

# Waste Management Modelling In Siak Regency

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## Abstract

Abstract: Siak regency is located in an area that extends from the coast of the sea (the Strait) to the mainland of Sumatra and irrigated by the Siak River which is the deepest river in Indonesia. The dynamics of community and industrial activities in this area have a negative impact on the amount of waste production every day which is not properly managed. This study aims to analyze the waste management in Siak Regency, and to create a waste management model in Siak Regency. The research method used is a survey, literature study, and interviews with the government involved in waste management, private parties / companies and respondents in 14 sub-districts in Siak Regency. The results showed that the waste management by Siak Regency was still low with the existence of environmentally unfriendly waste management practices and the implementation of the 3R System was low. To achieve a good environmentally friendly waste management, the waste management model in Siak Regency is formulated schematically from the existing conditions related to the 5 (five) main points of waste management, namely: (1) promoting the understanding of the concept of zero waste to minimize waste production; (2) developing waste banks and creative waste-based industries and increasing the role of garbage scavengers and collectors to apply the waste sorting method; (3) develop techniques and transportation of segregated waste to facilitate the final waste in the final dumpsite (TPA); (4) carry out a backfill system in local waste processing; and (5) developing an integrated waste processing method to obtain the benefit value of the waste. To implement this waste management model, active commitment and support is needed in the form of cooperation between the community, local government and the private sector / company.

## Keywords

Modeling, Waste Management, Siak

**To cite this article:** Hartati, Y.; Ahmad, A., Zulkarnain, Afandi, D. (2021). Waste Management Modelling In Siak Regency. *Review of International Geographical Education (RIGEO)*, 11(2), 12-18. doi: 10.48047/rigeo.11.02.02

**Submitted:** 4.10.2020 • **Revised:** 10.02.2021 • **Accepted:** 20.03.2021

## PRELIMINARY

Garbage is solid waste consisting of organic and inorganic waste which is considered no longer valuable by the first owner, which generally comes from household (domestic) activities, industrial activities, office activities, and others (Wals et al., 2014) and the continuous production of waste will build up piles of garbage that mount and pollute the environment (Bodycomb & Del Bagliyo, 2012). Garbage is a waste product resulting from various kinds of human activities which if not managed properly, it will cause pollution and damage to the environment physically and biologically. Waste can come from domestic activities, trade, agriculture, or the production process of an industrial activity (Meidiana & Gamse, 2011). Waste from domestic activities is generally produced by households in a residential area. Densely populated residential areas can produce quite a lot of household waste so that it requires proper management.

The problem of waste is a serious problem in terms of the environment and is related to everyday human life that every human being cannot be separated from the problem of waste, as the party who produces waste. In order to achieve conditions for people who live healthy and prosperous in the future, it is necessary to have a healthy residential environment. From the aspect of waste, the word healthy will mean a condition that will be achieved if the waste can be managed properly so that it is clean from the residential environment where humans are active in it (Annisa, 2016).

The government is still dealing with the problem of waste management in Indonesia by collecting waste in a place which is commonly called a Temporary Waste Storage (TPS) and then transported to a final dumpsite (TPA). This responsibility is still fully borne by the government. There are still many problems in waste management with various obstacles, including: limited funds, limited tools, limited TPS and TPA locations, limited human resources, limited technology to system limitations. All of these limitations create problems, resulting in frequent accumulation of garbage and causing environmental problems such as foul smell and flooding.

According to (Demirbas, 2011), the large population and the various of activities in metropolitan cities in Indonesia have resulted in the emergence of waste problems. Waste production will continue to increase in line with the increase in population. However, on the other hand, it is not accompanied by the addition and improvement of the quality of processing at waste management facilities. This condition occurs in almost all cities in Indonesia. In accordance with Law Number 18 of 2008 concerning Waste Management and Government Regulation Number 81 of 2012 concerning Household Waste Management, the old pattern of waste management in Indonesia in the form of patterns of collection, transportation and disposal has begun to change towards a pattern of sorting, processing, utilization and disposal of residue. However, the change in waste management patterns is taking place very slowly.

According to Binion & Gutberlet (2012), geographically Siak Regency has an area of 8,556.09 km<sup>2</sup> with a population in 2016 of 453,052 people. Based on SNI 19-3964-1995, small city waste production ranges from 0.3 - 0.4 kg / day so that from the description of the population of Siak Regency in 2016, waste production is estimated at 181.2 tons / day. Like most municipal waste in the tropics, the garbage in Siak Regency is organic waste which tends to rot easily. Based on its composition, solid waste in densely populated settlements is dominated by organic waste with the largest percentage (68%). This type of organic waste comes from various sources of waste, especially households, roads and markets. DPKP Siak Regency states that the total volume of waste produced in Siak Regency in 2016 was 556,718.20 m<sup>3</sup> and the waste disposed of in the TPA was only 51.8%. This condition still shows that the waste management in Siak Regency is still low. The existence of a waste management pattern in Siak Regency can be a very interesting and worthy model to be studied in an effort to solve the solid waste

problem so that this model will show the role of the community, government and private sector in waste management. The results of this research are expected to be able to contribute to the form of waste management in Siak Regency and at the same time support the achievement of Sustainable Development Goals (SDGs) in Indonesia.

## METHOD

This study used a survey method, literature study, and interviews. Field surveys were conducted to collect data related to research. The interviews conducted in this study were to know directly in depth some of the problems to find out the problems that arose when the research was carried out, to find out the opinions of related stakeholders who were able to provide an analysis of the waste management carried out. The research locations covered 14 (fourteen) districts in Siak Regency, namely Kandis, Minas, Tualang, Koto Gasib, Lubuk Dalam, Kerinci Kanan, Dayun, Siak, Mempura, Pusako, Apit, Sabak Auh, Bunga Raya and Sungai Mandau Districts. This sub-district has different regional characteristics because Siak Regency is located in an area that extends from the coast of the sea (the Strait) to the mainland of Sumatra and irrigated by the Siak River, which is the deepest river in Indonesia. Analysis of data using qualitative analysis methods, namely data obtained from respondents using a questionnaire and then analyzed descriptively. Research respondents include the community, local government elements involved in waste management and private parties / companies.

## RESULTS AND DISCUSSION

### Waste Management in Rural Areas

Rural areas are characterized by settlements that are not densely populated, far from the center of government and difficult to reach by waste transport fleets so that the community implements an on site system of waste processing by landfill or burning or even throwing it into rivers or ditches. The community collects rubbish around the yard of the house then burns it both organic and inorganic waste, especially plastic waste. Some of the community also made a dugout hole as a place to collect trash and when it was full, the community would pile it up with land (landfilled). However, during this collection process, the community also burns the waste in the dugout every day. Thus, the local waste processing system (on site system) with the backfill system is also inseparable from the combustion system.

Many people who live along the river will throw garbage into the river either directly or just collect it on the riverbank. However, if it rains, the waste will be carried by the flow of rainwater into the river, making the river water dirty or even blocking the flow of river water. Whenever it rains, it will be easy to flood.

### Waste Management in Cities

Urban areas are characterized by densely populated settlements, close to the center of government and reachable by waste transport fleets. In this area there is also an industrial area. For industrial and urban areas that are densely populated, such as markets, shops, housing and commercial areas, a centralized waste management system with a final disposal site (TPA) was developed by the Siak Regency Government.

The waste management carried out by the Siak Regency Government leads to the final processing of waste at the TPA so that the pattern carried out by the government is to transport waste from the source or TPS and then dispose of it at the TPA. The management pattern carried out by the government is still implementing the 3P system in waste management in its area, namely collection, transportation and disposal with the final processing of waste at the TPA carried out by the landfill method. However, the open dumping method is still visible in several landfills, although in the TPA, waste has been processed into biogas as an energy source and the processing of waste into compost through composting.

Some of the people of Siak Regency also collect garbage around their yards and burn it and it is not uncommon to see that people still throw garbage in any place such as empty land, rivers or ditches. This has resulted in the formation of illegal TPS (garbage collection points) and become a trash that is not transported. People who dispose of garbage at official TPS or collect it in containers in each house to be transported by the garbage fleet are also still without any sorting of organic and inorganic waste.

### **3R implementation**

The term 3R is an acronym for Reduce, Reuse and Recycle for waste management so that it becomes a waste management system that is considered environmentally friendly, has added value and has a good impact on social aspects. The 3R system is an effort to reduce waste production and increase the beneficial value of waste. The 3R system that seems to be implemented in Siak Regency is the sorting of organic and inorganic waste. People who live in Siak, Minas and Kandis Districts have been sorting their waste well. Types of inorganic waste in the form of cardboard, plastic / glass bottles, plastic cups and iron are collected in separate containers to be sold to scavengers. The role of scavengers is very big in reducing the amount of waste that will be transported by garbage officers to the TPA so that in terms of sorting waste, scavengers and garbage collectors play an active role in reducing the amount of waste production.

The waste bank and the waste-based creative industry have grown and developed well even though they are still in small numbers. This creative industry plays a role in the Reuse and Recycle of waste to obtain added value (value added) both use value and economic value. The waste bank was developed to motivate people to manage waste by increasing the economic value of waste. According to (Wulandari et al., 2017), the waste bank management model is not only useful in creating a clean environment but also has an impact on the local economy by increasing the income of housewives around the waste bank. Therefore, government support is highly expected to improve the waste bank mechanism and a better value waste model.

The 3R system in Siak Regency has also been developed in many schools with Adiwiyata's motivation as an appreciation for the success of schools in managing waste well at the school level. Wafa et al., (2019) states that the implementation of 3R in fostering students' concern for the environment can be done by making waste as a learning medium so that students can understand that used goods (trash) can be reused, students become creative, and students become accustomed to not consumptive lifestyle.

### **Waste Management Model Formulation**

The waste management model in Siak Regency is formulated from the existing conditions of waste management by considering matters related to the concept of zero waste, waste sorting, waste collection and transportation, waste management on site systems, waste processing and final processing.

#### **1. The concept of zero waste**

The concept of "zero waste" must be able to be instilled in the community as an understanding of waste management at the source level which is very important as a mitigation measure for waste production at the source level. The potential for waste management to zero waste through waste management from production to the end of a production process so that waste production can be avoided or waste is minimized (Sunarto & Sulistyarningsih, 2018). One of the concepts of zero waste is by applying the 3R principle (Reduce, Reuse, Recycle). The concept of zero waste is an integrated approach to implementing waste processing systems and technology at individual and regional scales with the aim of reducing the volume of waste as little as possible. The 3R concept is the basis of various efforts to reduce waste and optimize the waste



production process (Binion & Gutberlet, 2012).

In terms of recycling waste (Recycle), (Shanmugapriya et al., 2015) stated that when thinking about recycling is raised, one must really think about the whole idea of Reduce, Reuse and Recycle. The act of recycling can be started at home by not throwing away the old product (used goods) and even using it to become a new product, so this action is actually already an act of recycling. For that, the implementation of 3R is not only a way of doing it but also a way of thinking about it. With this understanding, the activities carried out by the community can be minimized to produce waste as small as possible so that the waste transported to the TPA does not increase in number and provides a great opportunity for TPA to process waste using the sanitary landfill method properly.

## **2. Waste sorting**

Waste sorting is carried out at the source level. To apply the waste sorting method, waste banks and waste-based creative industries have been developed and the role of scavengers and waste collectors is increased. In this sorting process, the 3R system is appropriate to be developed so that waste that can no longer be processed is residue. According to (Chowdhury et al., 2014), waste management must be carried out from the micro household level to the city macro level. In the direction of sustainable waste management, 3R systems can play an important role in protecting the environment from greenhouse gas emissions and turning waste into a priceless resource.

To implement the 3R system, the attitude of the community in sorting waste is very important so that the 3R system in waste management can run well. (Ediana et al., 2018) stated that there is a significant relationship between people's attitudes in sorting waste and the 3R system waste management efforts. The attitude of the community that does not sort the waste according to the type of waste, the 3R system of waste processing will not be realized.

In its application, this pattern must involve community participation to solve the problem of domestic waste. Active community participation will be realized if public perceptions are also positive. According to (Liow et al., 2013) stated that community participation in waste management is determined by perceptions so that increasing community participation must begin by increasing public perceptions. (Joshi & Ahmed, 2016) stated that community participation in sustainable waste management is the key to maintaining programs related to solid waste management.

## **3. Garbage collection and transportation**

Garbage collection at the source level must be carried out in a segregated manner between organic and inorganic waste. Thus, the process of transporting waste must also be carried out by fleets that have segregated waste containers. This also applies to TPS, which must separate organic and inorganic waste. The transportation process can be carried out directly from the source to the TPA or indirectly from the TPS to the TPA, which means that the waste from the source will be temporarily stored at the TPS. In addition to segregated containers, at the collection and transportation stages, closed containers must also be applied so that the waste does not pollute the environment and is able to increase aesthetic value. In line with what (Pratiwi & Santosa, 2019) stated, the container is segregated for organic and inorganic waste in order to facilitate further processing before being transferred to TPS or TPA. Then, the trash container must be closed, not easily damaged, waterproof and easily emptied so as not to cause a foul odor (pollution) that disturbs the environment.

## **4. Waste management on site system**

Local waste processing (on site system) is tolerable to be applied as a waste management method in rural areas. The recommended local waste processing is the

landfill method and not the combustion method. This is because the waste in the village area is mostly organic waste originating from household and yard activities so that this type of waste can be used as compost through the application of a landfill system. (Wafa et al., 2019) state that the direction for organic waste management in the village area focuses more on increasing community participation in being able to manage waste at its source in the form of composting.

## 5. Processing and final processing of waste

Waste management which leads to final processing (TPA) which is implemented by the Siak Regency Government should have implemented integrated waste management patterns. Garbage has great potential to be processed so that a greater benefit value is obtained. Waste has the potential to be processed into compost, biogas, fuel oil, plastic ore and brick / paving blocks. This processing can be done on a small scale or a large scale integrated with the TPA. The application of the concept of waste management is an environmentally friendly concept so that it will be closer to the concept of sustainable development. According to (Adipah & Kwame, 2019), sustainable development is the right approach to achieve the goal of providing welfare for present and future generations so that the contribution of sustainable development to urban solid waste management is a combination of city needs and aspects including waste reduction, recovery and proper treatment, waste management authorities, performance and financial sustainability, and public acceptance of best practice in waste management.

## CONCLUSIONS AND SUGGESTIONS

The waste management model in Siak Regency is conceptually formulated from the existing conditions related to 5 (five) main points of waste management, namely: (1) socializing the understanding of the concept of zero waste to minimize waste production; (2) developing waste banks and creative waste-based industries and increasing the role of waste collectors and collectors in implementing waste sorting methods; (3) developing segregated waste collection and transportation techniques to facilitate the final processing of waste at the TPA; (4) carry out a backfill system in local waste processing; and (5) developing an integrated waste processing method to obtain the benefit value of waste. To implement this waste management model, active commitment and support is needed in the form of cooperation between the community, local government and the private sector / company.

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