Policy Reform Towards Waste Management in Pontianak Municipality, West Kalimantan, Indonesia (A SWOT Analysis and Lessons Learned from Kyoto City)

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ABSTRACT

This study aims to describe the current state of the implementation of waste management as part of public service provision in Pontianak Municipality, West Kalimantan, Indonesia. For this purpose, this study employed a qualitative descriptive approach by applying SWOT analysis accompanied by lessons learned from Japan. The findings indicated that there has been an increase in waste transportation services year by year and that the waste management carried out by Pontianak Municipality still primarily relies on landfill. Waste reduction efforts through 3R programs such as integrated waste treatment plant and waste bank have not shown significant results in reducing the generation of waste. Using SWOT analysis, several factors that affect the performance of waste management in Pontianak Municipality were identified. By considering those influencing factors and learning from best practices executed by Kyoto City, this study suggests that the government needs to develop an integrated waste management based on priority scale with measurable and realistic objectives, particularly those related to reduction and recycling activities as well as stakeholder’s engagement.

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1. Introduction

The waste problem is an environmental issue that has always been a serious problem in almost all urban areas over the world. Amasumo & Baird (2016), based on thoughts developed by several scholars, remarked that most human activities produced waste. Figure below provides us with Projected Solid Waste Generation in Asia from 2000 to 2050 (Mohanthy, 2011). UNEP and ISWA stated that the volume of waste tends to double in low-income cities in Africa and Asia by 2030 because of an increase in population, urbanization, and consumption (United Nations, 2015).

![Projected Solid Waste Generation in Asia (2000–2050)](image)

By definition, based on the Law of the Republic of Indonesia No. 18 of 2008 on Waste Management, waste is regarded as the residual of human daily activities and/or of natural processes in solid form. According to BPS-Statistics Indonesia (2018), the waste generation in Indonesia has reached 65.2 million tons per year. The number is expected to increase by approximately 6 million tons in 2025. In the case of Pontianak Municipality, Khatulistiwa, et al. (2015) found out that the average amount of waste disposed to landfill (TPA) is 1,286 m³/day with waste density 248 kg/m³. The waste generation at TPA will be experiencing an increase by 1,785 ton every year, from 118,643.27 ton in 2016 to 127,760.92 in 2020. Increased waste generation can certainly be a serious problem if no waste reduction efforts are made from the source. Based on local mass media, in 2018, there were several protests from residents to the government regarding the handling of waste which had a negative effect on the environment. Therefore strategic measures are really necessary to be arranged to prevent the emergence of more serious problems resulting from improper handling of waste.

Regarding waste management in Indonesia, at the national level, the government has issued Law No. 18 of 2008 on Waste Management providing legal certainty, clarity of responsibility and authority of central government, local government, and the role of society and business sector so that waste management can run proportionally, effectively and efficiently. The policy adopts a waste management mechanism with the 3R concept consisting of Reduce: waste reduction, Reuse: limitation of the waste heap, and Recycle: recycling of waste and/or waste utilization. Furthermore, as an effort to socialize the change of paradigm about waste management as mandated by the law mentioned above, the government of Indonesia also issued some derivative rules. First, Government Regulation No. 81 of 2012 on Waste Management of Household Waste and Other Waste Similar to Household Waste. The point is the waste management policy with an end-of-pipe turn to a new approach –reduce at source and resource recycle through 3R. Second, Regulation of Minister of Environment No. 13 of 2012 on Guidelines of Reduce, Reuse, And Recycle Implementation Through Waste Bank. As a strategy developed at the community level, waste bank is a social activity that leads people to start sorting, recycling and utilizing the waste, given that waste has also good selling value.

Moreover, at the local level, there are diversities regarding the implementation of waste management policy due to the availability of infrastructure, human resources, and economic growth rate varying from one place to another. Based on the facts, this study then opted for a local level (Pontianak Municipality located in West Kalimantan Province) as a research object to gain more specific understanding. As it is known that, currently, local governments have a pivotal role in raising sustainable development programs.

According to the background above, the researcher is interested in looking at the extent to which the implementation of waste management policy in Pontianak Municipality. Then, this study aims to mainly provide the government with new insights with regard to proper waste management policy. In doing so, this study carried out a SWOT analysis in order to develop solutive strategies. According to Schmoldt & Peterson (2000), SWOT analysis can serve as: a framework useful for figure out a situation and then promoting proper steps; a groundwork for appraising main capabilities and competencies; an important key for change and success as well as an incentive to engage in the group experience (Srivastava et al., 2005). Moreover, this research also engaged a discussion related to waste management carried out in Japan, especially in terms of recycling and reducing waste generation. According to World Bank (2018), Japan, along with Europe Union, are global pioneers in the advancement of policies related to waste management. Finally, The findings generated are expected to be able to contribute to the existing literature on environmental issues related to waste management as well as provide the government with new insights in order to arrange more strategic measures. This background is then processed and used as a reference for making questions in the research.
2. Theory

2.1 Waste Concept

Based on the Law of the Republic of Indonesia No. 18 of 2008 on Waste Management, waste is defined as the residual of human daily activities and/or of natural processes in solid form. OECD suggested that municipal waste includes (a) bulky waste (e.g., white goods, old furniture, etc) and (b) garden waste, grass clippings, street sweepings, the content of litter containers, and market waste, if these are managed as waste (World Bank, 2018). This definition excludes waste from sewage network and treatment systems as well as municipal C&D waste, even though municipalities may reckon the small amount of C&D waste generated from house renovation projects. Regarding the definition that will be used in this study, the author refers to the term municipal solid waste that is generally taken for granted to include all wastes generated in a community, similar to the definition developed by OECD.

2.2 Integrated Waste Management

By the 1970s, several scholars first associated the term 'integrated' with solid waste management. Then the term of "Integrated Waste Management" had become common use by the mid-2000s after its use extensively by the scholars and imaged in various names of waste-related academic research centres such as 3R: Residual Resources Research, DTU, Denmark; the Integrated Waste Management Centre of Cranfield University, UK; the CSIR Centre for Integrated Waste Management, South Africa; and the Center for Integrated Waste Management of the University at Buffalo in the USA (Wilson, et al., 2013).

Arjmandi et al., (2013) defined IWM as a means for proper management of solid waste specifying the quantity and composition of generated waste, details of services related to storing, collecting, transporting and disposing stages, separation manner of recyclable and non-recyclable materials at the source, waste minimization and pollution control settings, harmful waste management instructions as well as all possible plans for minimizing or reducing waste generation. Furthermore, by summarizing several concepts of IWM developed by scholars, Menikpura et al., (2013) added that since society becomes more advanced, simple solutions are no longer sufficient to solve the ever-growing municipal solid waste disposal issues. In addition, there is no single management system which can be generally applied to all waste issues. Hence, it is necessary to combine appropriate treatment methods such as recycling, anaerobic digestion, incineration, and landfilling in order to form proper management. Then, this model is called integrated solid waste management (ISWM) including the recovery of useful materials and energy from waste. Memon (2010) added that the ISWM concept can optimize the gains of 3R and improve the waste management system. Moreover, USEPA (2002), has claimed that the hierarchy of integrated solid waste management follows the priority order: reduction, recycling, waste combustion or waste transformation and landfilling. Hirschhorn et al., (1993) mentioned that the waste hierarchy triggered a big shift from end-of-pipe to preventative thinking (Marshall & Farahbakhsh, 2013).

![Figure 2 Waste Hierarchy](image)

Source: A Global Review of Solid Waste Management, 2012 (UNEP, 2017)

In addition, as claimed by Amit (2008) and seeing Figure 2, it can be said that the 3R approach essentially revolves around the concept of the waste hierarchy, which is basically a precautionary principle that prioritizes the prevention and reduction of waste, reuse, and recycling of waste, and optimization of final disposal. Memon (2010) claimed that 3R, along with integrated solid waste management, has become regular terms for decision-makers and practitioners in the course of waste management. Efforts to reduce waste by raising public awareness and issuing policy can bring about significant reductions in term of waste generation. This understanding completes the concept of 3R to minimize the final volume of waste as well as to turn most of the waste into reuse and resource innovation.

Hotta (2015) remarked that many countries employ a variety of quantitative 3R indicators, such as total municipal solid waste generation, recycling rate, and resource productivity according to material flow accounting. Moreover, qualitative indicators can be employed for observing particular features and effectiveness of recycling status based on the goals arranged within the policies. More circumstantial social aspects are also taken as the sample of indicators for overseeing the advancement of 3R activities. Those aspects comprise public satisfaction of waste management models, a ratio of population involving in source separation, how well public grasp on local
preferences in waste management or fulfillment of waste management services.

2.3 SWOT Analysis

According to Helms & Nixon (2010) the term SWOT (Strength, Weakness, Opportunity, Threat) has developed as an important means for dealing with elaborate strategic situations by minimizing the quantity of information to enhance decision making. Johnson et al., (1989) suggested that by considering SWOT, a coordinator can effectively address potential problems, and find the ways to turn the threats into opportunities and ward off the weaknesses against the strengths. The SWOT analysis can be carried out for any idea, product, program or project, individual, as well as group or organization (Srivastava et al., 2005).

Eheliyagoda (2016) claimed that there are several studies demonstrating that the SWOT analysis approach, which came from the business management field and has been used to a broader loop of disciplines, is a better tool for addressing issues from a strategic viewpoint. In addition, Yuan (2013) conducting a SWOT analysis on environmental management concluded that the results can promote better environmental performance.

Furthermore, a detailed SWOT analysis can be executed based upon the research questions in which the answers are interpreted by analyzing information obtained from various sources such as field observations, governmental reports, related literature, questionnaire for citizens, and focus interviews with stakeholders, environment agency, council members and academics if needed (Eheliyagoda, 2016). It can be concluded that after conducting a SWOT analysis, in the case of waste management, there will be applicable measures that can be yielded, developed and performed to enhance the effectiveness. Author employed the SWOT analysis for better understanding of the current situation and raising some policy implications.

3. Research Method

This study used a descriptive research method within the qualitative approach to carry out several steps consisting of finding, describing and analyzing objects regarding the current state of the waste management in Pontianak municipality. This research focuses on: a) The current state of waste management in Pontianak Municipality including system improvements such as 3R implementation, and material balance; and (b) Recommended strategies to develop sustainable waste management in Pontianak Municipality.

Furthermore, this research is conducted in the Pontianak Municipality, West Kalimantan Province. It is selected as a research locus by considering the local government’s efforts to start preparing Pontianak to be a smart city as arranged in the Medium Term Development Program of Pontianak Municipality 2015 -2019 (Bappeda, 2015). Referring to Giffinger et al., (2007), explained that smart city is a program designed to improve the quality of life of people in urban areas by considering the following six indicators: smart living, smart environment, smart utility, smart economy, smart mobility, and smart people. In this case, proper waste management is part of an effort to achieve “smart environment”. In 2015, Pontianak was also selected by National Development Plan Agency as part of New City Program which aims to create a safe, comfortable and livable city in metropolitan areas and cities outside Java.

Regarding data collection, this study employed data collection technique as suggested by Kumar (2014), consisting of three techniques, namely: a) Interviews with local officials of Pontianak municipal government (bureaucrats and a political representative), academics and other stakeholders concerned with environmental issues in Pontianak; b) Documentation (Strategic Plan of Pontianak Environment Agency, Performance Report of Pontianak Environment Agency, Waste Bank Planning-Reporting Document, TPST (Integrated Waste Treatment Plant) Planning-Reporting Document, and other written files related to the research focus); and c) Observation, a technique that is carried out by observing directly and making some field notes about the implementation of waste management executed by the government. This is expected to enrich the findings along with interview and documentation.

4. Results and Discussion

4.1 Current Waste Management

In implementing waste management, there are at least three local regulations that are used as guidelines by the Pontianak municipal government. Those regulations are Pontianak City Regional Regulation No. 3 of 2004 on Public Order, and Pontianak City Regional Regulation No. 4 of 2011 on Public Service Levy, and Pontianak Mayor Regulation No. 6 of 2006 on Waste Disposal Schedule. At present, the regulations have not stated clearly about: the definition of waste, the operationalization of solid waste management based on 3R, and the participation of the public and the private sector in the waste management program in order to reduce the generated waste generation. As it is said by an interviewed official responsible for waste management, Pontianak Municipality has not issued a regulation that especially deals with the waste problem.

Waste management in Pontianak City is under the responsibility of DLH (Environment Agency), in accordance with the Mayor Regulation No. 61 of 2016 on The Organisational Structure, Main Task, and Function of DLH. As a basic service, the waste management carried out by DLH covers 6 districts divided into 29
4.1.1 Waste Collection

According to the Regulation of Minister of Public Works No. 3 of 2013 on The Operation of Waste Facilities and Infrastructure (Household Waste), storing is an activity to keep the waste temporarily in an individual or communal storage based on the type of waste (sorted waste). Generally, the containers are made of wood, plastic, or other materials (normally in the form of a bag made from plastic or other materials). After storing, the next stage is to put the waste into Temporary Shelter (TPS). This activity is generally carried out directly by the community itself or by the individual waste collector (someone who is regularly or voluntarily paid to collect waste from the house to house). They usually use a waste cart or a three-wheeled bike to bring the waste to TPS. The government also cooperates with a private IT-based company engaged in collecting and transporting waste, namely PT. Angkuts developed by a community of youth who care about the environment. They involve scavengers to collect rubbish, to be further sorted and sold or recycled.

At present, the government is no longer using permanent containers made of cement as TPS. To collect the waste, the government only provides portable containers to facilitate the process of transporting waste by truck. The biggest number of TPS is located in West Pontianak District by 29 TPS and Central Pontianak by 27 TPS. Other four districts have less than 10 units. The volume of TPS container is 6.5 m³. The overall capacity of all TPS is 1,129 m³. It shows that TPS only cover 56% of the total waste produced by Pontianak people (estimated 1,802 m³). Some of the waste was burned, stockpiled, and thrown to river, ditch, or illegal dumping. Based on the information of the head of DLH, in 2017 DLH found that there are 60 illegal dumping sites. This problem has been a concern for a long time.

Regarding market waste, based on information obtained from the interview, in general, each market has its own janitors employed by market administrator to clean and collect waste generated by both sellers or consumers. This is to reduce the government workload in handling market waste.

Moreover, there are cooperative contracts between DLH and third parties related to garbage transportation services, called KSO. DLH on behalf of the Pontianak Government provide waste transportation service for the third parties that produce large amounts of garbage regularly. The third parties have to pay for the services according to the contract. The money will be then transferred to the Pontianak Government bank account and regarded as regional revenue. The duration of the contract is 1 (one) year and can be extended if the third parties apply for a renewal. In 2017 there were 30 companies using transportation services provided by DLH on behalf of the Pontianak municipal government.

Furthermore, regarding street sweeping, DLH has a duty to keep 102 streets and 4 parks clean to create a comfortable atmosphere for street users. The street sweeping is performed every day starting from 05:00 to 08:00 am. The waste resulted from the sweeping is collected twice, from 07:00-11.00 and 13.00-17.00. The street-length reaches 105,865 m and the width is 662,980 m².

4.1.2 Transportation

Waste transportation from TPS to TPA (Batulayang landfill) is part of service which must be done by the government through DLH. It aims to create a clean, comfortable, and odorless neighborhood. According to regional regulation, the schedule of waste collection in TPS is between 18:00-06:00. The waste is transported from TPS to TPA every day and mostly carried out in midnight to dawn. As stated by an informant, DLH utilizes portable container as TPS with a capacity of 6.5 m³. According to data from 2017, there are 113 containers needed to transport waste to TPA.

In 2018, the average of waste volume successfully handled by the government is 1.587 m³/day of the total which reaches 1.827 m³. The remaining waste 240 m³/day is processed by TPST/waste banks, burnt, piled, or sent to illegal dumping sites. It is clear that 86.86% waste generated in Pontianak are sent to TPA Batulayang. Considering that Pontianak does not have advanced waste processing technology and still tends to use the old approach, the availability of an adequate fleet is highly required, such as dump truck, armroll truck, and pick up.

4.1.3 The Implementation of 3R (Reduce, Reuse and Recycle)

a) Waste Bank

Based on Law No. 18 of 2008 on Waste Management and Regulation of the Minister of Environment No. 13 of 2012 on Guidelines of Reduce, Reuse, And Recycle Implementation Through Waste Bank, society-based waste management is an attempt to reduce waste volume transported to TPA. In this case, the Pontianak government has facilitated the establishment of waste bank carried out by several groups of people who care about the environment. Until 2018, there have been 13 waste bank that have been established. Waste banks are aimed to educate people on waste management in terms of waste reduction at the household level.
b) TPS 3R
As it is known that the government needs to have innovative ways and concepts to reduce waste volume transported to TPS or TPA. In this case, the Pontianak government has established four TPS 3R (3R waste treatment plant) with a community-based communal composter. In addition, the government also established TPST, sometimes called TPST Edelweiss. It is managed directly by DLH and located on Purnama II Street, Parit Tokaya Subdistrict, South Pontianak. It was established in 2015 as an attempt to reduce waste volume and transform waste into useful products. The concept applied in the TPST is to convert organic waste into compost and biogas. As a trial project, TPST only covers waste coming from one traditional market (Sepakat Market) located on Dr. Wahidin Street, the closest market to TPST.

c) Environmental Campaign
Pontianak Municipality is also trying to improve public awareness through various environmental campaigns, such as: Dissemination of government regulations, Commemoration of the big days related to environmental campaigns, Clean and green city assessment at Rukun Warga (RW), Selection of ambassadors of the environment and DLH road to school.

4.1.4 Disposal
One of the important facilities in waste management especially for developing countries is landfill, in Indonesia called TPA. The presence of TPA is crucial especially for cities that do not have sophisticated facilities to reduce waste generation. Pontianak city has only one area to be used TPA. It is located in Batulayang Subdistrict, North Pontianak District, known as TPA Batulayang. Its operation is handled by a technical unit of DLH. The total area is 30.6 ha. At present, the area of TPA that has been occupied for waste disposal is 14 ha equal to 46% of the capacity of the landfill. Based on the performance report of DLH in 2018, the volume of waste transported to TPA is 1,587 m³/day. TPA Batulayang has applied open dumping since 1996 and started to develop controlled landfill since Law No. 18 of 2008 on Waste Management was issued.

In addition, during 2005-2009, Pontianak has ever utilized 1 unit incinerator machine with the capacity of around 3-3.5 m³/hour. It only covered one district area, South Pontianak. Burning garbage in an incinerator could reduce the generation of waste sent to the landfill. However, there were some problems faced while using the incinerator such as high cost for its maintenance and environmental pollution. Therefore, the government decided to stop the operation of the incinerator. Also, in 2007 Pontianak signed an agreement with a Japanese company, PT. Gikoko for controlling methane gas produced by the waste in the landfill. Yet, based on the evaluation in 2012, the project was declared unsatisfactory and stopped. All the equipment had been dismantled.

4.2 Material Balance
To find out the effectivity of waste reduction program carried out by the government, it can be seen based on the comparison between waste generation and waste disposed of to final disposal. According to data obtained from DLH, it is indicated that the service coverage increase steadily from 73.85% in 2009 to 86.86% in 2018. In other words, the government can transport most of the waste generated throughout the city area. This achievement also received positive appreciation from the community. Based on the results of a community satisfaction survey, in 2017, DLH got a score more than 80 that means Very Good in terms of service delivery. With regard to waste that has not been delivered to landfill (around 13% in 2018), some waste are converted to be recycled products such as compost and biogas through waste bank (more than 50 tons in 2017 and 2018) and TPST (117 tons in 2018) while the rest is collected by scavengers and disposed of illegally.

However, the government has not shown significant results in reducing waste. In 2015, the remaining land area was 12.3 Ha. Based on calculations by DLH, the residual time of Batulayang Landfill is 8 (eight) years, which means that the landfill will be fully filled with waste in 2023. To anticipate this, the government is conducting land acquisition for landfill expansion at the end of 2017 and is now planning to run land expansion of 10 ha. The volume of waste that continue to increase surely can cause a negative effect in the future with regard to the availability of landfill and further towards the sustainability of the environment.
4.3 SWOT Analysis

Based on data obtained from the field, both primary data and secondary data, which were collected through interviews (of government officials, academics, environmental activists, and business people), document reviews, literature review and other information related to this research, the SWOT structure can be summarized as follows:

a) Strength (S)
   - Pontianak is one of the emerging cities with good achievement in terms of public service provision and development;
   - Local government has a strong concern about dealing with the waste problem; and
   - There is a specific agency known as DLH.

b) Weakness (W)
   - Outdated local regulations;
   - Weak strategy for the sustainable long-term plan (dependence on landfills);
   - Lack of public awareness;
   - Lack of facilities and technology to carry out waste management properly;
   - Lack of financial strength;
   - Lack of research and development program; and
   - Lack of public private partnership program.

c) Opportunity (O)
   - Waste management is one of the global major concerns;
   - Central government considers waste management an important issue and has issued some laws related to it;
   - Some people/ communities want to cooperate and take part in waste management activities;
   - Engaging academics in an effort to find good and suitable waste management methods; and
   - Private involvement in waste management.

d) Threat (T)
   - Increasing urbanization rate;
   - Limited landfill area; and
   - Environmental pollution.

4.4 Lesson Learned from Kyoto City

Following what has been carried out by the central government of Japan, especially with regards to a sound material-cycle society, the Kyoto City government has also been running proper waste management. According to guidelines from the Kyoto City Official Website (information of living) and the Kyoto City International Foundation (garbage and recycling), waste is divided into four types: combustible/burnable waste; cans, glass bottles, and PET bottles; plastic containers and packaging materials; and small size metal items and spray cans.

Residents are directed to place household waste in the plastic bags determined by the government based on the type of waste. The residents can find and buy the designated bags at convenience/retail stores and supermarkets. In collecting the waste, the government has also involved the private sector, under the supervision of the government. For those who live in an apartment or complex of houses where the waste is collected by a private company, they do not have to use the Kyoto City designated bags; transparent bags can be used instead. Furthermore, each type of waste will be collected on different days where days and collection points differ from one area to another. Illegal dumping is a violation that can be punished. Disposing of waste outside the specified standards can be subject to fines or prison sentences.

In addition to the four types of waste mentioned above, there are several types of waste that have special handling including recycling activities, products subject to the Home Appliance Recycling Act (conditioners, TV sets, refrigerators, washing machines, laundry dryers, personal computers); waste paper and miscellaneous goods (newspapers, cardboard, magazines, flyers, and other recyclable paper types); used tempura oil; returnable/reusable bottles (beer, sake bottles); fluorescent bulbs; dry cell (button batteries, rechargeable batteries); paper cartons/packs; used small household electronics; and large size waste such as furniture (handling charges differ according to the type and size of an item).

Regarding waste reduction, Kyoto City managed to reduce the waste volume by 50% from 820,000 tons in 2000 (the enactment of the Basic Act for the Promotion of the Recycling-Based Society) to 413,000 tons in 2017. The eventual goal to be achieved by 2020 is 390,000 tons. Furthermore, the Kyoto City government has reduced the number of Clean Centers from five to three, so that it can save costs up to 15.4 billion yen per year. According to the Waste Reduction Promotion Section, the Recycling Society Promotion Department, and the Environmental Policy Bureau of Kyoto City, in order to obtain these achievements, some strategic steps were carried out by the Kyoto City government.

a) Major Changes to Garbage Reduction Policies such as improvement of separated trash collection, base collection and mobile base collection (increasing opportunities for recycling) including the separation of 26 items; fees for garbage; "Shimatsu-no-Kokoro" Ordinance promoting 2R activities; Collaboration among citizens, businesses and government; and the agreement on promotion of bringing reusable shopping bags and reduction of plastic bags;

b) Measures for Food Loss Reduction such as Certification of "Stores Promoting Zero Leftover Food"; and

c) Efforts for Paper Waste Reduction including expanding the use of community collection systems and promoting the use of the private collection by
wastepaper collection contractors as well as mandating separation and recycling of paper waste by an ordinance. Environmental Education through cooperation and partnership programs with schools, regions, NPOs, and companies, etc.

5. Conclusion

Recalling the purpose of this paper, it was to describe the current state of waste management in Pontianak Municipality, West Kalimantan, Indonesia. Based on the results and discussions, in general, Pontianak Municipality is still running a collect-transport-dispose method in handling the waste. In terms of waste transportation, the government showed a quite positive performance with a percentage of transported waste of more than 85%. However, Pontianak Municipality is facing a serious problem related to the waste volume that continues to increase. This has an impact on the residual time of the landfill and requires the government to expand the landfill area at certain periods. Due to several constraints, such as limited facilities and management skills that have not been qualified, waste reduction efforts through the TPST program and waste banks have not made a significant impact in reducing the amount of waste sent to landfill. Less than 1 percent of the waste generated can be processed. In addition, there are no productive collaborations with other stakeholders, such as the private sector, society, and academics in addressing waste problems. The 3R campaign, especially related to waste reduction and recycling activities, does not yet have a clear target so that the results do not have much impact on increasing public awareness.

Furthermore, by way of compiling the SWOT structure, the factors that influence waste management in Pontianak can be clearly seen. These factors indicate that in promoting proper waste management, Pontianak Municipality should focus on amplifying its strengths and overcome some weaknesses. Moreover, it is evident that Pontianak Municipality has some opportunities that can be benefited from. However, at the same time, there are some threats which will undoubtedly be a challenge for the government.

Regarding Kyoto’s experience, as it is known that Japan, including Kyoto City, has managed to significantly reduce waste production rates by 50% from 2000 to 2017. Even Kyoto City succeeded in diminishing the number of the clean centers from five to three from which the government could save 15.4 billion yen annually. In realizing this achievement, several changes and strategic programs carried out by the government are mainly related to the purpose of reducing and recycling waste. With some adjustments to the situation in Pontianak, several programs in Japan, especially Kyoto City, can be lessons for Pontianak to develop environmentally friendly waste management which mainly encompass sorting, reducing and recycling activities.

Considering the basis of what has been concluded above, it is clear that the main problem faced by Pontianak Municipality today is the volume of waste that continues to increase rapidly every year. As a landfill site is not unlimited and there will eventually be a situation where the landfill is no longer able to accommodate waste generation. Thus, it can be said that waste reduction is the most urgent policy to be implemented at this time. Based on the research on the current situation in Pontianak Municipality and lessons learned from Kyoto City, as well as considering some limitations that exist, it is recommended that Pontianak Municipality should focus on a number of priority steps. First, in order to increase the effectiveness of waste recycling and reduce the amount of waste transported to the landfills, it is important to require the community to sort waste at the source. Second, the operation of the TPST 3R needs to be technically assessed by involving academics to improve its performance. Third, it is important to increase public involvement in handling waste problems by expanding bank waste programs, accompanied by training programs. Fourth, there is a need for the promotion of environmental awareness campaigns to the public – including business people, school students, and universities – especially related to segregation, reduction and recycling activities. Finally, as a long-term plan, Pontianak needs to prepare a design for an application of innovative technology along with the supporting instruments such as the budget allocation and human resource development.

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