



ARTICLE

Waste Management System in Pekanbaru City

City Government Capability, Issues, and Policy Alternatives

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Abstract: This study aims to describe the government's capability in waste management, problems, and alternative policies that can be made to overcome waste management problems in the city of Pekanbaru. This research uses a combination of quantitative and qualitative research methods. Quantitative methods describe the government's capability in waste management by distributing questionnaires to lecturers, students, and alumni of the Environmental Science doctoral program at the University of Riau, environmental activists, and academics with master's degrees who know about waste issues in the city of Pekanbaru. Qualitative research methods describe issues and policy alternatives by relying on document data from various literature ranging from journals, books, and online media, which are then analyzed using interactive data analysis methods. The results of quantitative data analysis show that the majority of respondents stated that the indicators of the Pekanbaru city government's capability in managing waste transportation were the weakest technical and leadership skills. Furthermore, the results of qualitative data analysis show that the capacity factor and waste management issues can be overcome with several alternative policies. The problem of poor waste management can be overcome by using sustainable waste management, which needs to be supported by strong political will from the city government in making adequate regulations, updating waste management technology, utilizing information technology for waste transportation, and strengthening human resources. In addition, the government needs to involve the community and stakeholders to reduce waste production, collect waste, and sort waste. The support of the city government, entrepreneurs, and city residents will determine the success of sustainable waste management.

Keywords: government capability; policy; management; waste

1. Introduction

Waste management is an important indicator that must be met in realizing sustainable development. UNDP directs that there is a management that manages waste starting from preventing, reducing, recycling, and reusing (UNDP Indonesia, 2015). Even the amount of waste generated that is successfully recycled is also an indicator of the assessment of sustainable development (Kementerian Perencanaan Pembangunan Nasional/Bappenas, 2017). Sustainable municipal waste management with Municipality System Management Waste (MSMW) with the concept of zero waste can protect the environment and humans (Saleem et al., 2016).

According to Ernawati et al. (2019) that the city of Pekanbaru has not been able to manage waste optimally both at the reduction and processing stages so that the amount of waste in the landfill becomes unmanageable. Waste management in Pekanbaru has not been carried out in an integrated manner, and it is still left to the awareness of each individual in society (Febriani et al., 2020). In Pekanbaru city, the majority is 70 percent organic waste, 11 percent plastic waste, and 8 percent paper waste (Puspa et al., 2017). The volume of waste increases in line with the increase in the standard of living of the population (Taušová et al., 2020). Many examples show that some city governments seem less concerned with the problem of landfills and waste (Aulia, 2015).

Waste management with the collect-transport-disposal system implemented by the Pekanbaru city government has several weaknesses that result in uncontrolled waste generation in the landfill (Rizani & Rahayu, 2021). Constraints in this system are: 1) landfill collection services do not reach residents' homes; 2) there is no temporary waste disposal in the neighborhood; 3) waste pick-up is sometimes not carried out every day; 4) shortage of waste collection fleet; 5) The locations that can be served by waste transportation are still limited (Rahman, 2013).

It must be admitted that waste processing is not optimal, even when transporting waste to the final disposal site; there are still problems in the city of Pekanbaru. On the side of the road, there were many piles of waste, as shown in Figure 1.

Figure 1 shows that waste piled up at many points in Pekanbaru City is not transported. Inadequate waste collection and inefficient management systems are a serious cause of urban pollution and a risk to public health and the environment (Adipah & Kwame, 2018). It shows that waste management in Pekanbaru City is not running as it should. The problem of this research is how the capability of the Pekanbaru city government in waste management is? What are the problems of waste management in Pekanbaru? What kind of policy alternatives can be offered as a solution to waste management issues in Pekanbaru City? This study aimed to describe the capability of the city government in waste management and to describe the



Figure 1. Piles of Waste Scattered in Pekanbaru City in 2021

Source: MonitorRiau.com (2016), Siregar (2021), and Syukur (2021)

problems and alternative policies for sustainable waste management as a solution to the waste problem in Pekanbaru city.

2. Methods

This study uses quantitative and qualitative methods to analyze cases of waste problems in the city of Pekanbaru. Quantitative methods determine the government's capability by collecting data through questionnaires to 200 respondents, but 100 respondents only fill in the questionnaire. The capture of 100 respondents was considered feasible for analysis because it met the sampling rules with a sampling error rate of 10 percent according to the Slovin formula (Isyala & Pharmawati, 2019). The 100 respondents consisted of lecturers, students, and alumni of the Postgraduate Doctoral in Environmental Sciences, University of Riau, environmental activists, and academics with master's degrees who were considered to understand the waste problem in the city Pekanbaru. The questionnaire results were processed, analyzed, and displayed in the form of a pie chart. Furthermore, qualitative research methods are also used to describe problems, and alternative waste management policies that are carried out by collecting data from documents, online media, journals, books and then processed using data analysis proposed by Miles and Huberman through interactive data analysis models in various stages carried out simultaneously (Rijali, 2019).

3. Results and Discussion

The capability of local government, which is examined using quantitative methods, is measured by the following indicators: 1) institutions that have clear structures, roles, responsibilities and are connected to all levels of government; 2) adequate human resources; 3) effective policies in the form of adequate policies, rules and regulations to make decisions, mobilize resources and bind the public relevant; 4) finance which is indicated by the ownership of financial resources to finance activities; 5) technical capabilities demonstrated by an effective management system, adequate information technology, and communication networks between organizations, communities and the media; 6) leadership shown by the development of the leader's ability to make decisions quickly and precisely when needed (Kusumasari et al., 2010). Based on these indicators, after researching with 100 respondents, the capability of the Pekanbaru city government in managing waste, especially waste transportation according to respondents, can be seen in Figure 2.

Based on , it can be seen that the weakest element according to the majority of respondents is the technical and management capability of the Pekanbaru city

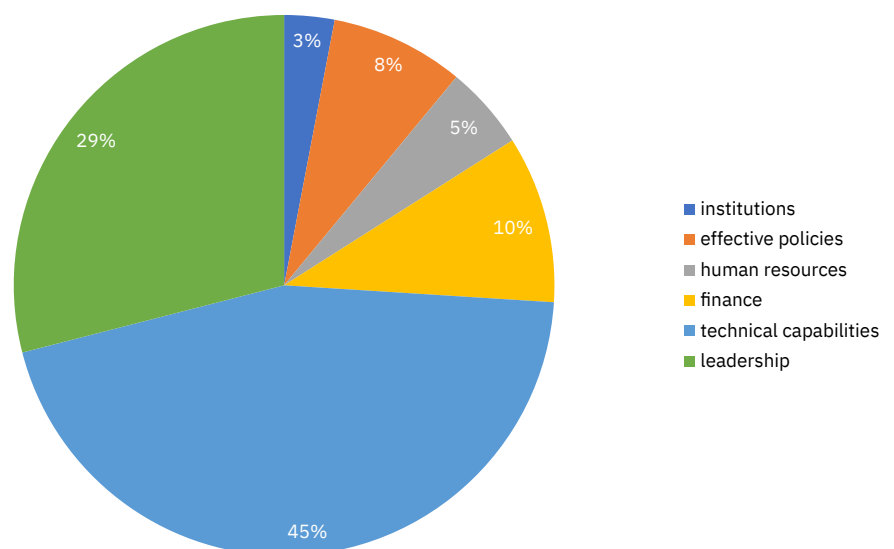


Figure 2. The Weak Elements of Pekanbaru City Government Capacity in Waste Transportation

government in managing waste, reaching 45 percent of 100 respondents. The low technical ability in managing waste transportation is seen from the inability of the Pekanbaru city government to determine the winner of the waste transportation auction before the end of 2020. Even until March 2021, the winner of the waste transportation auction has not been successfully determined by the Pekanbaru city government. The auction has been conducted three times, but all of them are canceled, and the winner cannot be determined (Wibowo, 2021b). The Pekanbaru City Regional Representatives (DPRD) requested that all levels of officials in the Department of Environmental Services and Cleanliness (DLHK), starting from the head of the service to the lower officials who are responsible for waste problems, need to be evaluated (DPRD Kota Pekanbaru, 2021). Position holders in regional bureaucracies sometimes have low-quality resources, and recruitment has not been based on a job analysis (Apriani, 2015; Ginting & Daeli, 2012).

On the other hand, the technical and management capabilities of the Department of Environmental Services and Cleanliness to overcome the problem of self-managed waste accumulation, when the winner of the auction has not yet been determined, is also inadequate. Waste transportation on the main road is carried out by the Department of Environmental Services and Cleanliness; in neighboring neighborhoods, the neighborhood association forums carry it out in their respective areas, which proved to be ineffective (Lusiana, 2021). The city government's waste collectors are limited, and there are only 37 dump trucks while ideally 80 cars. Therefore many people suggest the city government hire a different fleet to transport waste (Riauterkini.com, 2021). The situation is getting worse because as many as 318 freelance daily workers (THL) who are usually involved in transporting waste are dismissed by DLHK so that the waste is increasingly unmanageable (Lusiana, 2021). This finding shows that officeholders in regional bureaucracies do not seem to have adequate human resources, and their recruitment is not based on a job analysis (Apriani, 2015; Ginting & Daeli, 2012).

Furthermore, as many as 29 percent of respondents stated that the mayor of Pekanbaru and related ranks, especially the Department of Environmental Services and Cleanliness, is responsible for waste transportation. Unfortunately, the leadership of the mayor of Pekanbaru has not been able to provide a quick solution during the waste transportation crisis. A public leader must work in situations of financial constraints, high demands, and limited resources (Deslatte & Stokan, 2020). Regional leadership is required to be able to make breakthroughs and innovations to overcome problems in the region and the ability to change the mindset of the people they lead to support their policies (Fachrudin & Yuwono, 2017; Fanani et al., 2020). But what happened in Pekanbaru was that in less than one month, the mayor of Pekanbaru had made four changes to the head of the Department of Environmental Services and Cleanliness. Starting from Agus Pramono, then replaced by Azhar, who was then Secretary of the Department of Environmental Services and Cleanliness. Then the position was entrusted to Azwan, who is Assistant I of the Pekanbaru City Regional Secretariat. Less than two weeks later, Azwan resigned as head of the Department of Environmental Services and Cleanliness and was replaced by Marzuki (Wibowo, 2021b). This finding again shows that the ranks of the bureaucracy have low-quality human resources, and their recruitment has not been based on a job analysis (Apriani, 2015; Ginting & Daeli, 2012).

Then as many as 10 percent of respondents stated that the city government's limited financial problems made the city government unable to provide alternative solutions in transporting waste. The amount of money allocated for waste transportation each year reaches 45 billion (Wibowo, 2021a). The 45 billion waste transportation budget is divided into two zones. Zone 1 covers the Tampan subdistrict, which is now divided into Binawidya and Tuah Madani, as well as Payung Sekaki subdistrict and Marpoyan Damai subdistrict. And zone 2 includes Bukit Raya subdistrict, Sukajadi subdistrict, Pekanbaru City subdistrict, Senapelan subdistrict, Lima Puluh subdistrict, Sail subdistrict and Tenayan Raya subdistrict and Kulim

subdistrict (Pekanbaru.go.id, 2021). The adequate regional financial capacity allows local governments to solve problems in their regions ([Haryanto, 2018](#)).

Regarding the weak capability of the Pekanbaru city government in waste transportation and waste management in general, a solution is offered in the form of implementing sustainable waste management. The purpose of sustainable waste management is to reduce the negative impact of waste on the environment and gain economic benefits from waste management ([Taušová et al., 2020](#)). Success in sustainable management has impacted economic welfare in material and energy recovery ([Halkos & Petrou, 2016](#)). Sustainable waste management has three dimensions, namely economic, social and environmental. From the economic side, it can be done in the form of processed waste that can be processed and produce a green economy; on the environmental side, it is done by reducing waste production, and on the social side, it is done with an attitude of producing and consuming waste responsibly ([Khudyakova & Lyaskovskaya, 2021](#)).

One variant of sustainable waste management (sustainable waste agent) is Integrated Waste Management, as shown in [Figure 3](#).

As shown in [Figure 3](#), Integrated waste management needs to be implemented in Pekanbaru to solve the waste problem sustainably. The chart starts from the input process in the form of waste, energy, and other materials are collected and sorted. Sorting is done into three categories, namely organic waste, recyclable waste, and non-recyclable waste. The three types of waste are processed with technology to produce output in compost due to organic waste; recyclable waste such as plastic, glass, iron, paper is recycled using technology to produce new products. Then the output of the waste that cannot be recycled is sought to be used as energy ([Elsaid & Aghezzaf, 2015](#)).

The initial stage of integrated waste management is the collection and sorting of waste. The collection of waste by sorting is an absolute thing to do ([Izvercian & Ivascu,](#)

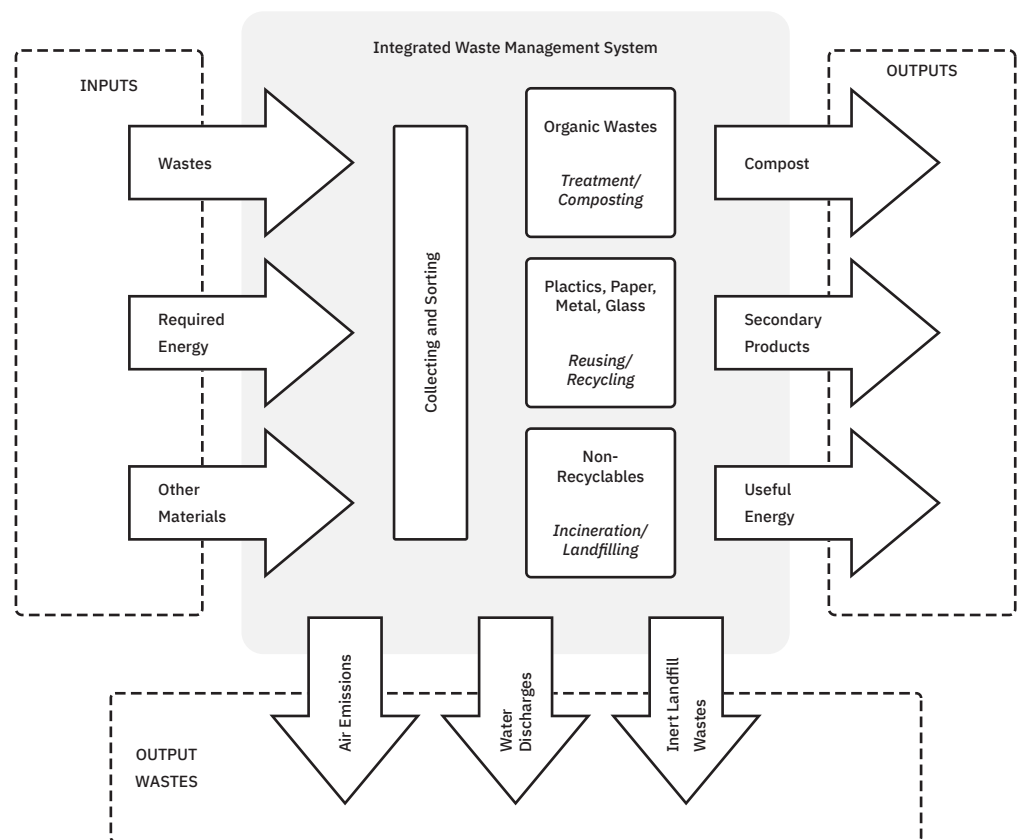


Figure 3. Integrated Waste Management System

Source: [Elsaid and Aghezzaf \(2015\)](#)

2015). Waste sorting activities can increase if regulations are made (Taušová et al., 2020). In Pekanbaru, the majority of household and industrial waste does not segregate waste. As a result, the waste that is disposed of and transported by the Department of Environmental Services and Cleanliness is waste that has not been sorted (Ernawaty et al., 2019). Therefore, regulations that require residents to do sorting must be made by the Pekanbaru city government.

In addition to collecting and sorting waste, public awareness is also needed to reduce waste production significantly. If the waste produced at the household level decreases, it would certainly reduce the government's performance in processing waste. Reducing waste production starts with individuals reducing consumption, consciously managing shopping and daily life, encouraging reuse and recycling (Gören, 2015). Informal and non-formal institutions, environmental education is needed to increase community participation to consciously reduce waste production (Pandit Wagh, 2017). Likewise, at the industrial level, it is necessary to use green technology that produces products without waste (Gören, 2015).

However, efforts to reduce waste production, waste collection, and waste sorting in Pekanbaru are still hampered due to the low awareness of the community and other stakeholders. In addition, the current condition of community participation in managing waste is still expected due to the community's education, economy, and social attitudes (Suardi et al., 2018). Therefore, increasing actors' awareness is very important, starting from waste reduction, collection, processing, and final disposal (Akil & Ho, 2014; Johnson, 2017; Khaw-ngern et al., 2021). Counseling on the advantages of managing waste and the disadvantages if waste is not managed needs to be improved so that people are motivated to sort waste (Selin, 2013; Zakianis et al., 2018). In order to increase public awareness to participate in reducing waste production, waste collection and sorting need to be carried out by education by four parties, namely schools and formal educational institutions, the Pekanbaru city government and its bureaucracy, regional apparatus at the village level, namely the neighborhood and hamlet. In addition, religious leaders through mosques and prayer rooms also need to make their community aware of the importance of managing the environment, including waste issues.

To overcome the accumulation of waste that is not transported optimally in Pekanbaru, according to the author, the government needs to use Information, and Communication Technology called mobile government in the form of an application that allows the public to report online to the city government about the location of the waste that is not transported or piled up and the application can be downloaded via smartphone. With public reports related to the location of the waste, the garbage collectors can quickly find out, and they can move quickly to transport the garbage. The development of communication through mobile phones and computerized technology opens the idea that interaction and working using mobile phones can improve services regarding waste by the government.

The use of mobile phone technology in the government sector provides an alternative channel of communication and public service delivery. But, more importantly, can make the government move mobile and change the traditional e-government service delivery model (Gang & Tony, 2006). Several countries have implemented mobile government in tourism, health, agriculture, environmental management, and others (Ntaliani et al., 2008). Advances in information technology have been used to manage waste in various countries. Among the use of e-waste has become part of the solution to reduce environmental damage (Izvercian & Ivascu, 2015; Owoche et al., 2019).

Figure 4 is showing the waste transportation system by utilizing information technology which can also be applied in the city of Pekanbaru.

The implementation of an application-based mobile government that can be downloaded as a channel for public complaints against online services should also be implemented in Pekanbaru. Prerequisites that need to be developed are government

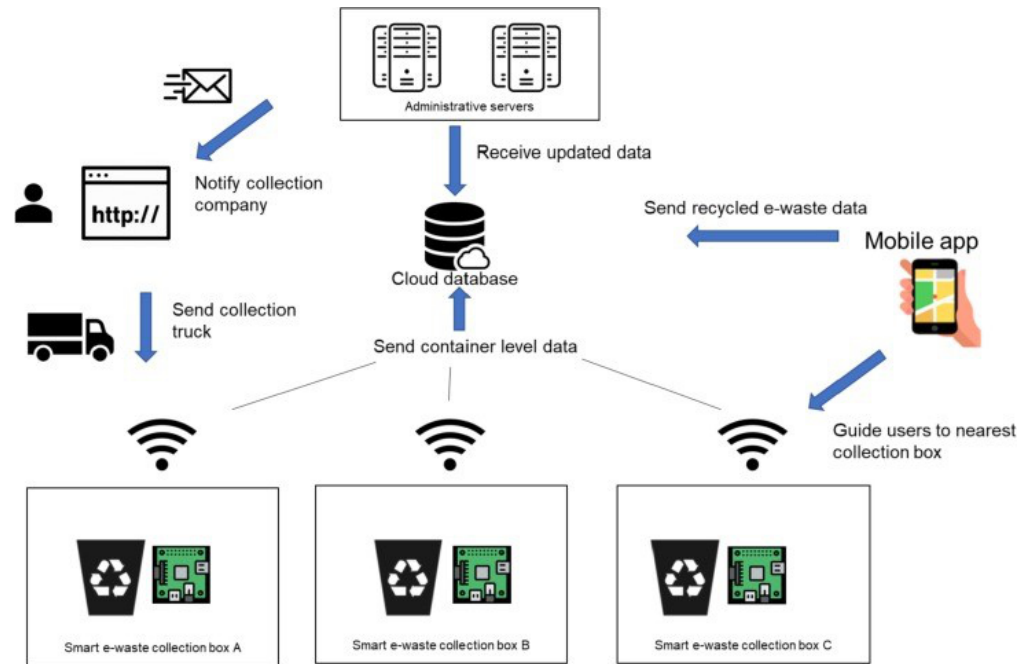


Figure 4. A Digital Waste Transportation System Utilizing an Application on a Smartphone (Mobile Government)

Source: Kang et al. (2020)

support in preparing the bureaucracy and the digitally literate community regarding this application (Huda & Yunas, 2016; Napitupulu, 2017).

The next thing that the Pekanbaru city government owns is waste processing technology so that existing waste can be reused either as compost, new products that are recycled or converted into energy. Implementing the latest technologies in the urban waste management sector can play a very important role in providing a pollution-free and sustainable environment (Saleem et al., 2016). Innovations and technologies are needed to make waste management efficient, especially in developing countries (Agamuthu et al., 2007; Fehr et al., 2020). With technology, for example, plastic waste can be used as a mixture of asphalt (Angelone et al., 2016). However, do not just rely on technology alone, but the linkages with the environment, socio-culture, law and institutions, and the economy must also support the effective functioning of the system (Guerrero et al., 2013).

Then the most important thing is the political will of the Pekanbaru city government to realize sustainable waste management. Political will is the commitment of governments and bureaucrats to objectively mobilize resources in a sustainable manner (Kukutschka, 2015). Brinkerhoff (2010) suggested indicators measuring the government's political will: government initiatives, selected programs, mobilization of stakeholders, commitment to public desires and mobilizing resources, applying credible sanctions, business sustainability, and willingness to learn and adapt. Sustainable waste management requires a commitment to effective policies, regulations, integrated supply chains, and participation in technology (Durgekar, 2016). The city government needs to make regulations so that citizens, government administrative apparatus, policymakers are willing to accept sustainable waste management and collaborate to make it successful (Fehr et al., 2020; Selin, 2013).

The Pekanbaru City Government has prepared a clean waste area plan policy scheme (Anugerah et al., 2020). However, the available data shows that the Pekanbaru city government's policies regarding waste management have not been adequate and integrated in a sustainable manner. Until now, waste is still a problem that needs to be completely resolved.

Based on the description above, the authors design a model as illustrated in Figure 5.

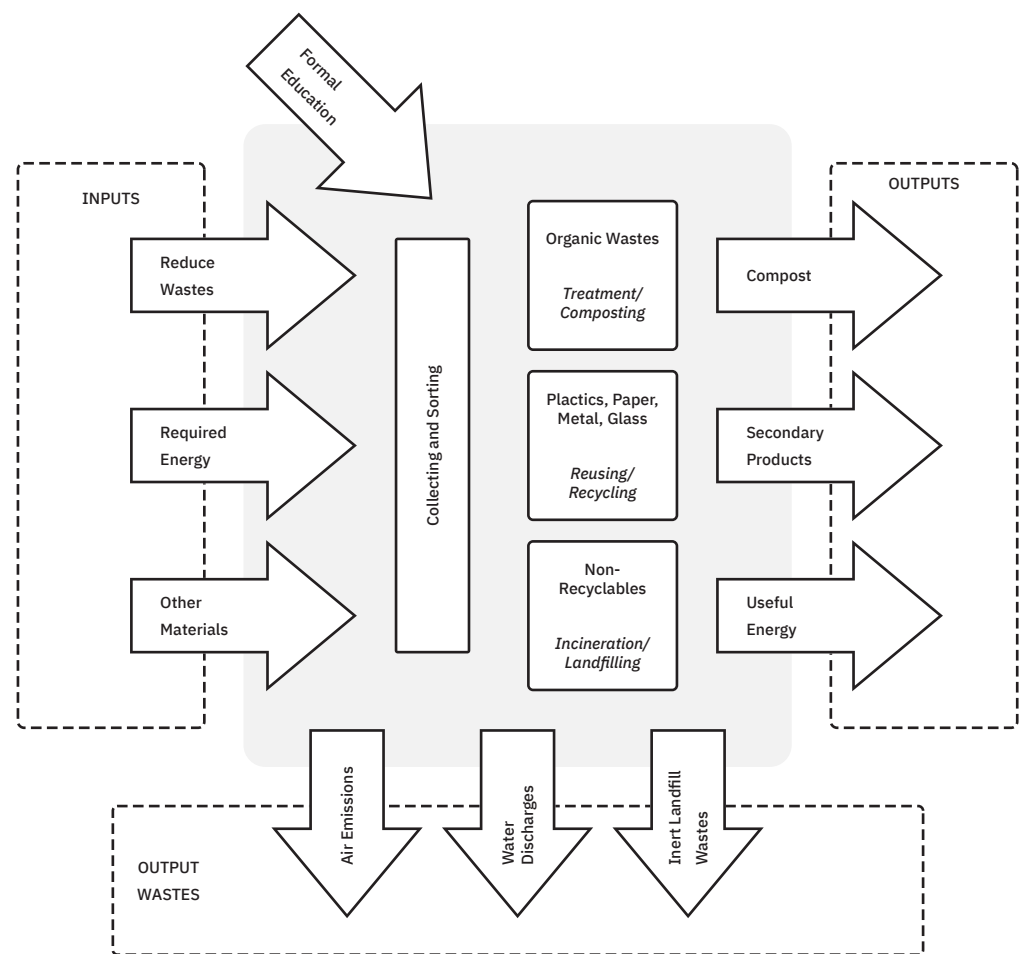


Figure 5. Sustainable Waste Management for Pekanbaru City

Source: Author's analysis adopted from expert opinion and the reality of waste management in Pekanbaru City

The participation of community groups in waste management is the key to success in waste management in various cities (Wirawan et al., 2018). In the context of the city of Pekanbaru, it is necessary to increase public awareness on the dimensions of reducing, collecting, and sorting waste in several ways, including:

3.1. Integration of Waste Management Knowledge into Formal Education

The importance of waste collection and sorting needs to be taught at every level of formal education from kindergarten to high school or equivalent by incorporating these points into the education curriculum. Because schools are obliged to teach about the collection, sorting, and reduction of waste production, of course, these values can be embedded in students' thinking and behavior. Thus, it is hoped that in the next few years, the production of waste will decrease, and the waste produced will be in a segregated state to facilitate transportation and processing. Integration learning also has several options, including the integration of environmental education (green school) through learning in schools which can be carried out in 4 forms, namely (1) Integration through extra-curricular activities, namely environmental learning activities in the classroom according to the curriculum; (2) Integration through environmental co-curricular activities, namely activities outside of intra-curricular activities but in order to support intra-curricular activities such as learning outside the classroom; (3) Integration through extra-curricular activities such as clean Fridays, in collaboration with extra-curricular nature lovers, the Red Cross Youth, and School

Health Enterprises S; (4) Integration through non-curricular activities, namely the formation of an ecological or green school sophisticated environment, such as the habit of disposing of waste in its place, as well as waste recycling activities, and so on (Muzadi & Mutholingah, 2019). The role of environmental education in applying environmental care values is also very influential on the way students think and behave in everyday life outside and inside the school environment (Ariyunita, 2019).

3.2. Reduce Waste Socialization

The impact of reducing waste socialization is that Pekanbaru residents are expected to reduce their waste products to decrease waste production. Reduce activities can be carried out daily, such as 1) Choose products with recyclable packaging; 2) Avoid using and buying products that generate large amounts of waste such as plastic bags; 3) Use refillable products. For example, stationery that can be refilled; 4) Maximize the use of electronic storage devices that can be erased and rewritten; 5) Reduce the use of single-use materials; 6) Use both sides of the paper for writing and photocopying; 7) Avoid buying and using things you don't need (Shentika, 2016). Socialization about waste reduction is an important attribute that needs to be done to realize proper waste management (Satori et al., 2018).

3.3. Activating Waste Sorting

Waste sorting is done by separating organic and inorganic waste that can be recycled and inorganic waste that cannot be recycled. The benefits of sorting recycled waste include: (a) reducing the amount of waste that is disposed of in landfills, (b) reducing the environmental impact that occurs due to the accumulation of waste in the environment, (c) being able to increase income through the sale of recycled products produced, (d) reduce the use of natural materials for the needs of the plastic, paper, metal, and other industries (Kusminah, 2018). Sorting can be done when the community realizes that these activities bring economic value to themselves and have a positive impact on the environment (Krisnani et al., 2017). One form of implementation of sorted waste recycling is that it can be sold or exchanged for necessities to the collectors at the neighborhood or hamlet level (Suyanto, 2018).

3.4. Assistance for Household Waste Management Community Groups

This is still related to the selection of organic waste that can be used as organic fertilizer. Households can be encouraged to manage the organic waste they produce into compost (Bachrein, 2012). Community groups who are interested in managing organic waste at the household level need to get assistance from the city government so that they become professional producers of solid and liquid fertilizers, which can later be sold to bring economic benefits to the family (Sulistiyani & Wulandari, 2017). In carrying out the waste management program, good communication skills are needed from facilitators to community groups (Hartiningsih, 2016). The growth of social capital in the form of mutual trust, cooperation between the parties, is a key element of the success of environmental governance (Dwijatenaya & Dewi, 2016).

4. Conclusion

In general, it can be concluded that the Pekanbaru city government's capacity to transport waste is still weak on the indicators of technical and leadership capabilities. In order to overcome the existing weaknesses, the city government needs to make sustainable waste management policies in detail regulating the reduction of waste production, waste collection, and sorting, the use of modern waste processing technology and information technology in waste management to avoid negative impacts on society from the social side, economy and environment. Furthermore, it is necessary to involve various parties such as the neighborhood/hamlet, schools, and

community leaders to educate the community on waste reduction and segregation before related parties transport waste.

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