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The Potential Integration of Informal to Formal Workers in Muara Fajar Landfill (TPA) Pekanbaru with the Circular Economy Concept

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ABSTRACT

Waste is a serious problem in developing countries due to infrastructure limitations, one of which is the city of Pekanbaru. The existence of the landfill triggered the arrival of informal workers such as scavengers to collect waste as recycled product materials. Most scavengers live below the poverty line, even though scavengers have a role in restraining the waste generation rate in landfills. This study aims to analyze the potential integration of scavengers in the Muara Fajar Landfill Area with formal workers using integrated waste management, "Clean Pekanbaru Movement." The research was conducted using observation methods, interviews, and questionnaires filled out by scavenger and collector respondents in the landfill area. The recycling rate (RR) of the Muara Fajar landfill area is 1.08%, and the average individual RR of 150 scavengers is 0.72%. The proposed integrated waste management concept is the "Clean Pekanbaru Movement," which manages the Muara Fajar landfill area and acts as a recycling industry player. The study results show that the recycling rate at the Muara Fajar landfill only reaches 1.08%, while the average individual scavenger only reaches 0.72%. The Pekanbaru Clean Movement model is proposed as a solution that integrates scavengers into a formal waste management system with regulatory support and the recycling industry. As many as 82% of respondents are willing to participate in this program for a fixed income and better social security. This study concludes that the potential for waste generation because of recyclable materials is still huge, and the potential for integration is very possible at the Muara Fajar Landfill, Pekanbaru. Implementing this program can improve the social welfare of scavengers and reduce the environmental impact due to the open waste disposal system.

Introduction

Economic growth causes urbanization of citizens to urban areas, causing the volume of urban waste to increase rapidly, especially in developing countries (Guerrero et al., 2013). Globally, the amount of waste generated reaches 2 million tons annually; by

2050, the amount of waste is estimated to reach 4.54 million tons per year (Global Waste Management Outlook UNEP, 2015).

Waste is a serious problem, especially in poor and developing countries, due to its limited infrastructure and human resource capacity. (Botello-Álvarez et al., 2018). If waste management is not done correctly, it will negatively impact the environment and public health. (Sahar, 2019; Singh, 2019) It can even cause greenhouse gases, one of the causes of climate change.(Yousefloo & Babazadeh, 2020).

All cities in Indonesia face waste problems, including Pekanbaru City, the capital of Riau Province. According to 2020 data, the daily waste in Pekanbaru City reached 1,052.16 tons, originating from 15 sub-districts. It was disposed of in the Muara Fajar landfill in Rumbai District, Pekanbaru City, Riau Province. (Hayati et al., 2022). Muara Fajar landfill has been established since 1985 using an open dumping system. (Subechan et al., 2017).

The existence of landfills triggers the arrival of informal workers (scavengers) to find and collect waste that still has economic value. This waste is then sold to the recycling industry as raw material for secondary or recycled products. The types of waste scavengers collect include PET plastic, cardboard, paper, cans, iron, and glass. (Sartika et al., 2020)Scavengers are informal workers because they work independently without a coordinator or institution to oversee them. (Singgih Hendarto, 2021). Most scavengers live below the poverty line and cannot access social security. (Ferronato et al., 2020). In addition, informal workers often experience conflict with other communities. (Prihandoko et al., 2021). Even though they play an important role in reducing the negative impacts of poor waste management systems (Botello-Álvarez et al., 2018). The circular economy is a development of the linear economy concept that aims to reduce waste generated and use natural raw materials. (Velenturf & Purnell, 2021)The circular economy offers opportunities to create an integrated waste management system involving scavengers, improving their welfare and giving them the same social security as other communities (Erpinda et al., n.d.; Yousafzai et al., 2020).

One example of the application of integrated waste management found in Brazil is the formation of a special scavenger cooperative whose task is to buy recyclable waste from scavengers at a fair price and provide necessities for scavengers.s (Botello-Álvarez et al., 2018).

According to our findings, the incineration-based PLTSa could be a viable option for Pekanbaru to develop better waste management. During the operational phase, PLTSa must be supported by a stable supply of waste feedstock, proper waste pre-treatment, and advanced technology for controlling air emissions. (Siregar et al., 2022).

Through the circular economy concept, this research focuses on the potential integration of informal workers at the Muara Fajar Landfill in Pekanbaru. Although previous research has explored waste management in various urban contexts, this study introduces a new approach by exploring a structured transition model from informal to formal work. The study aims to bridge the gap between informal waste collection and the organized recycling industry and provide a framework for sustainable waste management.

The urgency of this research is emphasized by the increasing accumulation of waste in Pekanbaru, where daily waste production reached 1,052.16 tons in 2020, with all waste directed to the Muara Fajar Landfill. Without intervention, inefficiencies in waste management will continue to pose environmental and economic challenges.

This research aims to analyze the feasibility of the integration process of informal workers into the formal part of the waste management system with the concept of circular economy to improve the welfare of scavengers. This research is expected to provide several benefits. First, this study offers insights for policymakers in developing inclusive waste management policies. Second, this study recommends that recycling industry players improve supply chain efficiency. Finally, the study contributes to the well-being of informal workers by advocating for decent wages, social security, and safer working conditions.

Method

a. Methods

This research is descriptive quantitative non-experimental, with data collection methods through interviews and filling out questionnaires. Data was collected by accidental sampling, with respondents being informal workers in the Muara Fajar Landfill Area (scavengers and collectors) and the local government through the Environmental and Cleanliness Office (DLHK) of Pekanbaru City.

The research data originates from observation and interviews with respondents. The data is used in the form of the amount of waste collected by scavengers and waste sold by collectors to recycling factories. The results will be presented using a descriptive analysis approach to present numerical data on the informal sector's potential for recycling around the Muara Fajar Landfill.

b. Time and Locations

The research was conducted from May to September 2024. The research location is Muara Fajar landfill, which is located on Jl. Ikan Raya, Muara Fajar Village, Rumbai District, Pekanbaru City.

c. Sample Research

The target sample size of 105 respondents with a 95% confidence level refers to Isaac and Michael's theory, which is based on preliminary observations of the scavenger population in the landfill area, which is estimated to reach 150 people, as in the Isaac and Michael theory table. (Amin et al., 2023).

Results and Discussion

a. Analysis of potential waste volume

Based on field observations, the amount of recyclable waste collected by 110 waste pickers who became respondents was less than 3 tons or only 2.84 tons. If calculated, the average amount of waste obtained by waste pickers is 26 kilograms daily. This amount is much less, with only 1.07% of the recyclable waste entering the Muara Fajar landfill at 263 tons per day.

The following is a graph of the waste collected by scavengers at Muara Fajar Landfill in Pekanbaru City.

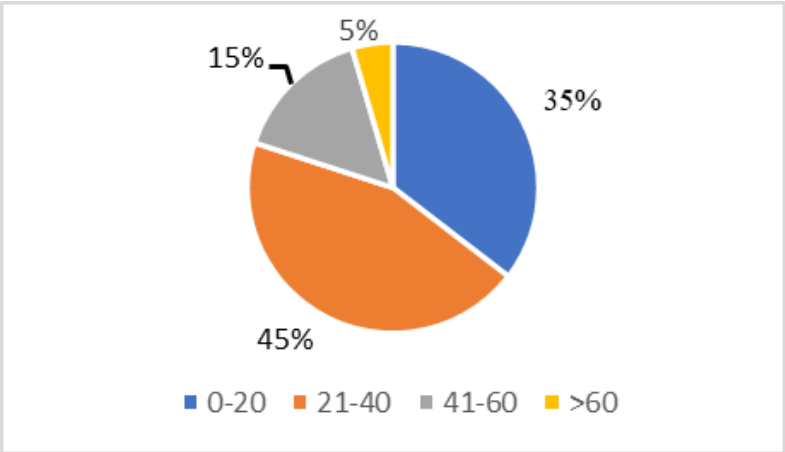

Figure 1: Distribution of The Amount of Waste Collected by Waste Pickers Per Day (Kg)
Source: Author's data

This factor is due to the landfill's less-than-optimal waste management system. Scavengers only focus on certain types of waste, such as lightweight plastic packaging, which occupies a larger volume of space and has higher selling prices. This factor provides a massive opportunity for the government and recycling industry players to manage the waste accumulating in the Muara Fajar Landfill.

Based on the calculation results, the recycling rate in the Muara Fajar landfill area was 1.08%, and the recycling rate for 110 waste pickers who became respondents was 0.72%. The results showed that the recycling rate obtained was relatively more minor when compared to other regions, such as Bandung City at 8.05% (Febrino & Rahardyan, 2015) and individual waste pickers at Bantargebang Landfill at 2.2% (Sasaki et al., 2020). Even the recycling rate of individual waste pickers in Brazil reached 18.53% (de Sousa Dutra et al., 2018).

Several factors influence the non-optimal amount of waste collected and recycled, such as the inaccuracy of the records made by scavengers and collectors; quantitative data on recycled waste in Indonesia is still limited because there has not been much research on the flow of waste recycling. (Sasaki et al., 2014, 2020).

Other types of waste can also be utilized, such as organic waste, such as food waste, market waste, twigs, and leaves, which can be processed as organic fertilizer (compost) and animal feed known as "pulp." Waste can also be utilized as a source of electrical energy using refuse-derived fuel (RDF) technology.

Pekanbaru City has no integrated waste treatment facility and only relies on the Muara Fajar Landfill (TPA), which has been operating since 1985 using the open dumping method. As a result, the storage capacity continues to decline.

b. Scavenger's Problem

Based on the results of observations conducted in May and September 2024 with 110 respondents who are waste pickers in the Muara Fajar landfill area, Pekanbaru, waste pickers around the Muara Fajar landfill often face several problems, such as economic, social, work safety, health, and environmental problems.

Waste pickers most commonly face economic problems because their income is still far below the standard of living. The average income of 110 respondent scavengers at Muara Fajar Landfill is only Rp1,037,363, with details of 68% or 70 respondents earning less than Rp1.5 million, 31% or 39 respondents earning between Rp1.5 and Rp3 million, and only one respondent earning more than Rp 3 million per month. Meanwhile, the regional minimum wage for Pekanbaru City in 2024 is IDR 3,451,584.

The low-income waste pickers receive is due to the highly volatile price of recyclable waste and the relatively long supply chain from waste pickers to the recycling industry. The price of recyclable waste varies depending on the type and condition of the waste, ranging from Rp. 1000 for uncleaned waste known as "Chong" to Rp. 4000 for cleaned waste. Collectors determine the price scavengers receive by buying waste from them and reselling it to recycling plants. Factors influencing the price of recyclable waste include supply and demand and the distance between collectors and recycling plants, which affect transportation costs. Although the income received is still below the standard, waste pickers do not have other employment options, as can be seen from the percentage of workers' reasons for becoming waste pickers, reaching 47% of the total respondents. This was followed by the reason for the following family, such as husbands and parents, at 46%, as shown in Figure 2 below.

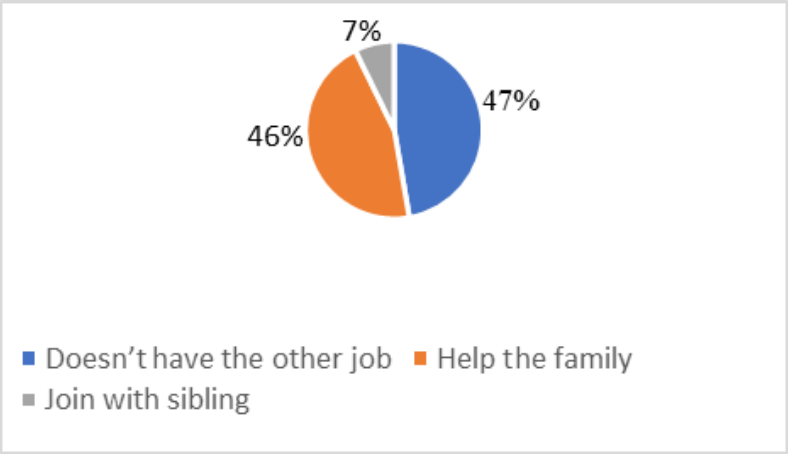

Figure 2: Distribution of reasons for becoming a scavenger
Source: Author's data

The main factor that causes many respondents to choose a job as a scavenger is that their education level is still relatively low, only up to junior high school level. Another problem often experienced by waste pickers is social conflicts, such as conflicts between fellow waste pickers, landfill officers, and the surrounding community.

When doing their work, waste pickers only use makeshift personal protective equipment and do not comply with work safety standards, putting them at risk of injury. This problem is exacerbated by the waste pickers being too close to the heavy equipment operating to tidy up the waste piles, as shown in Figure 3 below.

Figure 3. Scavenger Activities at Muara Fajar landfill
Source: Author's Documentation

The waste pickers do not have social security such as BPJS and other social security because most of them are migrants from outside the area, such as North Sumatra, and do not have identity cards (KTP) of Pekanbaru City, so the local government cannot provide social security specifically for people experiencing poverty for the waste pickers. The problem of waste pickers encountered during the observation was that there were still underage workers/child waste pickers, even though the number reached 21% or 23 people from the total number of respondents of 110 people.

Child scavengers' motivation to work is to alleviate their parents' economy and earn extra pocket money. All child scavengers are still students at the elementary, junior high, and high school levels. However, the author does not have any documentation regarding these child scavengers.

c. Integration Potential of Scavengers

Based on the various problems of waste pickers described previously, the author provides recommendations for improving their welfare and optimizing the amount of waste that can be recycled.

The recommendation is in the form of an integration concept that involves waste pickers as an official part of the city's waste management with a partnership system called the "Gerakan Pekanbaru Bersih," where this waste management will become an official partner of the local government in managing and utilizing waste in the Muara Fajar Landfill.

The landfill area will be closely monitored so that waste pickers who do not participate in this integration program cannot access the Muara Fajar landfill.

Workers who have participated in the integration will get a fixed monthly income and better social security than when they were informal waste pickers. In addition, workers will be equipped with personal protective equipment (APD) according to safety standards. When conducting waste search and collection activities.

Workers/former waste pickers who are members of the Gerakan Pekanbaru Bersih will be given training, especially on the types of waste, to collect a larger volume of waste than they currently do. The hope is that the rate of waste accumulating in the landfill can be reduced.

The type of waste to be collected by workers/ex-scavengers will be regulated by the management. In addition to receiving waste from workers at the landfill, it can also receive recyclable waste from outside the landfill, such as waste from the general public in the Pekanbaru City area, with a direct buying and selling system, as is already taking place in the current buying and selling activities between scavengers and sellers/collectors.

However, the selling and buying price of waste set by the Pekanbaru Bersih Movement manager will be more competitive even above the current market price because the manager of the Pekanbaru Bersih Movement will act as a recycled industry player so that it can shorten the supply chain for recycled waste to become recycled products as shown in Figure 4.

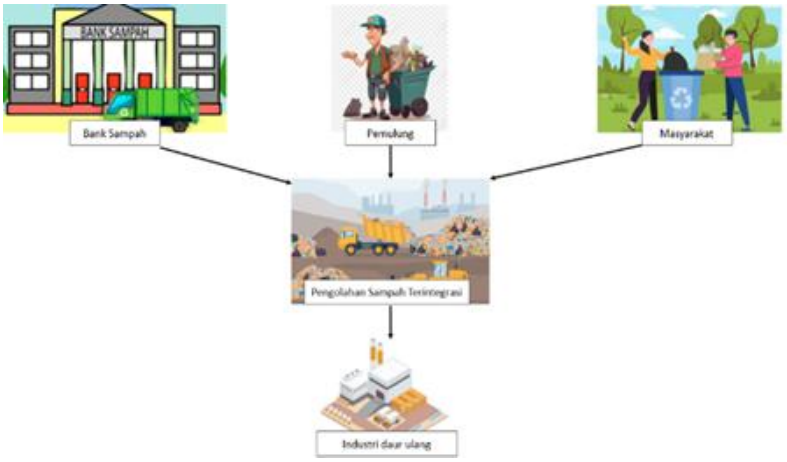

Figure 4: Integrated Waste Management Scheme

The results showed that 82% of respondents accepted and wished to join the integration program to get a permanent job and better welfare than the current one. In comparison, 18% of respondents refused to join the integration program because they wanted to work independently, were too old, and wanted to continue their education to a higher level. Some worked only to earn additional income for the family (not as a primary job).

The high interest of waste pickers to participate in the integration program was also seen in previous research conducted in Jambi City, Bukittinggi City, Cirebon City, Malang City, Denpasar City, and Bogor Regency (Bappenas, 2022). The concept of

integrated waste management takes an example of a waste management facility in Hanam City, South Korea, which has an integrated waste management facility called The Hanam Union Park (Yoon, 2020).

This facility has several waste treatment installations, such as municipal waste treatment, food waste treatment, recycled waste treatment, and incinerators that convert waste into electrical energy. These installations adopt high technology to reduce the impact of pollution from urban waste.

The positive impact of the waste management integration process will be reducing production costs, which will shorten the recycled waste supply chain. Large-scale recycling industry facilities are still focused outside Pekanbaru City, such as Medan City and North Sumatra. Hence, recycling industry players must incur enormous production costs, especially transportation costs.

If this integrated waste management system can be implemented and a large-scale recycling industry is present in Pekanbaru City, the difference in production costs can be diverted to improve the welfare of workers through providing decent worker wages, purchasing recycled waste at competitive prices from partners outside workers, and procuring personal protective equipment that meets safety standards such as head protection, eye protection, masks, gloves, shoes, and others.

d. Challenges Integration of Workers

This integration concept has challenges, such as high investment costs, a long time to feel the positive impact of the integration process, and regular research on the products to be produced. According to some literature, products derived from the recycling process are of lower quality than products derived from raw materials.

Some packaging derived from the recycling process cannot be used as food containers / not food grade standards, and professional management is needed because it will be directly related to the large-scale packaging industry as a user of the products produced as well as with the local government as the owner of the landfill (TPA) and the authority for waste management in urban areas.

Another challenge is that this integration concept can potentially kill the businesses of existing small-scale waste collectors and the recycling industry. Therefore, it is necessary to find a solution so that integrated waste management will not harm existing waste recycling actors in the future. In addition, it is necessary to understand the community so that they can recognize the existence of informal workers and support to get civil rights from the government.

Conclusion

The Pekanbaru Bersih Movement is an integrated waste management concept that provides benefits to improve waste pickers' welfare and reduce waste in the Muara Fajar landfill. This study analyzes the potential for integrating informal workers (scavengers) into the formal sector in a circular economy-based waste management system at the Muara Fajar Final Disposal Site (TPA), Pekanbaru. The study's results show that the

potential for recyclable waste is still huge. However, the Muara Fajar Landfill's recycling rate is still relatively low, at only 1.08%, with the recycling rate of individual scavengers at 0.72%. Scavengers' main problems include income instability, lack of social protection and job security, and potential social conflicts with the community and landfill officers. However, the study results showed that 82% of respondents were willing to participate in the integration program offered through the concept of the Clean Pekanbaru Movement. This program is expected to improve the welfare of scavengers through a more structured waste management system, the provision of fixed wages, social security, and work safety equipment. In addition, this concept allows for the optimization of waste management through technology and partnerships with the recycling industry. Although there are challenges in implementation, such as significant investment needs and risks of impacting small-scale recycling businesses, this integration concept can be a long-term solution in creating a sustainable waste management system in Pekanbaru. With the support of the government, the private sector, and community participation, integrating scavengers into the formal sector can be a strategic step in realizing cleaner and more economically empowered cities.

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