that the MDS model for this environmental dimension is a suitable representation and effectively captures the issues that arise. Therefore, there is no need to add attributes to address the actual circumstances.

Economic Dimension

The results of the Ordination on the sustainability of waste management in the city of Kupang, from an economic dimension, yield an index result of 42.19 (Figure 4). It can be interpreted as having a category of' less sustainable'. The coefficient of determination (R^2) for this data is 94%. This means that 94% of the data variation is explained by the factors included in the model. In the Monte Carlo Sheet, there is a repetition of the algorithm to assess the existence of errors in determining the score of attributes or attributes used that are not by the unit being analyzed. (Mahida et al., 2019). When viewed in Figure 4, Monte Carlo's analysis results reveal a dense distribution of units, indicating the absence of significant errors related to the economic dimension.

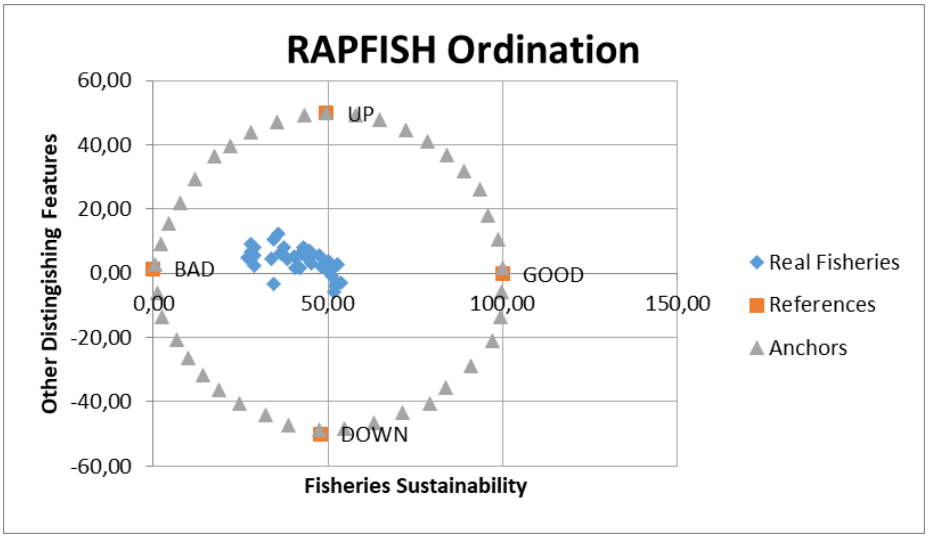

Figure 4: Results of The Ordination of The Waste Management Dimension in Kupang City from The Economic Dimension

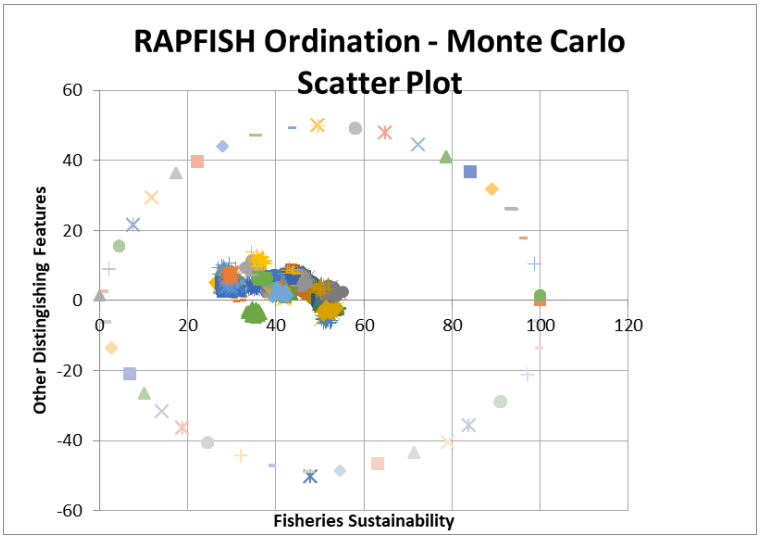

Figure 5: Results of The Monte Carlo Ordination for Managing The Waste Economic Dimension in Kupang City

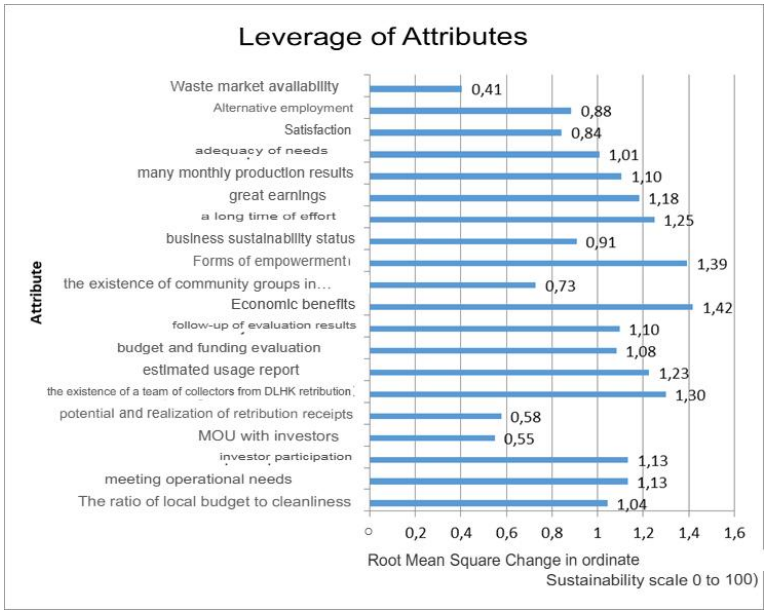

Figure 6: Results of LEVERAGE Analysis of Waste Management Against The Economic Dimension

Management dimension

The results of the Coordination of Sustainability of Waste Management in Kupang City, from the management dimension, have a result index of 61.88 (Figure 7). It can be interpreted as having a category of entirely sustainable, with a stress value of 0.198176 or less than 0.25. Here, stress is a measure of error, where the lower the Stress value, the smaller the analysis error. This data's coefficient of determination (R^2) is 94% or 0.944893. This means that 94% of the data variation is explained by the factors included in the model.

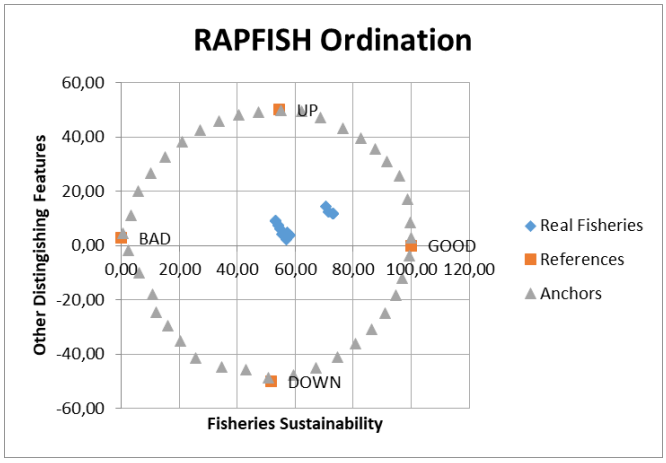

Figure 7. Results of Coordinating The Waste Management Dimension in Kupang City from The Management Dimension

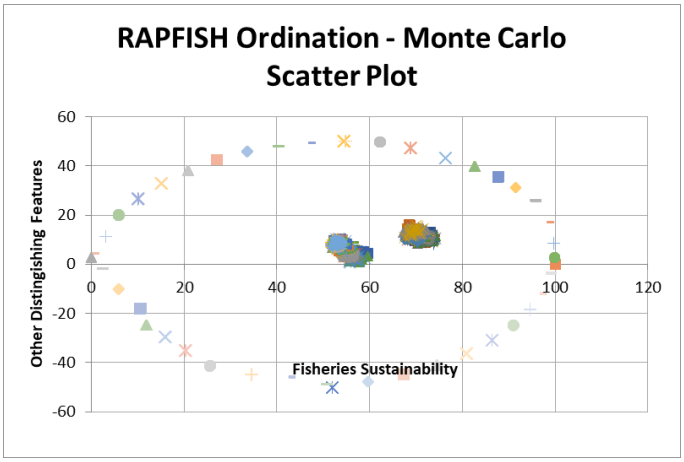

Figure 8: Monte Carlo Ordinance Results on the Management Dimension

In the Monte Carlo Sheet, there is a repetition of the algorithm to assess the existence of errors in determining the score of attributes or attributes used that are not by the unit being analyzed. (Mahida et al., 2019). Moreover, as shown in Figure 4, the results of the Monte Carlo analysis reveal a distribution of units that tend to be separate, indicating a slight error, possibly related to the distribution of various scoring or the informant's choice of answer. (Mahida et al., 2019).

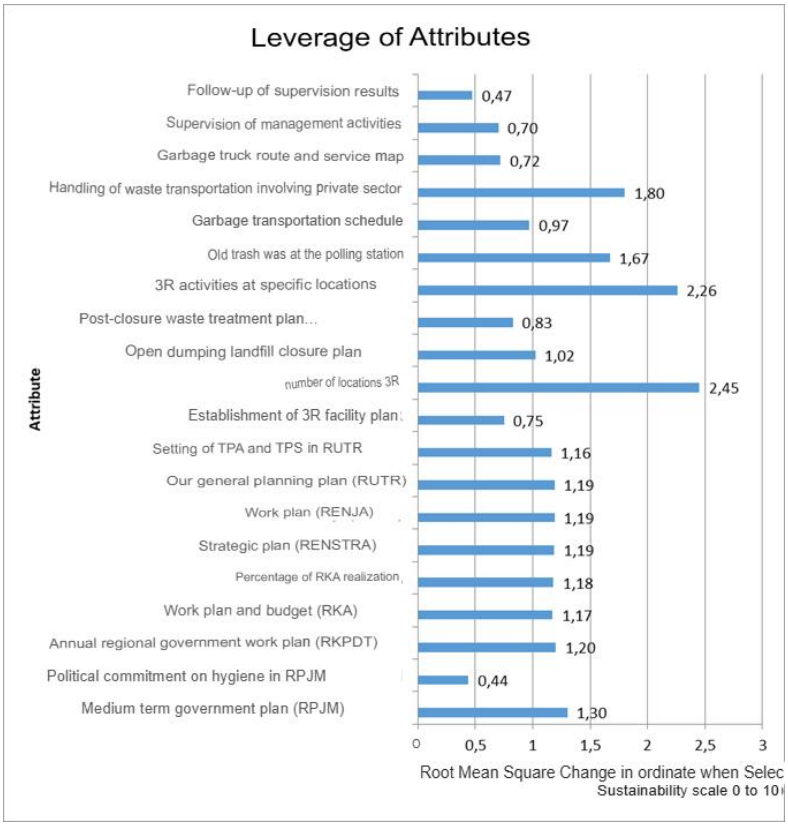

Figure 9: Results of LEVERAGE Analysis of Waste Management from the Management Dimension

Legal and Institutional Dimensions

Based on the MDS Rapfish analysis results, three analysis results were obtained: the coordinates value of the sustainability status, as reviewed from the Environmental dimension, is 45.06. This means it falls into the category of less sustainable, with a stress value of 0.202546 or less than 0.25. Here, stress is a measure of error, where the lower the Stress value, the smaller the analysis error. The coefficient of determination (R^2) for this data is 94% or 0.9435383. This means that 94% of the data variation is explained by the factors included in the model.

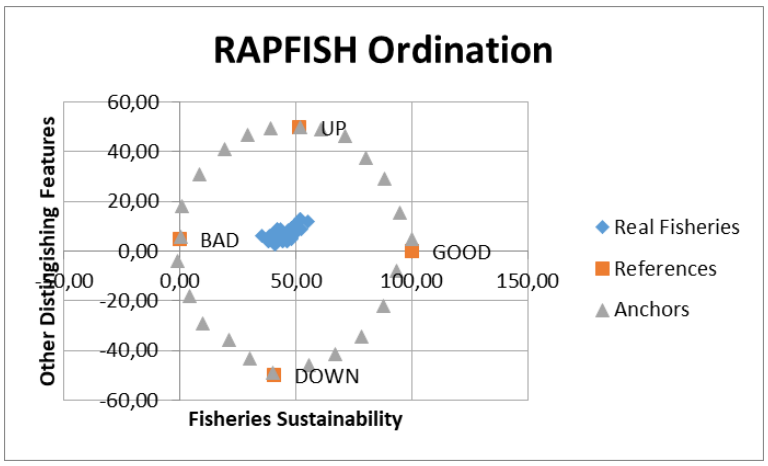

Figure 10: Results of Waste Management Coordination from the Legal and Institutional Dimensions

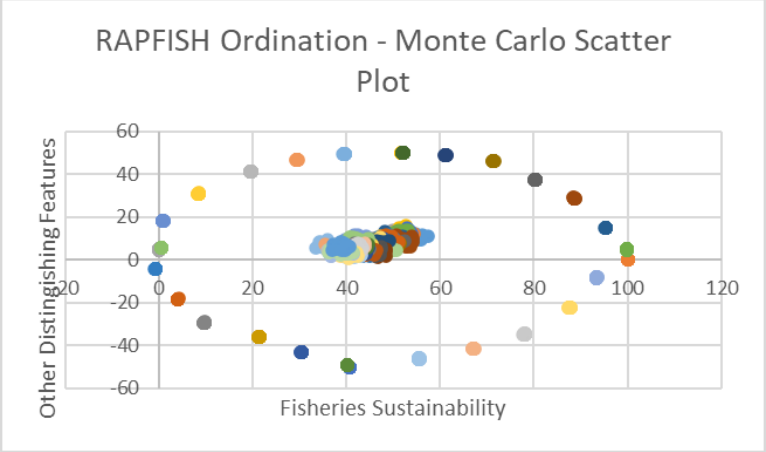

Figure 11: Results of Waste Management Ordination in the Legal and Institutional Dimensions

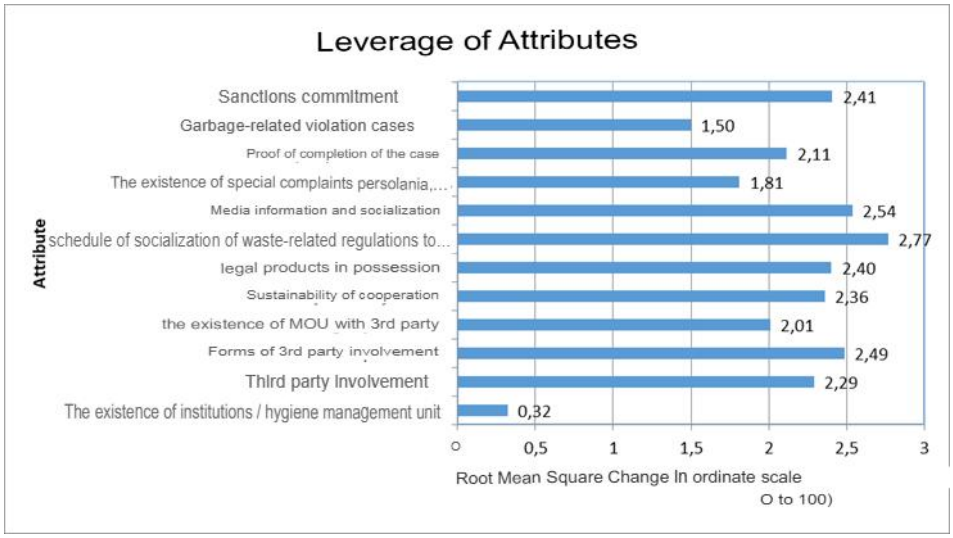

Figure 12: Results of Laverage Analysis of Waste Management in The Legal and Institutional Dimensions

Social and Cultural Dimensions.

The results of the Ordination on the sustainability of waste management in Kupang city from the socio-cultural dimension have a result index of 47.26 (Figure 7). It can be interpreted as having a category of Quite sustainable. With a stress value of 0.179605 or less than 0.25 where we know that Stress is a measure of error, where the lower the Stress value, the smaller the error of the analysis The Coefficient of Determination (R^2) for this data is 94% or 0.9316. This means that 94% of the data variation is explained by the factors included in the model.

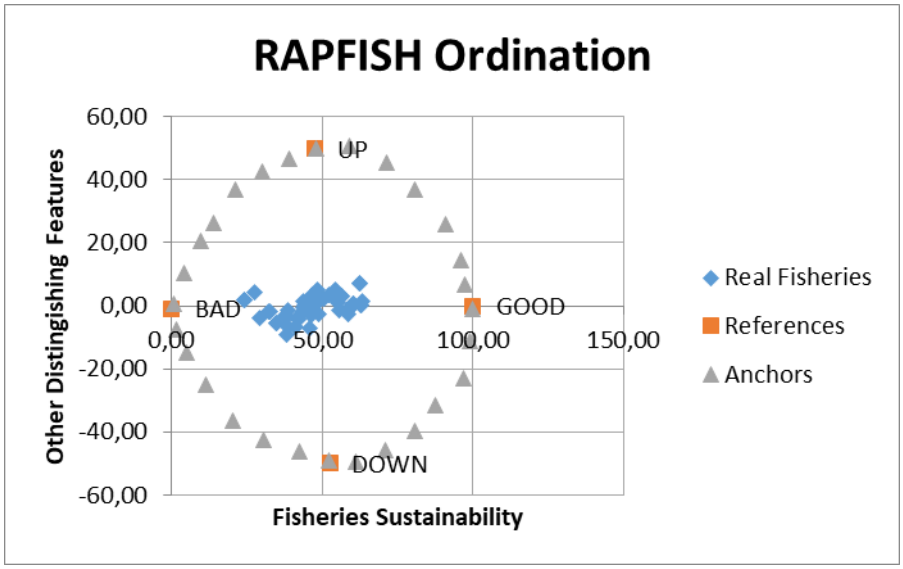

Figure 13. The Results of The Analysis of The Rapfish Ordination on Waste Management in The Social and Cultural Dimensions

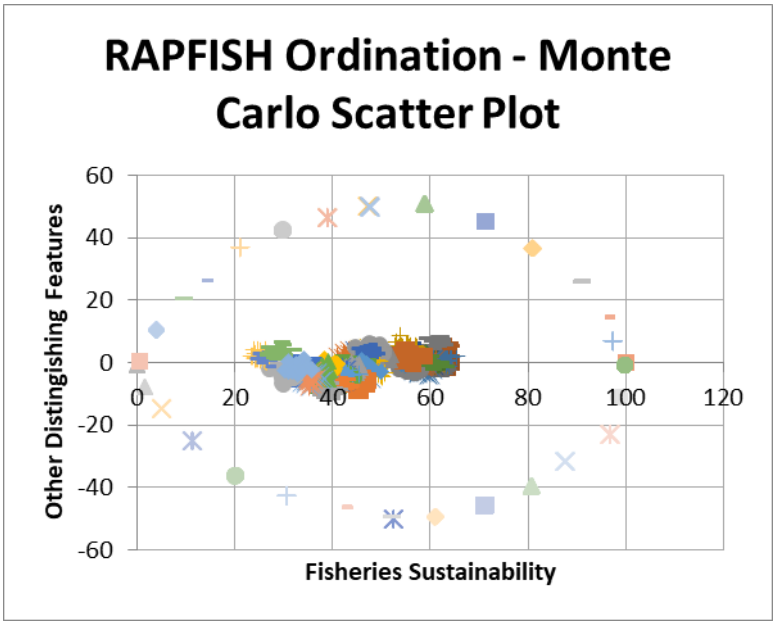

Figure 14: Monte Carlo Analysis of Waste Management in The Social and Cultural Dimension

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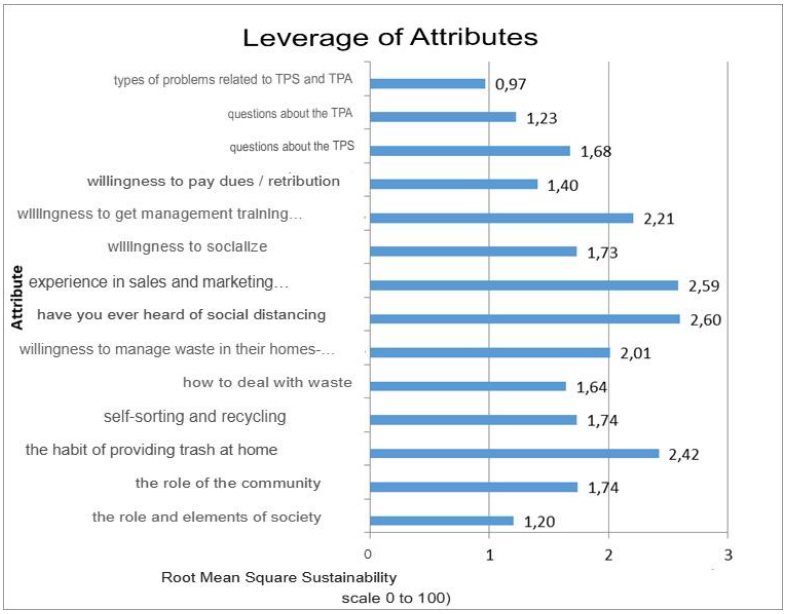

Figure 12: Results of Laverage analysis of waste management in the legal and institutional dimensions.

Dimensions of Facilities and Infrastructure

The results of the Ordination of Sustainability of Waste Management in Kupang City from the Infrastructure Dimension have a result index of 46.12 (Figure 19). It can be interpreted as having a category of ' less sustainable', with a stress value of 0.217002 or less than 0.25, where stress is a measure of error. The lower the Stress value, the smaller the analysis error. The coefficient of determination (R^2) for this data is 94% or 0.944232.

This means that 94% of the data variation is explained by the factors included in the model.

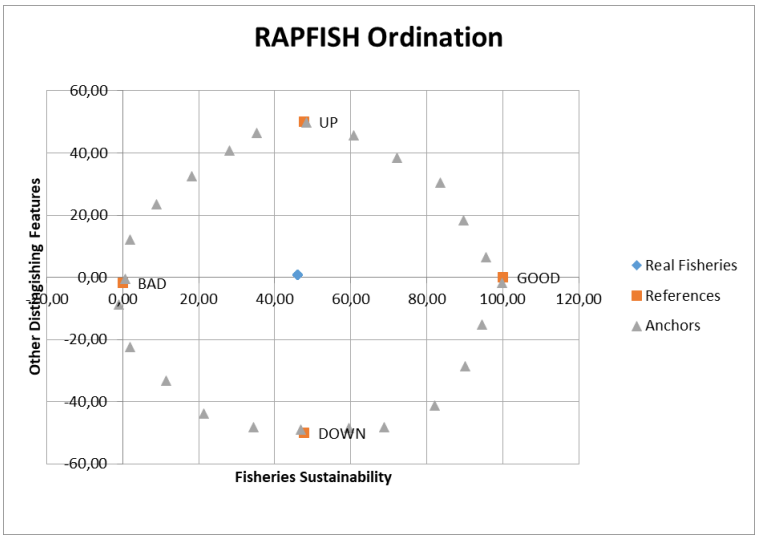

Figure 13: Results of the analysis of the rapfish ordination of waste management from the dimension of infrastructure

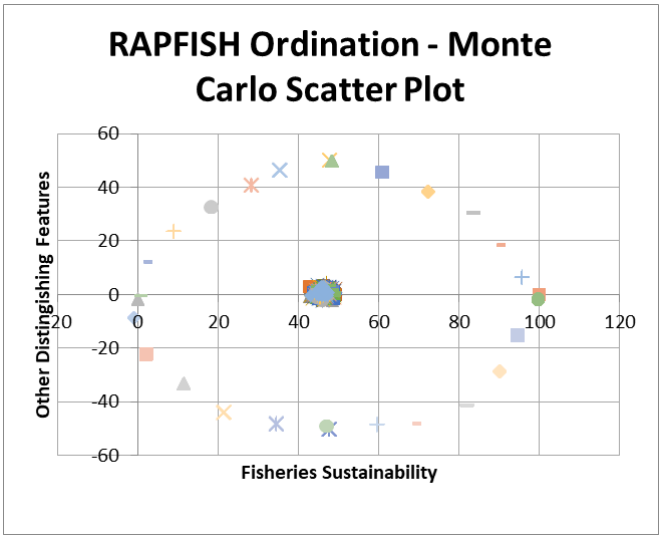

Figure 14: Results of the Monte Carlo coordination analysis of Waste management from the Infrastructure Facility dimension

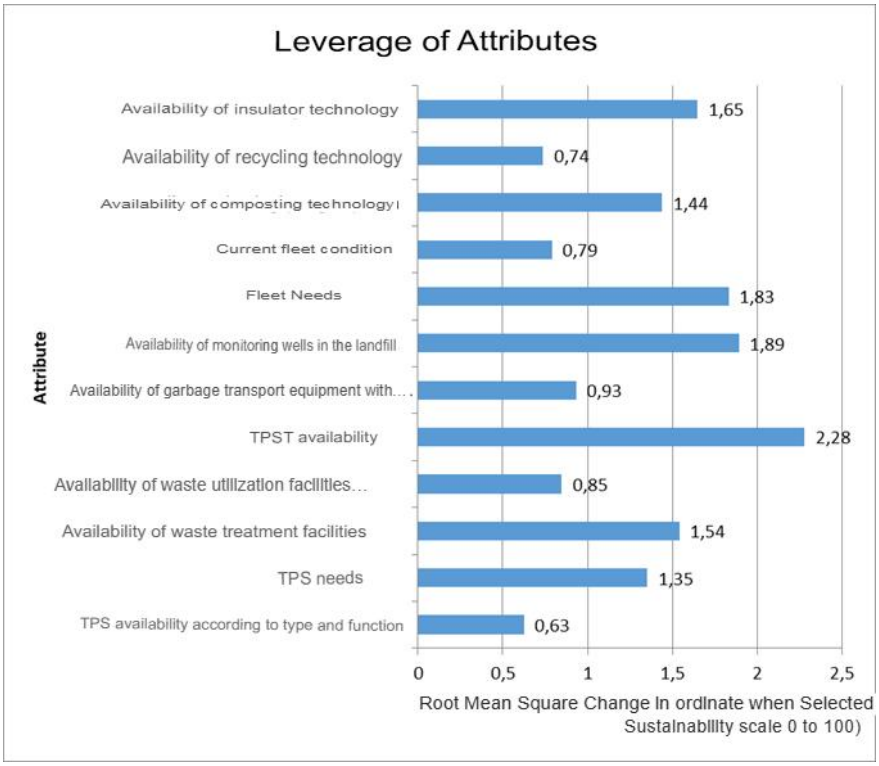

Figure 15: Results of The Analysis of The Coordination of Waste Management from The Infrastructure Facility Dimension

Leverage Indicator (long bar) based on the results of the leverage analysis and the Cause of the Undersustainability Status.

It	Dimensions/indicator	Cause
1	Environmental dimensions	Based on interviews, questionnaires, and observations
	• Personal protective equipment (PPE)	There is no PPE, even if it is available through self-procurement and rarely used, because it is not provided or required by the institution due to reasons such as familiarity, discomfort, and a limited budget. This is not in accordance with the Order of the Kupang City Regional Regulation, Number 3 of 2011, concerning the Implementation of Handling Household Waste, Article 26, which states that waste handling implementers are obliged to maintain the safety and health of workers, including conducting periodic health tests.
	• Frequency of fires and smoke	The alak landfill, which operates with an open dumping system, has experienced overcapacity and has often burned and emitted smoke for a long time, because emergency response equipment is limited, while the fire center is at a certain depth with indications of methane gas explosion so that it is difficult to handle by existing resources, even this year's fire caused health disturbances for the community around the landfill as many as 800 people, So it is set as an emergency alert status.
	• Waste handling system	The waste handling system in Kupang City primarily focuses on collection and transportation, while the sorting, processing,

It	Dimensions/indicator	Cause
		and Final Processing management system remains suboptimal. In line with this, the reduction system, in the form of (3R), is still not optimal either. This is not mandated by Law No. 18 of 2008, concerning Waste Management, and is therefore considered suboptimal.
	• Landfill fence and livestock in the landfill area	Because the landfill fence is not intact, the southwest corner of the gate, which covers an area of one-quarter of the landfill, remains unfenced. Meanwhile, the existing fence has been damaged at various points, allowing a considerable number of livestock to scavenge for food in the landfill area. This is categorized as bad based on *Regulation of the Minister of Environment and Forestry* Number P.76/menlhk/setjen/kum dated 1/10/2019 concerning Adipura.
2	Economic Dimension	
	• Economic Benefits	This must be a priority that not only involves managing waste but also offers significant economic benefits and can have a substantial impact on income. However, it is not used for economic purposes because it only focuses on collection and transportation. Furthermore, a reduction system consists of reusing waste that can still serve the same function or other purposes. Reduce everything that results in waste (*Reduce)—reprocess (recycle) waste into new, valuable goods or products (Recycle).* Not optimal.
	• Forms of empowerment	The form of this empowerment program can take various forms, including training, workshops, capital investment, production equipment assistance, facility and infrastructure improvements, and others. With community empowerment in the economic sector, it is hoped that it can improve the economy and community welfare. However, in terms of waste management, individuals involved in waste handling, such as scavengers, collectors, and waste banks, feel that they lack empowerment from waste managers, specifically the government through DLHK Kupang City.
	• Existence of the Cleanliness Levy Collection Team	There is no waste levy collection team; it is based solely on awareness and compliance with depositing it into the regional treasury. A memorandum of understanding (MOU) was signed between the head of the Kupang City Sanitation and Landscaping Service and the President Director of the Regional Drinking Water Company on October 28, 2011, regarding the implementation of waste/cleaning service levies in the city of Kupang. The agreement states that customers or users of drinking water services from the Kupang City PDAM are obliged to pay a levy. However, in its implementation, there is no collection team from either PDAM or DLHK, so the achievement of realizing the waste levy through PDAM Kupang City is less than 1% of the actual levy compared to the potential levy, as it depends solely on customer compliance in paying water account bills. Even then, not all

It	Dimensions/indicator	Cause
		residents of Kupang City become customers of drinking water. As of 2020, the population of Kupang City was 442. Seven hundred fifty-eight people in BPS Kupang city have a significant income potential. There is also potential income from cooperation agreements in terms of waste reduction, as well as through PKS agreements, which involve 64 PKS, with a potential value of RP. 107,250,000/month or IDR 1,287,000,000/yr, there needs to be a levy collector.
3	Management Dimension	
	• Plan to increase the number of 3R locations	TPS 3R is only one piece. However, there is no procurement plan in the Regional Development Work Plan (RKPD) document, which is a planning document for the Regional Government for a one-year period. This results in a significantly reduced waste volume in the management of waste in the city of Kupang. In waste management in the city of Kupang, the government has made every effort. However, it is constrained by various things, so that the TPS in other forms: TPS Iron Container (mobile) (71), TPS Permanent (cast cement) = 147 pieces, Communal Waste Bins (324), Unsorted Waste Bins 80, Sorted Waste Bins 500, Sorted Waste Bins 500 so that a total of 1080 pieces are collected.
	• 3R activities in specific locations	There is no waste reduction system in the form of 3R activities. However, 3R locations must be available in specific locations, such as schools, housing, markets, offices, hotels, terminals, and hospitals. This is related to the target of reducing the volume of waste per month or year in the planning and management documents for waste management.
	• Transportation handlers involve the private sector.	DLHK Kupang City is experiencing transportation obstacles, but has not considered alternative solutions to cooperate with the private sector. The state of the field turned out to be: There were 38 dump trucks, of which 32 were in good condition, while six were in damaged condition. Armroll Trucks: 10, of which eight are in good condition and two are in damaged condition. There are two garbage motorcycles, one of which is in good condition, while the other is in a damaged state. There are two excavators, one of which is in good condition, while the other is in a damaged state. There were 3 street sweeper cars, all in a damaged state. Bulldozers totaled two pieces, and all of them were damaged.
4	Legal and Institutional Dimensions	
	• Schedule for socialization of regulations related to waste to the community	Legal products related to waste management in the city of Kupang are complete, namely: Law No. 18/2008 concerning Waste Management and Law No. 32/2009 concerning Protection and Management. Environment, Government Regulation No. 81/2012 concerning the Management of Household Waste and Similar Household Waste (SRT and SSSRT); Government Regulation

It	Dimensions/indicator	Cause
		No. 27/2020, concerning Specific Waste Management; Presidential Decree No. 97/2017 concerning Policies and Strategies National SRT and SSRT Management; Minister of Public Works Regulation No. 03/Prt/M/2013 concerning the Implementation of Waste Infrastructure and Facilities in Handling SRT and SSSRT; Minister of Environment and Forestry Regulation No. P.10/Menlhk/Setjen/Plb.0/4/2018 concerning Guidelines for the Preparation of Regional Policies and Strategies for the Management of SRT and SSSRT; Minister of Environment and Forestry Regulation No. 14/2021 Waste Management in Waste Banks; Regional Regulation No. 13/2000 concerning Waste/Hygiene Service Levy; Regional Regulation No. 3/2011 concerning the Implementation of SRT and SSRT Handling; Regional Regulation No. 4/2011 concerning the Implementation of SRT and SSRT Reduction; Guardian Regulation 19/2019 concerning Kupang City Policies and Strategies in the Management of SRT and SSSRT; Guardian Regulation 33/2019 concerning Reduction of the Use of Plastic Bags; Inwali No. 071/2019 concerning Plastic Waste Reduction in Schools and Places of Worship; Inwali No.045/2022 concerning the Implementation of GPS. However, very few people are aware of the contents, orders, prohibitions, and sanctions of all the regulations in question, as they do not receive socialization related to the waste rules in question.
	• Information and socialization media	The waste manager admitted that he had conducted socialization, but the schedule, time, and documentary evidence did not exist. Types of good socialization media widely carried out in the community include seminars, counseling, brochures, social media that is easily accessible at any time, or Pilot media. This is categorized as not being maximized because it is not mandated by Regional Regulation No. 3/2011, concerning the Implementation of the Handling of Household Waste and Similar Household Waste, Article 33.
	• Commitment to sanction	There is no evidence of providing legal witnesses to individuals who violate waste rules. This relates to the orders, prohibitions, and sanctions of a legal product, where fair and firm law requires a commitment to the provision of sanctions.
5	Social and Cultural Dimensions	
	• Socialization of Waste Rules	The community admitted that they rarely, if ever, received socialization and training, which affected their understanding of orders, penalties, and sanctions for violating waste rules.
	• Waste management and utilization training	The community admitted that they rarely, if ever, received training on waste management and utilization, which affected

It	Dimensions/indicator	Cause
		their knowledge of habits and culture related to the provision of garbage cans (open, closed, and segregated).
	• The habit of providing a trash can at home	The community acknowledges that they do not feel the need to provide trash cans and sorting bins because the waste will be combined at the available polling stations, so they feel it is more practical to use only bags or sacks.
6	Dimensions of Facilities and Infrastructure	
	• Integrated TPS	Kupang City does not have an integrated TPS (Transportation Planning System) facility. Approximately 200 tons of waste (equivalent to 70,000 tons per year) are discharged into the environment due to the lack of treatment at the TPS.
	• Availability of monitoring wells at landfills	The existence of this monitoring well does not exist in the Kupang City Landfill, so it cannot conduct a laboratory test. The existence of this monitoring well is essential for testing water quality, whether it meets quality standards or not, and to assess the amount and potential of pollutants that endanger human life and living creatures in the area, especially since the distance from residents' houses to the Alak Landfill is only 200m.
	• Fleet needs	A transportation fleet for waste managers in Kupang City is necessary because the existing fleet, in terms of both quantity and quality, is inadequate. All include old age and require high operational and maintenance costs.
	• Availability of incinerator technology	Incinerator **tools** are available, but are broken and no longer functional. The heat energy produced can be used as a source of electricity. Another benefit is that it significantly reduces waste and can save landfill space, thereby preventing overcapacity, as seen in the Alak Landfill in Kupang City.

A summary of the sustainability status through Rapfish's multidimensional scaling (MDS) analysis of waste management in Kupang City can be seen in the following table:

NO	Dimension	Stress	R^2	Index (coordination)	Description/category
1	Milieu	0,156867	0,945957	34,48	Less sustainable
2	Economics	0,19946	0,923709	42,19	Less sustainable
3	Management	0,198176	0,944893	61,88	Quite sustainable
4	Legal and institutional	0,202546	0,943538	45,06	Less sustainable
5	social and cultural	0,179605	0,918316	47,26	Less sustainable
6	Facilities and infrastructure	0,217022	0,944232	46,12	Less sustainable
	Results of MDS Analysis			46,17	Less Sustainable

If all the pillars or dimensions above are expressed by Sudrajat, (2018) The five pillars of sustainable development, namely social, economic, institutional, environmental, and law enforcement, should be implemented in Indonesia, then through waste management in the city of Kupang, according to the opinion of Sri Bebassari from the Indonesian Waste Forum (IWF) in Asrori & Yudiyanto, (2019) Said that overcoming waste management problems must be comprehensive and handled from multi-dimensional, including: environment, law and institutional/institutional, community participation/socio-cultural aspects, funding or economic aspects, and technological dimensions, as a wisdom to think about sustainable development for the welfare of the community, and meet human needs in the present but not detrimental to future generations (Emil Salim, 1990) then I can describe the sustainability status of waste management in Kupang City in the following gafik Ini:

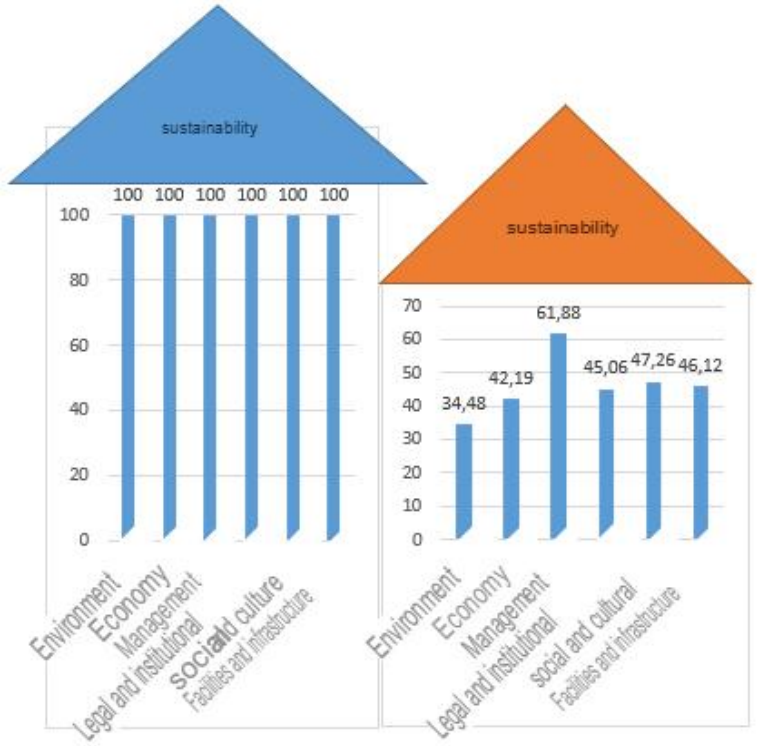

Figure 1. Ideal Overview of Sustainability and The State of Sustainability of Waste Management in Kupang City

The ideal picture of sustainability is like "a tall house with pillars or poles that are the same height and sturdy" while the description of the sustainability of waste management in Kupang City is like "a short house, with irregular pillars/support poles", then physically it is certainly not strong and less sustainable.

Conclusion

The sustainability status of waste management in the city of Kupang has an average index value of 46.17. This indicates that the sustainability status of waste management in

Kupang City is categorized as "Less Sustainable." To improve the sustainability status of waste management from the less sustainable category to sustainable (PASS), the manager in this case the Kupang city government needs to observe the long bar in the laverage analysis, namely the Lever Indicator (long bar) and the Cause of the Less Sustainable Status (3.7), among others: changing the landfill system from open dumping to Sanitary landfill with a complete fence, socializing waste regulations, waste management and its benefits, self-sorting and providing sorted and closed waste bins, empowering the community to provide economic benefits from waste management, involving the private sector including handling transportation and other investments and increasing the amount of the APBD budget for cleanliness so that it can improve basic facilities and infrastructure such as transportation fleets and waste processing technology.

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