

WASTE MANAGEMENT IN KEPULAUAN SERIBU: IDENTIFYING KEY FACTORS AND ENHANCING BUSINESS PROCESSES

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Article history: received 13 June 2024; revised 21 June 2024; accepted 21 July 2024

DOI: <https://doi.org/10.33751/jhss.v8i3.9499>

Abstract. Business process in waste management play an important role in influencing the effectiveness of household waste management in archipelago area like Kepulauan Seribu. Kepulauan Seribu is one of the areas that has potential in the tourism sector. Despite its unique location as an archipelago, Kepulauan Seribu experiences difficulties managing its waste and must transport it to landfills in Jakarta. The aims of this research are to develop the business process of household waste management program, identify the inhibiting and driving factors of the household waste management program and provide the suggestions for improving business process in Kepulauan Seribu. This research is based on qualitative methods. In-depth interviews with targeted respondents are used for data collection. Business process analysis such as waste analysis, value-added analysis, why-why analysis and pareto analysis are employed to further enhance the understanding of waste management processes and identify areas for improvement. This research discovered that business process in waste management in Kepulauan Seribu required to be improved and eliminate the unnecessary processes. Additionally, this study helps Kepulauan Seribu's household waste management program, and it is anticipated that it will help the local government formulate more sensible and useful policies.

Keywords: waste management; BPM; Kepulauan Seribu.

I. INTRODUCTION

Kabupaten Kepulauan Seribu is a distinctive area within the DKI Jakarta province. Situated in the Java Sea and Jakarta Bay, it boasts a range of unique characteristics and abundant natural resources. Its geographical location sets it apart from other regions within DKI Jakarta and presents opportunities for economic development and environmental conservation (Santosa et al., 2021). Kabupaten Kepulauan Seribu, has a compelling vision to transform itself into a sustainable field and marine life park. With its unique geographical location in the Java Sea and Jakarta Bay, the regency holds immense potential to achieve this ambitious goal while promoting environmental conservation and responsible tourism (Sahwan, 2004). Kepulauan Seribu produces 20-22 tons of waste a day (Agustino, 2022), and based on annual waste data from the Ministry of Environment and Forestry, average each Indonesian citizen produces 0.68 kilograms of waste every day (Indonesia.go.id., 2021). Hence, each person of Kepulauan Seribu's residents produces 0.77 kilograms, which exceeds average daily amount of waste produced by an individual in Indonesia.

The Regency of Kepulauan Seribu is located north of Jakarta Bay and the Java Sea. It is a part of the DKI Jakarta Province. The regency is situated between 06°00'40" and 05°54'40" South Latitude, as well as 106°40'45" and 109°01'19" East Longitude. With a land area of 864.59 hectares (8.76 square kilometers) and a water area of 474,562

hectares (4,745.62 square kilometers), the Regency of Kepulauan Seribu offers captivating natural beauty. The region consists of a total of 110 islands, with 11 of them being inhabited. These islands serve as an attraction for tourism and play a significant role in the lives of the local community (Badan Pusat Statistik Kabupaten Kepulauan Seribu, 2022). The islands are characterized by their small land area, which restricts the space available for waste disposal and treatment. This limited land poses a significant challenge in finding suitable locations for waste processing, such as recycling facilities or landfill sites. Furthermore, the islands of Kepulauan Seribu not only generate their own waste but also receive waste from other areas, exacerbating the waste management problem. The influx of waste from external sources increases the overall waste volume, straining the existing waste management infrastructure and resources. This situation is further compounded by the practice of waste burning, which is driven by the lack of proper waste disposal options. The frequent burning of waste leads to environmental pollution, health hazards, and an increased risk of fires, which can be detrimental to the fragile ecosystem of the islands. Given these challenges, an in-depth study is necessary to improve the waste management process in Kepulauan Seribu. In Kepulauan Seribu Regency, waste has become a prominent issue that needs to be addressed. Efforts to manage waste are currently being undertaken by the Environmental Agency of Kepulauan Seribu, both at an institutional and collective level

by involving the community, private entities, and relevant local government agencies. With the implementation of Governor Regulation Number 77 of 2020 concerning waste management at the neighborhood (RW) level in DKI Jakarta Province, household waste management can be intensified and improved in its implementation (Baidowi et al., 2020).

Accordance Tempo Magazine (2021), It has been found that approximately 52% of households in Kepulauan Seribu have implemented waste sorting practices before disposing of their household waste. This indicates a positive trend towards waste management and environmental consciousness among a significant portion of the population. However, it is important to address the remaining 48% of households who have not yet implemented a sorting process. The lack of waste sorting among this portion of households can have a detrimental impact on waste management efforts. Without proper waste sorting, the effectiveness of waste management processes such as recycling and composting is compromised. This leads to increased volumes of unmanaged waste, which can have negative consequences for the environment, public health, and overall cleanliness of the region. The contradiction between the lack of waste sorting and the slogan of Kepulauan Seribu, "Daya Bersehati (Berbudaya Bersih, Sehat, dan Senyum)," is evident. The slogan emphasizes the importance of cleanliness, health, and culture, and waste management is an integral part of maintaining a clean and healthy environment. By not implementing waste sorting practices, a significant portion of households is not aligned with the values and goals promoted by the local authorities.

Previous research in the field of waste management has primarily focused on the application of waste processing technologies. These studies have explored various technologies that can be combined to effectively manage and process waste. The significance of this research lies in the understanding that waste management is a complex process that requires a combination of technologies to address different types of waste and their unique characteristics (Sahwan, 2004). Another research is a case study conducted by Ko et al., (2020) on waste management crisis in South Korea, explained that community prefers to spend more money for the sake of comfort and avoiding waste piles. However, the research did not specifically address waste management process in archipelago area by using business process modeling methods, as described in this study. Various regulations and laws have also been enacted to support waste management activities in Kepulauan Seribu, but it is still considered to have a limited impact on waste management improvement.

Indonesian Law Number 18 of 2008 serves as the governing framework for waste management. According to this law, waste is defined as waste or residue resulting from daily human activities and natural sources, primarily in the form of solid waste. It recognizes the importance of proper waste management procedures to mitigate potential harm to the environment. Inadequate waste management practices can lead to adverse environmental consequences. As highlighted by Ejaz et al., (2010), improper disposal or handling of waste

can result in pollution of soil, water bodies, and air, leading to ecological degradation and negative impacts on human health.

Business process analysis is the process of studying and documenting existing business processes in one or several organizations, including normal operations and any exceptional situations that may occur (Djankov et al., 2007). Business process analysis is a systematic approach to analyze and document existing working processes in order to identify areas for improvement, increase efficiency, and reduce costs. The ultimate goal of business process analysis is to improve organizational performance and achieve better outcomes (Burlton, 2014).

Analyzing the business process life cycle is another important step in business process analysis. The business process life cycle consists of several interrelated stages, including design, development, implementation, monitoring, and continuous improvement (Sukanto, 2013). Business process analysis (BPA) is one of approach to analyze business processes, BPA is carried out by examining business processes in detail in each part carried out to identify performance in each process, and determine which processes need to be improved or eliminated to improve ongoing business processes (Dumas et al., 2018).

Value-Added (VA) Analysis is a valuable tool used to identify non-value-added steps within a business process. Its primary purpose is to enhance efficiency and effectiveness by eliminating unnecessary steps and focusing on activities that directly contribute value to the final product or service. In the context of VA Analysis, value-added steps refer to those activities that directly contribute to the creation of the product or service and are essential in meeting customer requirements. On the other hand, Business Value-Added (BVA) steps are necessary but do not directly contribute to the value of the final product or service. However, Non-Value-Added (NVA) steps are the steps that do not add any value to the product or service and can be considered wasteful. By conducting a VA Analysis, organizations can identify and differentiate between value-added, business value-added, and non-value-added steps. This analysis helps in understanding the flow of the process, identifying waste, and determining areas for improvement. The focus is on eliminating or reducing non-value-added steps to enhance efficiency, reduce costs, and improve overall process effectiveness. Eliminating waste is a key objective of Value-Added Analysis, as it helps organizations streamline their operations, reduce unnecessary activities, and optimize resource utilization. This waste elimination aspect plays a vital role in enhancing business processes, improving productivity, and delivering better value to customers. By applying Value-Added Analysis and targeting waste reduction, organizations can achieve leaner and more efficient processes, leading to increased customer satisfaction, improved profitability, and a competitive advantage in the market.

There are eight types of waste that can be found in a business process. It contains overproduction, waiting, transportation, processing, motion, inventory, defects, and unused talent. By identifying and eliminating these wastes, businesses can become more efficient and effective in

delivering value to the customers. By identifying value-added, non-value-added steps and also waste, businesses can make changes that lead to improved performance and increased customer satisfaction (Dumas et al., 2018).

The figure 1 describes current management process in Kabupaten Kepulauan Seribu:

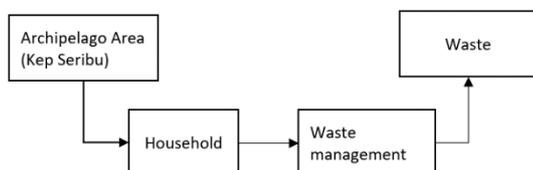


Figure 1 Current waste management process

Source: Observation (2023)

The generation of waste is considered undesirable by stakeholders, who are individuals or groups with an interest or involvement in the waste management process. Stakeholders may include local communities, businesses, government agencies, and environmental organizations, among others. Waste generation poses various challenges, such as environmental pollution, health risks, and resource depletion (Halkos & Aslanidis, 2023). Waste management is indeed closely aligned with the concept of the circular economy. The circular economy aims to achieve sustainable growth, reduce negative environmental impacts, and build a more economically sustainable society (Geissdoerfer et al., 2017). One of the key principles of the circular economy is to keep materials and products in use for as long as possible, extending their life cycle and reducing the need for new production. By aligning waste management with the principles of the circular economy, a more sustainable and resource-efficient approach can be adopted. This approach not only reduces the environmental impact of waste but also promotes economic growth and fosters innovation. By extending the life cycle of products through sharing, leasing, reusing, repairing, refurbishing, and recycling, the circular economy contributes to a more sustainable and circular system of production and consumption (European Parliament, 2022) The implementation of the circular economy concept in waste management is indeed crucial for Kepulauan Seribu. To achieve this, a well-developed business process management is essential. Therefore, the objectives of this research are to develop the business process of the household waste management program in Kepulauan Seribu, identify the inhibiting and driving factors of the household waste management program, and provide recommendations for improving the waste management program in Kepulauan Seribu. By focusing on developing the business process, identifying inhibiting and driving factors, and providing recommendations, this research aims to contribute to the development of an effective and sustainable waste management program in Kepulauan Seribu. Implementing the circular economy concept in waste management can lead to reduced waste generation, increased resource efficiency, and a healthier and more sustainable environment for the islands' residents and ecosystems.

II. RESEARCH METHOD

This research utilizes a qualitative method to comprehensively analyze the waste management program business process in Kepulauan Seribu. Qualitative methods are used to study the phenomena, qualities, and different manifestations of each phenomenon and the contextual factors surrounding them (Busetto et al., 2020). By employing a qualitative approach, the research aims to gain in-depth insights into the factors that hinder and facilitate effective waste management in the region. This method allows for a holistic understanding of the waste management process, considering not only the technical aspects but also the social, economic, and environmental factors that influence waste management practices.

The research follows a well-defined and systematic process consisting of multiple sequential stages. Firstly, a thorough literature review is conducted to explore the existing knowledge and research on waste management. This step ensures that the research is built upon a solid foundation of prior understanding and helps identify any research gaps or areas that require further investigation. Data collection is carried out through in-depth interviews, employing purposive sampling techniques. This approach ensures that the research captures a diverse range of perspectives and experiences from key stakeholders involved in waste management, such as waste producers, waste management officers, and community members. By conducting in-depth interviews, rich and detailed qualitative data is obtained, enabling a comprehensive analysis of the waste management process in Kepulauan Seribu. To analyze the collected data, advanced analytical tools such as the NVIVO application are utilized. This allows for systematic data coding, categorization, and thematic analysis, enabling the researchers to identify patterns, trends, and key findings. Additionally, mapping techniques, such as waste analysis, value-added analysis, "Why-Why" analysis, and Pareto analysis, are employed to further enhance the understanding of waste management processes and identify areas for improvement. Pareto Analysis, Value-Add Analysis, and the "Why-Why" Analysis are all tools and techniques commonly used in process improvement and problem-solving methodologies. While they have distinct purposes, there is a connection between them in terms of their application and contribution to identifying and addressing issues in a systematic way. Pareto Analysis helps prioritize and focus efforts on the most significant problems, while Value-Add Analysis identifies areas for improvement in terms of value creation and waste reduction. The "Why-Why" Analysis complements these techniques by helping to uncover the root causes behind the identified issues, guiding the development of targeted solutions. Furthermore, the research utilizes BPMN modeling using Camunda, a well-established business process modeling tool. BPMN (Business Process Model Notation) is a method used to assess the quality of a business process (Kopp et al., 2022). This modeling approach provides a visual representation of the waste management process, allowing for a clear understanding of process flows, decision points, and potential bottlenecks. The utilization of Camunda facilitates process optimization and offers insights

into streamlining waste management procedures for improved effectiveness and efficiency.

The research commenced in March 2023 and focuses specifically on Pulau Kelapa within the Kepulauan Seribu Regency of DKI Jakarta Province. Pulau Kelapa was selected as the research site due to its high population density, making it a representative location to examine waste management challenges in the region. This practical approach of selecting a single island with the highest population density allows for a focused analysis while considering the diverse waste management practices across the numerous islands within Kepulauan Seribu Regency. By conducting this comprehensive research, valuable insights and recommendations can be generated to address the identified inhibiting factors and enhance the waste management process in Kepulauan Seribu. The combination of qualitative data, advanced analytical tools, mapping techniques, and BPMN modeling using Camunda ensures a robust and rigorous research methodology that can contribute to effective waste management strategies and practices in the region.

III. RESULT AND DISCUSSION

A business process is a series of interrelated activities that work towards achieving specific business goals. The waste management process involves various activities such as collection, transportation, processing, and disposal of waste in an efficient and effective manner. To ensure that waste management is conducted in a sustainable and effective way, it is important to consider environmental, health, and safety aspects. The Business Process Model and Notation (BPMN) is used as a standard notation to model and optimize waste management processes. BPMN diagrams help to identify and analyze the interactions between the elements involved in the process. BPMN has the main objective of facilitating business analysis from the start of the business process until its completion (Chinosi & Trombetta, 2012). Camunda is an open-source application that is used to model, automate, and monitor business processes based on BPMN. Camunda provides monitoring and reporting features that allow the performance of business processes to be monitored in real-time. Bartmann et al. (2021) stated that Camunda can be used to predict delays in business processes by applying predictive process monitoring techniques, which can lead to more effective business process improvement.

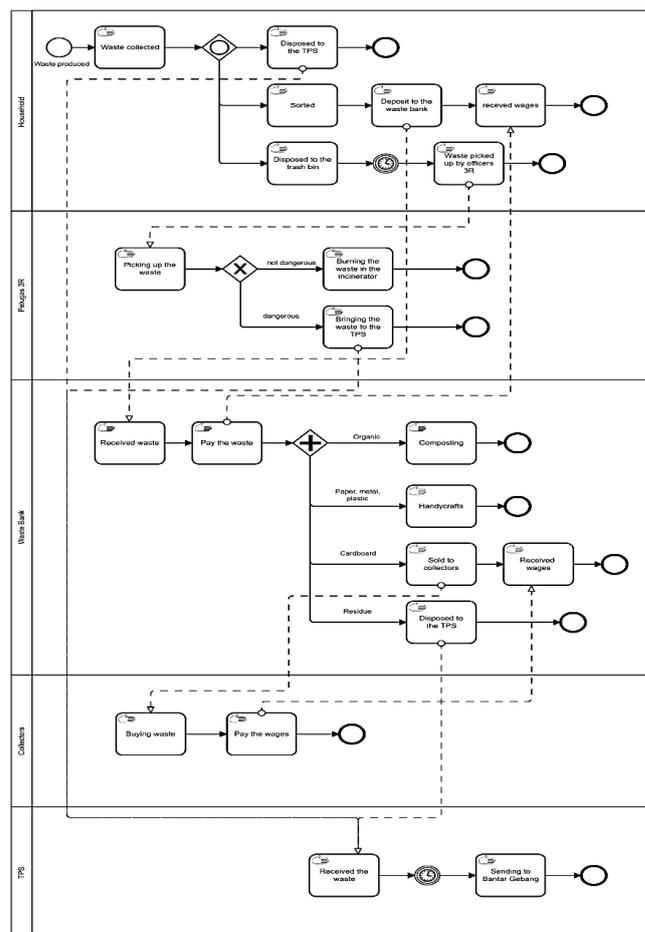


Figure 2. Waste Management Business Process in Pulau Kelapa, Kabupaten Kepulauan Seribu
 Source: Observation (2023)

The waste management business process in Pulau Kelapa, Kabupaten Kepulauan Seribu, is depicted in Figure 2, there are several ways in which waste management is carried out at the research location, including directly disposing of waste to the landfill without any management, disposing of waste in the trash and waiting for it to be collected by waste collectors, and sorting waste for further management according to its type and eventually depositing it to the waste bank available in each community association (RW). The third method is considered the best waste management method as it involves sorting and processing waste according to its type. Organic waste is usually processed into fertilizer, while inorganic waste is usually sold (if still valuable) to merchants, made into handicrafts, and if it can no longer be utilized, it will be sent to a temporary landfill (TPS) which will then be transported to a final landfill in Jakarta.

Proper waste management is crucial to maintain the cleanliness and health of the environment and to minimize negative impacts on society and the surrounding environment. Good waste management includes efforts to reduce waste sources, improve air quality, optimize land use, and minimize negative impacts on society and the environment. In the above diagram, it is shown that some residents of Kabupaten Kepulauan Seribu have carried out waste management by sorting and depositing it to the Waste Bank, but this

person's knowledge, the more positive the behavior demonstrated in the sense that the individual will understand more about the importance of waste management and be more likely to carry out these activities. This knowledge can be obtained through campaigns or discussions about the importance of waste management which can be carried out in communities, schools and other organizations. In accordance with Jusoh et al. (2018) which states that consumer participation can be increased through campaigns that emphasize the importance of environmentally friendly sorting and separation of household waste. Indirectly, they gain a good understanding of subjective norms, attitudes and positive behavior in managing household waste. Therefore, the government's role is very necessary in realizing these campaign activities, talks or activities so that people do not forget and are aware of the importance of waste management in everyday life.

The analysis of waste management in the business process of Kabupaten Kepulauan Seribu involved the application of value-add and waste analysis. In this analysis, each step within the business process was carefully examined, and non-essential steps were identified and eliminated. This analysis categorized the steps into three distinct categories: value-adding (VA), business value-adding (BVA), and non-value adding (NVA). Based on the BPM created, the following is the value-added analysis table:

Table 1. Value Added Analysis and Waste Analysis

PIC	Process	VA	NVA	BVA
Household	Collecting waste			
	Disposing to Temporary Disposal Site		√	
	Sorting			√
	Disposing to waste bin			
	Depositing to waste bank			√
	Receiving payment	√		
3R officer	Waste is picked up by 3R officers	√		
	Collecting waste		√	
	Burning waste in incinerator		√	
Waste Bank	Transporting waste to TPS		√	
	Receiving waste			√
	Paying for waste	√		
	Making compost	√		
	Making handicrafts	√		

Merchant	Selling to vendors	√	
	Disposing to TPS		√
	Receiving payment	√	
	Buying waste	√	
Temporary disposal site	Paying for labor	√	
	Receiving waste delivery		√
	Delivering waste to Bantar Gebang		√

Based on the table provided, the waste management steps can be categorized as Value Adding (VA), Business Value Adding (BVA), or Non-Value Adding (NVA). VA steps are those that contribute value and satisfaction to waste producers (the community), BVA steps add value to waste management officers/bank officers, while NVA steps do not add value to either waste producers or waste management officers/bank officers. Consequently, it is necessary to eliminate the NVA steps in the waste management process in Kabupaten Kepulauan Seribu since they do not provide value to any of the involved parties. The steps that should be eliminated consist of dumping waste at TPS, picking up waste, burning waste, transporting waste to TPS, TPS receiving waste, and delivering waste to the final landfill location at Bantar Gebang. By eliminating these NVA steps, the waste management process can become more efficient and effective. This approach ensures that resources and efforts are directed towards value-adding activities that benefit both the waste producers and the waste management officers/bank officers. It also promotes sustainability by reducing unnecessary activities that may have negative environmental impacts, such as burning waste. Ultimately, streamlining the waste management process based on value-adding steps can lead to improved waste management outcomes in Kabupaten Kepulauan Seribu.

In managing waste sustainably, the basic principles are reduction, reuse, and recycling (3R). Therefore, several steps can be taken to optimize waste management processes in Kabupaten Kepulauan Seribu, including reducing waste through education and socialization campaigns to the public about waste reduction and organic and non-organic waste sorting, encouraging reuse through the development of waste banks or community sharing programs, recycling waste that can still be recycled such as paper, plastic, and metal, utilizing organic waste to be compost or alternative fuels, and managing non-recyclable or usable waste in an environmentally friendly manner such as through modern landfill systems.

In the waste management process, various steps can be categorized as Business Value-Added (BVA) or Non-Value-Added (NVA). BVA steps, such as waste transportation from homes to waste collection points (TPS) or waste banks, waste sorting, and waste transportation from TPS or waste banks to

final processing sites, are necessary for maintaining environmental cleanliness and ensuring proper waste management. These steps contribute to the overall effectiveness of the waste management program. On the other hand, actions such as burning rubbish or throwing rubbish at TPS without proper sorting can be classified as NVA. These activities not only have a negative impact on the environment but also do not provide real benefits for waste producers or waste management officers/bank officers. Activities like this cause environmental pollution and hinder progress in sustainable waste management. By identifying the above activities, the efficiency and effectiveness of ongoing waste management programs can be assessed. The goal is to optimize BVA steps while eliminating or minimizing NVA steps. This can be achieved through improving waste management processes, including increasing citizen awareness, improving waste sorting practices, improving transportation systems, and encouraging the use of appropriate waste processing and disposal methods.

When eliminating the Non-Value Adding (NVA) steps, it is crucial to conduct a comprehensive evaluation of the entire waste management process in Kabupaten Kepulauan Seribu. This evaluation should take into account environmentally friendly and efficient alternatives for waste management. By exploring and implementing sustainable practices, such as recycling, composting, or innovative waste treatment technologies, the waste management process can be optimized to minimize environmental impact and resource consumption. Additionally, active participation from the public is essential in sorting and managing their waste effectively. Public engagement and education programs can be implemented to raise awareness about the importance of waste segregation, recycling, and responsible waste disposal practices. Encouraging the community to actively participate in waste management not only promotes a sense of ownership and responsibility but also helps to alleviate the burden on waste management officers/bank officers. By involving the public in waste management efforts, the community becomes an integral part of the solution, leading to increased compliance with waste management regulations and higher levels of waste diversion from landfills. This active participation fosters a culture of sustainability and empowers individuals to make conscious choices regarding waste reduction and recycling.

Furthermore, a Pareto chart analysis was conducted to determine the most influential factors in the success of the waste management program in Kepulauan Seribu. The Pareto chart is a valuable tool for identifying the key factors that have a significant impact on the effectiveness of a waste management program (Pyzdek & Keller, 2003). By focusing on these critical factors, stakeholders can prioritize their efforts and allocate resources more effectively to achieve successful waste management practices in Kepulauan Seribu. The Pareto chart is a powerful tool that allows decision-makers to prioritize the factors that have the greatest impact on a problem or situation. It helps to identify the key factors that need to be addressed to solve a problem effectively. In the context of waste management in Kabupaten Kepulauan

Seribu, the Pareto chart analysis has revealed the most influential factors that contribute to the inefficiencies in the waste management process. By addressing these factors first, waste management stakeholders can make significant improvements in the overall effectiveness of the waste management system. Therefore, the use of Pareto charts can be highly beneficial for waste management decision-makers in identifying and prioritizing the critical factors that require attention to achieve efficient waste management practices.

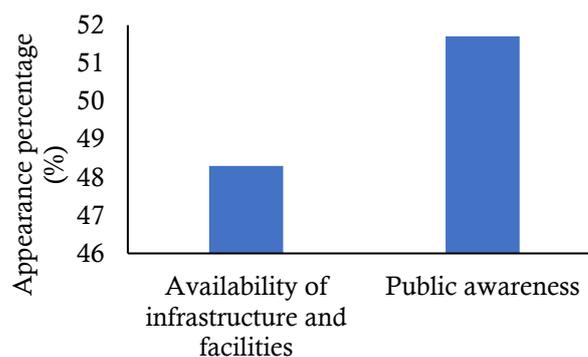


Figure 4. Pareto Chart of Barriers to Waste Management

Source: Observation (2023)

The Pareto diagram is used to determine the obstacles that most influence the success of the waste management program in Seribu Islands Regency. Based on the analysis of the picture above, the two most influential inhibiting factors in the success of the waste management program in Seribu Islands Regency are the low level of public awareness of the importance of waste management and the availability of facilities and infrastructure, with a frequency of occurrence of 51.7% and 48.3% respectively. This is in accordance with Ferronato and Torretta (2019) who stated that the lack of public knowledge about waste management and limited infrastructure are the main obstacles to successful waste management. Therefore, increasing public awareness is very important for the success of the waste management program in Seribu Islands Regency. To achieve this, various media can be used to carry out educational campaigns regarding waste management. In addition, waste management training for the community and community involvement in integrated waste management programs that utilize technology can help overcome these obstacles.

Based on the findings above, the root of the problem can be formulated which could be an inhibiting factor in the waste management process. The root of the problem can be identified using "Why-Why" analysis. "Why-Why" analysis is a method that is widely used to analyze cause-and-effect relationships to identify the root causes and main causes of a problem (Wilson et al., 1996). By using this method to analyze the waste management business process in Seribu Islands Regency, the root of existing problems can be identified and resolved more effectively. This approach helps ensure that these problems are addressed at their roots, resulting in more sustainable and long-lasting solutions. Therefore, "Why-Why" analysis is a useful tool for waste

management agencies to improve their operations and ensure that they meet their waste management objectives in a cost-effective and efficient manner.

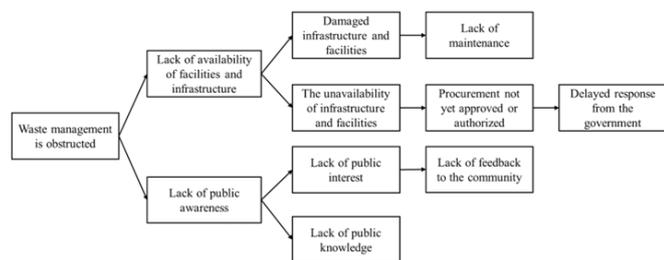


Figure 5. Why-why analysis

Source: Observation (2023)

Analysis using the "Why-Why" diagram above shows that the main cause of hampered waste management in the Kepulauan Seribu is the lack of adequate facilities and infrastructure due to the government's low attention to waste management. Moreover, waste processing in the Kepulauan Seribu is hampered due to a lack of awareness of the importance of waste management and its negative impact on the environment and human health is another reason for hampered waste management.

According to the research that conducted by Minelgaitė and Liobikienė (2019) the level of responsibility is also important for the promotion of waste management and declared efforts to reduce waste significantly influenced people to recycle the waste. The declaration may affect to the public waste management awareness. This indicates that there is a need to address the issue from both the supply and demand side. Apart from that, public awareness and knowledge can be increased by disseminating information about these problems (Wan et al., 2019). This can be done by providing outreach regarding the importance of waste processing. Another strategy that can be used is the expansion of information through verbal or written messages that remind individuals to behave appropriately, for example recycling slogans that attract individuals' attention to participate in recycling practices. Therefore, an integrated and sustainable solution is needed to address the root causes of the problem. This includes increasing public awareness of the importance of waste management through education and campaigns, as well as ensuring the availability of adequate facilities and infrastructure for effective waste management. It is important to involve various stakeholders, including the government, waste management companies, and the public, in developing and implementing sustainable waste management strategies to achieve long-term success.

Based on the inhibiting and driving factors above, a business process improvement can be proposed as follows:

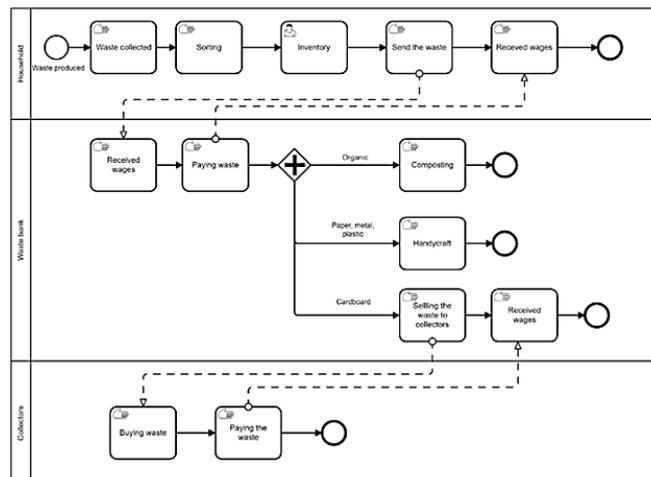


Figure 6. Improvement of waste management business processes in Kelapa Island

Source: Observation (2023)

Figure 6 provides a simplified business process for household waste management in Pulau Kelapa, which involves three main actors: households, waste banks, and waste collectors. Households will be the key players in waste management, in addition to waste banks. Waste will be sorted independently by households, entered into a technology-based waste inventory system, sent to waste banks, and receive compensation for the value of the waste that has been sorted and has economic value. On the other hand, waste banks will receive waste deposits from each household, collect and sort organic and inorganic waste, coordinate with traders or collectors for the sale of economically valuable waste, and record incoming waste from each household, outgoing waste to collectors for sale, as well as recording income, expenditure, and waste balances. Waste banks will also provide facilities for exchanging special waste accounts, especially waste that has economic value, to households or the community. The third actor is waste collectors who carry out the collection of residual waste or waste that no longer has value, cannot be recycled, reused, or reduced, and then sent to the final waste disposal site in Bantar Gebang, Jakarta.

Improving waste management in Pulau Kelapa through the business process improvement discussed in Figure 6 can bring positive impacts on the environment, society, and economy. These benefits include:

- Increased waste management efficiency: Implementing integrated waste management based on technology can make the waste management process more efficient, economically valuable, and sustainable.
- Improved environmental quality: Better and more effective waste management can help improve the quality of the environment, such as reducing waste disposal to landfills and utilizing waste as fertilizer. This is in line with Zorpas (2020) who states that good waste management can improve the quality of life in terms of economy, health, and more.
- Improved public health: Poorly managed waste can pose health risks, and improving the waste management process can help reduce such risks. This is consistent with

Oyebode (2018) who state that good waste management can reduce health hazards and improve public health.

By improving the waste management process, existing waste management businesses can become more productive and generate greater profits. This is consistent with the opinion of Wulandari et al., (2017) who stated that good waste management can improve the local economy.

IV. CONCLUSIONS

A small number of residents in Seribu Islands Regency have carried out waste processing. There are several things that hinder the success of the household waste management program in the Seribu Islands district. One of them is inadequate facilities from the government, damaged waste management infrastructure, lack of community involvement, low public awareness, limited knowledge about waste management, and limited land, especially in dense residential areas. However, there are still supporting factors such as training and education initiatives, community-based organizations involved in waste management, and the existence of a Waste Bank.

A comprehensive evaluation is needed to optimize waste processing. Therefore, an improvement plan can be proposed to improve the household waste management process on Kelapa Island, Seribu Islands Regency. The steps that can be taken to improve waste processing in the Kepulauan Seribu start with households sorting waste, using a technology-based waste inventory system, and depositing it into the Waste Bank. Households also receive compensation. The Waste Bank sorts waste, coordinates with merchants, records transactions, and provides waste account exchange. Scavengers collect worthless waste and send it to the final disposal site in Bantar Gebang, Jakarta. By implementing these steps, it is hoped that waste management in Seribu Islands Regency can become more effective and efficient, thereby maintaining environmental cleanliness, improving public health, and supporting overall business goals.

Furthermore, the government needs to pay greater attention to waste management by providing adequate facilities and carrying out routine maintenance of waste management infrastructure. Increasing community involvement in waste management activities is also needed. The government can increase training and education programs organized by environmental activists or local NGOs to increase public awareness about the importance of waste management. In addition, effective campaigns and outreach efforts are needed to increase community participation in waste management. For further research, evaluation and improvement of new business process models can be carried out, starting from household waste management, including waste sorting, use of a technology-based waste inventory system, collaboration with Waste Banks, and proper waste disposal.

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