

WASTE MANAGEMENT WITH BLACK SOLDIER FLY (BSF) FOR SUSTAINABILITY DEVELOPMENT IN WEST BANDUNG REGENCY

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ABSTRACT

This study aims to explore the concept of household waste management using the BSF larvae method that is claimed to be able to reduce organic waste piles that have the potential to cause disease and reduce the beauty of the environment in Padalarang District, West Bandung Regency. descriptive and exploratory qualitative analysis are employed to examine the relationship between stakeholders in managing waste associated with the theory of management functions according to GR Terry so that the system that has been running with BSF media can reduce the volume of landfill waste. Six respondents were interviewed with in-depth interviews so that this study obtained the information needed to explore the concept of waste management.

Keywords: Waste Management, Black Soldier Fly, Green Circular Economy, West Bandung Regency.

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ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi bagaimana konsep pengelolaan sampah rumah tangga dengan metode penggunaan larva BSF sehingga diklaim dapat mengurangi timbunan sampah organik yang berpotensi menjadi penyebab penyakit dan menurunkan keasrian lingkungan di Kecamatan Padalarang, Kabupaten Bandung Barat. Metode yang digunakan adalah dengan analisis kualitatif deskriptif dan eksploratif untuk melihat hubungan antar pemangku kepentingan dalam mengelola sampah yang dikaitkan dengan teori fungsi manajemen menurut GR Terry sehingga sistem yang telah berjalan dengan media BSF dapat mereduksi volume timbunan sampah. Sebanyak enam responden telah diwawancara dengan in-depth interview sehingga Penelitian ini mendapatkan informasi yang dibutuhkan untuk mengeksplorasi konsep manajemen pengelolaan sampah.

Kata Kunci: Manajemen Pengelolaan Sampah, Black Soldier Fly, Ekonomi Sirkular Hijau, Kabupaten Bandung Barat.

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INTRODUCTION

There are numerous factors that can contribute to environmental damage. The issue of waste and its management is one of the main factors that harms the environment and has negative effects. One of the elements that negatively affects the environment is garbage, which is characterized by a decline in the level of cleanliness and health in the area (Hartono, 2008). This is possible due to the wide variety of waste, which has a significant impact on the deterioration of the environment. Waste is separated into organic and inorganic categories based on its shape. The term "organic waste" refers to waste that originates from living things, including people, animals, and plants (Sucipto, 2012).

One of the issues that requires special handling in relation to its management and management is the handling of waste. One requirement for waste management is to provide a Final Disposal Site (TPA), which must satisfy these two criteria, far from residential areas and in remote locations (Arum et al., 2017). The TPA's existence as the goal of waste management has so far been deemed ineffective. The capacity and absorption of managing Indonesia's total waste production, which in 2020 totaled 67.8 million tons from various fields (household and industrial), has become a separate issue. With the potential for increased waste production, as well as an increase in population and industry, the situation is getting worse (Rizaty, 2021). 50% of them are organic waste out of that total.

In all areas of Indonesia, where waste production—primarily organic waste—is expected to keep rising—serious issues with waste management

arise. West Bandung district is one of these areas. West Bandung Regency faces high waste production as well as inadequate facilities, poor services, and subpar technical waste operations (Hadyanto, 2016).

This is made worse by the Sarimukti TPA's decreased capacity to handle waste because it now also handles waste from the city of Bandung and the Bandung regency in addition to West Bandung. (Suganda dkk., 2012).

The West Bandung district government has thus far persisted in its efforts to reduce community waste production through innovation and tighter regulation. The publication of Regent's Regulation number 16 of 2019 regarding Regional Policy Strategies and Strategies for the Management of Household Waste and Waste Similar to Household Waste, also known as Jakstrada (West Bandung Regent's Regulation, 2019), was one of the reinforcements that was carried out. The regulation was created in anticipation of rising waste production because West Bandung Regency is experiencing one of the highest rates of population growth in West Java (1.65%), with a projected total population of 1,788.34 thousand in 2020 (Badan Pusat Statistik, 2021).

The amount of waste produced in the smallest community unit in West Bandung Regency indicates an increase in waste generation (RW). RW 24, in the Padalarang District's Padalarang Village, is one of them. The average daily waste production in the area is 100 kilograms, with 60% of that being organic waste. This organic waste has a significant impact on the deterioration of the environment because it can decompose, emit unpleasant odors, and spread disease by attracting pests like flies, rats, and other

living things (Salaswati dkk., 2008; Masyhuda dkk., 2017; Widiyanto dkk., 2019). Leachate, which is an organic gas and liquid produced during the decomposition of organic waste, pollutes the air and ground water (Suganda dkk., 2012).

The community produces a lot of organic waste, so there is a need for a solution that can both lessen the amount of waste produced and benefit the community financially. Using the maggot from the Black Soldier Fly is the community's current course of action (BSF). Technically, the BSF seeds' larvae/maggots will consume organic waste as their primary source of food, which will have a significant impact on reducing the amount of waste (Broeckx et al., 2021). Due to the significant volume reduction in waste, maggot waste management is currently regarded as efficient and environmentally friendly. Additionally, a procedure results in the production of BSF being used as animal feed (Ambarningrum dkk., 2019; Faridah & Cahyono, 2019; Putra & Ariesmayana, 2020).

There is no doubt that using maggots as a medium for the decomposition of organic waste is not the only way waste processing is carried out. Each decomposition process involves a period of time, which needs to be managed well to benefit the community. In order to reduce accumulation, waste management management affects not only the quantity of waste in the community but also the amount of waste that is dumped in landfills. Good waste management can also influence the community's habit of disposing of waste on a regular basis, which has an effect on environmental cleanliness (Kahfi, 2017; Nigiana dkk., 2016;

Panoban dkk., 2019). Waste management in RW 24 is an interesting topic to research using qualitative analysis because it will demonstrate how the process affects how the community disposes of waste and fosters good habits. The use of products from maggot decomposition as animal feed ingredients as well as environmental conditions will be impacted by waste management using maggots.

METHODS

The regulator, represented by RT/RW, and the neighborhood's daily organic waste managers in RW 24, Padalarang Village, West Bandung Regency, as well as other participants in the study, were interviewed to gather data. The information required relates to planning for the construction of facilities and management procedures for the management of organic waste using BSF maggot media. The research focuses more specifically on the mechanism for modifying RW 24's waste generation rate in Padalarang Village.

The primary data sources used in this study were gathered through convenience sampling-based surveys. By using samples that are geographically close to the subject of the study, are simple for surveyors to reach, and have the time and willingness to participate in interviews, this method enables data collection (Etikan et al, 2016). The completeness of the data was also obtained from secondary sources obtained from the Padalarang District Office in the form of descriptive analysis in the form of the amount of waste piles, the number of employees involved, and the number of community participants in waste management activities carried out in RW 24

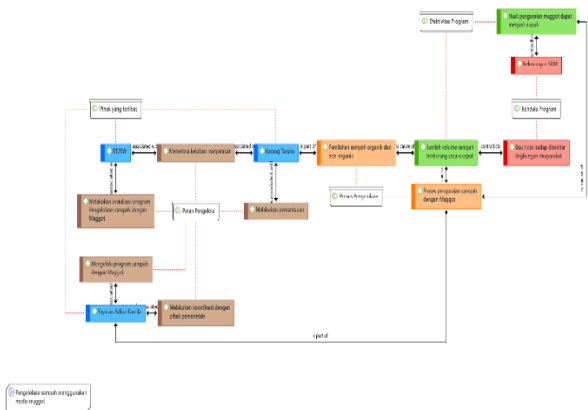
Padalarang Village. Population data for West Bandung Regency in 2021 that was obtained from the BPS is also used.

Network Analysis (QNA) technique was used for the data analysis in this study. The method focuses on investigating causal relationships that emerge from connections and the use of networks among a group of individuals. In order to learn more about the social relationships formed and the processes connected to these relationships, the QNA analysis will examine the relationship between the respondents' professional and personal sides based on group size, group status, and the number of groups (Ahrens, 2018). Atlas Ti software, which is CAQDAS-based software (Computer-Aided Qualitative Data Analysis Software), will also be used in the analysis phase of this study. Using Atlas Ti involves marking, comparing, and connecting

various pieces of information that will eventually form a relationship in graphic form. Atlas Ti's use is also a result of its comprehensive scientific reference database for qualitative research (Hwang, 2008).

RESULTS AND DISCUSSION

The Black Soldier Fly maggot was used in the organic waste management process at RW 24 Padalarang Village, West Bandung Regency, to break down the volume of waste so that it did not accumulate and could be put to good use. The following causal relationship graph illustrates how waste management in RW 24 Padalarang Village relates to observations and interviews with managers and representatives of RW 24.



Picture 1. Graph of causal relationship between waste management in RW 24 Padalarang Village, West Bandung Regency
Source: Atlas Ti software analysis results

Parties Involved And Roles Carried Out

In the RW 24 neighborhood of Padalarang Village, there are at least two parties involved in the management of organic waste using maggot media. The Adiba Kamila Foundation is the first party, acting as the management partner in this instance and starting the waste management program using maggot media. The second party is a government official who represents the organization in charge of managing waste and providing waste for processing.

The party coordinating matters with the Adiba Kamila foundation on behalf of the government is the management of RW 24 as a stakeholder, assisted on the technical level by the local Youth Organization.

The existence of the Adiba Kamila foundation, which serves as a managing partner, is thought to be crucial to the program's operation. This is demonstrated by the efforts made to manage organic waste using maggot media in an effort to improve health and environmental quality and use locally available organic resources to create something useful (Auliani et al., 2021).

The managing partner, Adiba Kamila Foundation, is entirely in charge of the waste management activities. Operations for waste management are carried out using management principles based on the findings of interviews with the daily management. Designing the idea for waste management, purchasing equipment like reactor tubes and BSF maggots, and coordinating with the government—in this case, through the management of RW 24 and Karang Taruna—are all examples of how planning is carried out. The community is then involved in carrying out the organization since they will be the ones supplying the organic waste. Utilizing maggots to process organic waste is how the implementation process is carried out. Along with regular monitoring of the decomposition process and the monitoring of the end products of decomposition in the form of solid fertilizer, liquid fertilizer, and animal feed. The Adiba Kamila Foundation also engages in activities that are unrelated to its core business. These actions consist of: assisting in the processing of waste decomposition products;

facilitating assistance in waste sorting; and collaborating with other parties (Arifin, 2019).

Without the stakeholders who keep the program going, managing partners would not be able to function. Administrators from RW 24 and Karang Taruna play a crucial role in this situation. The management of RW 24 and Karang Taruna's primary responsibility is to accept the Adiba Kamila Foundation's invitation to join them as a partner in the use of maggots to manage waste. The majority of the residents of RW 24 are shop owners, so organic waste is easily accessible as a raw material for processing, which contributed to this acceptance. The existence of the RW and Karang Taruna management also affects the program's effectiveness and efficiency. This success can be seen in the way waste sorting and processing regulations function, which leads to a regular and periodic coordination process that aims to monitor program implementation and update regulations in line with the situation and conditions in the field (Rahayu dan Jannatan, 2021).

Additionally, the government's position as a policy holder can help facilitate communication between the community and management partners through socialization efforts made by RW management and the provision of regular forums to address community suggestions and grievances regarding activities related to the management of organic waste that use maggots. (Andrianto dkk, 2020; Riogilang, 2020; Yulistia dkk, 2015).

Process Management

Using maggot media to manage organic waste involves a multi-step process. The management has an important part in each step of the process. Sorting out organic and inorganic waste is the first step. The Karang Taruna management, which also serves as the technical implementing partner of the Adiba Kamila Foundation, sorts the trash gathered by the community. To prevent hazardous materials and non-organic waste from contaminating the organic waste that will be processed, sorting is necessary. If this happens, the decomposition process will be hampered and living organisms that act as decomposers will be harmed (Nurhayati dkk., 2020). The organic waste is then divided into smaller forms and transported to the processing building to be processed. The enumeration's primary objective is to speed up the BSF maggot's process of decomposition. According to the manager's exposure, 10–20 kilograms of organic waste typically decompose each day.

Decomposition is the subsequent process. After being sorted and chopped, the trash is put into storage containers. Adult BSF larvae, which are about 18 days old, perform the decomposition process. Because chopped-up organic waste is consumed by BSF larvae, the decomposition process takes place. Typically, these larvae can consume up to 80% of the amount of provided organic waste. The BSF larvae will then turn black during the decomposition process, stop eating after about 21 days, and mature into adult larvae. The larvae moving from the waste storage area to a drier area is one sign that they are ready to be harvested. Due to the decomposition of organic waste, BSF larvae also produce liquid and

black, fine-textured feces during the process (Auliani et al., 2021). The remaining liquid and food, along with the adult BSF larvae and their feces, are all ready to be recycled into new products.

Program Effectiveness And Constraints

Using maggot media to manage organic waste is thought to be one of the most efficient ways to lessen the amount of waste that businesses and households produce each day. Maggot waste management was successful in reducing the volume of waste by 50–60% of the total amount produced, according to the findings of interviews with management officers and the RW who assisted in overseeing the operation of the program. This is consistent with the typical value of using maggot media to process waste, which can reach 70% if the decomposition process is successful (Ichwan et al, 2021).

The substantial decrease in the volume of organic waste significantly aids in lowering the amount of waste transported to the TPA and can gradually lessen Indonesia's waste management trend, which is still heavily focused on sending waste to the TPA (Simanjorang, 2014).

Organic waste management with Maggot is effective not only in terms of significantly reducing the volume of waste, but also in that it generates new products that can benefit the community in line with the zero waste concept, especially in agriculture and animal husbandry. With a total protein content of 41–42%, adult BSF larvae can be used as animal feed because they are high in protein and beneficial for livestock. The digested BSF larval material, known as fine manure, can be used to make solid organic

fertilizer that is good for plants. Similarly, liquid food residue can be used as liquid fertilizer (Auliani dkk., 2021). In addition to being beneficial for farming and animal husbandry, the new product created by the use of maggots in the decomposition of organic waste also has a high market value. Products made from compost and animal feed can be sold for a profit. Additionally, the method of managing waste by using maggots and creating useful products is a practical illustration of how the economic, environmental, and social sectors can work together at the micro level (products, businesses, consumers) in the idea of a green circular economy. (Stankevičienė, Nikanorova, & Čera, 2020).

The process of managing organic waste using maggot, in addition to being effective in handling the volume of waste, also has obstacles in its implementation. The main obstacle in this program is the emergence of unpleasant odors which are the result of the process of accumulating organic waste in the form of food (Satori et al., 2021). Because the position of the processing site is close to residential areas, it is quite disturbing and often creates pros and cons in the community. This needs to be addressed immediately both by the manager and by the local government as a stakeholder, because if left unchecked it will affect the health of the surrounding residents. Organic waste management facilities need to have an available environmental buffer as a barrier between the processing location and residential areas. Facilities for the management of organic waste must have an accessible environmental buffer that serves as a wall between the processing site and residential areas. Trees, fences, or a significant distance from

residential areas can act as barriers. Additionally, efforts are made to direct the wind around the processing site in the opposite direction from the residential area (Nurhayati et al., 2020).

The manager and the local government's efforts to date have been to cover and sprinkle the piles of organic waste that are decomposing with sawdust in an effort to somewhat lessen the offensive odor that permeates the neighborhood.

In addition to having benefits, the availability of new products presents yet another barrier to the use of maggot media for the management of organic waste. Due to the fact that the management process for these new products involves more than just sorting, moving organic waste, and stocking BSF larvae, it also involves processing adult BSF larvae, as well as feces and leftover organic waste residues that can be used as raw materials compost (Aziz et al, 2021).

The lack of sufficient human resources to carry out the management process from sorting to selling products in the form of feed and fertilizer is one of the challenges managers in RW 24 Padalarang Village face. One of the reasons is that the management system employs a salary system, even though the funding for this is still not fully utilized. As a result, it continues to rely on current employees and gets additional help from the Karang Taruna management, which aids in the sorting process. To solve the HR issues, the management still needs to work with a variety of parties, including the highest levels of government and other institutions (Arifin, 2019).

CONCLUSION

Using maggot as media for the management of organic waste has been proven in lowering the overall amount of waste dumped in landfills. A good model of how to operating a waste management using maggot media done in RW 24 Padalarang Village, West Bandung Regency by a foundation. A join effort among the Adiba Kamila Foundation that is involved in the process as an implementing partner, and the local government, which in this case is represented by RW 24 management and Karang Taruna management, has responded favorably. Management principles, such as planning, organizing, actuating, and controlling processes, are used to implement organic waste management using maggots. After sorting and enumerating the waste, the self-management process uses BSF larvae as a decomposer of organic waste.

When it comes to reducing the amount of waste near RW 24, waste management using the BSF maggot is extremely effective. With the assumption that 10–50% of waste is collected each day, the reduced volume of waste is 50–60% of the total volume produced. twenty kilograms each day. Additionally, waste processing with BSF maggots results in the creation of fresh goods like organic fertilizers and animal feed that have high economic value and can be applied to agriculture and animal husbandry. However, there are still several challenges in managing organic waste. The manager and the local government must focus on the processing of the organic waste that is undergoing a decomposition process that emits an unpleasant odor to the community and requires many of human

resources in order to find a solution. In order to avoid negatively affecting the community, it is crucial to choose a management location that is quite remote from the settlement. It is also crucial to work with different parties to increase the management's human resource capacity. This is necessary so that waste management can be done more successfully and serve as a model for other areas managing organic waste to achieve sustainability development in this regency.

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