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COMMUNITY EMPOWERMENT EFFECTIVENESS IN WASTE MANAGEMENT WITH MAGGOT BSF BIOCONVERSION IN TANGERANG CITY

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ABSTRACT

Waste problems in big cities is something that is often faced, as well as in the city of Tangerang. Garbage is a continuous problem that requires the active role of the community in solving it. The Tangerang City Government has carried out recycling activities with Black Soldier Flies (BSF) bioconversion in managing waste which is a form of innovation by empowering the community. For this reason, it is necessary to carry out evaluations and strategies through the theory of effectiveness seen from the aspects of achieving goals, integration and adaptation in order to see results and measure the achievements of the programs implemented and the benefits for the community. In this study using a qualitative descriptive analysis method by describing the circumstances and phenomena that occur as well as problems by conducting interviews, observations, and published documents and information. The research interviews were conducted with representatives of the Tangerang City government, environmental activists (Indonesian Benua Lestari Foundation), Jatiuwung ITF officers, and the community who received maggot cultivation training. The results obtained in the implementation of community empowerment in processing organic waste with BSF bioconversion when viewed from the aspect of achieving goals, integration and adaptation have not been effective.

Keywords: *Waste, Bioconversion, Black Soldier Flies (BSF), Empowerment*

A. INTRODUCTION

Garbage is one of the problems in urban areas that will continue to be faced, if not handled immediately it will have a negative impact on life. The same thing was also conveyed by Legi (2022), the waste problem is a problem that has long been faced in almost every country. This waste problem is not only a burden and responsibility for the government but is our collective responsibility. Community involvement in managing waste can be done by changing people's behavior in the

use and use of goods into waste by means of 3Rs, namely: reducing, utilizing waste suitable for use (reuse) and recycling waste (recycle). Sumodiningrat (1999) argues that in empowering in society, there is a goal to explore the potential capabilities possessed so as to create an independent society. This can run optimally, if the community is actively involved and has an important role directly in waste management activities. In line with this thought, according to Dharmariza et al., (2020), community empowerment is also an alternative in reducing social conflicts in the community.

In overcoming solid waste which is a continuous problem faced by the Tangerang City government, an active role for the community is needed in solving it through community empowerment. Currently, Tangerang City as one of the supporting cities for the capital city of Jakarta, must be able to manage waste problems. The countermeasures related to waste management are part of the achievement of the Sustainable Development Goals (SDGs) targets which require policy synergy at the national, provincial and district/city levels for the welfare of the people.

The waste problem in Tangerang City can be seen from the production of waste that continues to increase every year. This can be seen from the large volume of waste entering the Rawa Kucing TPA located in Neglasari District, which is 494,176.281.08 tons/year in 2021, while for 2022 the volume of waste entering the TPA is 412.514,564.64 tons/year. years (data up to 6 September 2022), with an average of 1,650 tons per day (Dinas Lingkungan Hidup, 2022). Of these types of waste, about 60-70% is organic waste (household waste) and the rest is non-organic waste. For this reason, the Regional Government is responsible for being able to manage waste properly so that it is able to create a comfortable, healthy, and productive city.

In waste management, it is not enough to reach the service stage to the Final Processing Site (TPA), but efforts are needed so that the waste that reaches the TPA is really not reused. For this reason, the government needs to utilize waste so that it can be efficient and more economical. In the City of Tangerang, in 2021, the target for waste reduction has been achieved, which is 18.33% or equivalent to 90,578.09 tons/year which has been successfully reduced, calculated based on the total number of restrictions on waste generation, waste utilized, and recycled waste. compared to the production volume of waste generation for the entire community of Tangerang City which reached 494,177.11 tons/year in 2021 (Dinas Lingkungan Hidup, 2022).

Starting from this problem, the issuance of Regional Regulation Number 2 of 2022 concerning Waste Management, stating that the tasks of local governments are to facilitate, develop, and implement efforts to reduce, handle, and utilize waste. To support this, the Tangerang City Government continues to strive for environmental improvement by empowering the community through organic waste (household waste) with maggot bioconversion. So far, processing organic waste into compost requires a longer time. For this reason, a new breakthrough is needed so that the composting process can run faster. One of the waste processing methods that can be applied is maggot bioconversion or Black Soldier Flies (BSF).

In accordance with the Medium-Term Development, the 2019-2023 changes are a development stage that is directed as the initial stage of establishing Tangerang City as an 'Advanced and Sustainable City'. In the 2019-2023 RPJMDP, one of the development priorities related to waste management with maggot bioconversion is Spatial Management, Natural Resources and the Environment (Pemerintah Kota Tangerang, 2021). For this reason, in accordance with the development priorities of the City of Tangerang, it is necessary to develop a development strategy of community empowerment so that the ongoing maggot cultivation can continue and develop. This is in line with the opinion of Nguyen et al., (2015) and Gabler (2014) that maggot bioconversion using BSF maggot larvae is one of the innovative and sustainable strategies in organic waste management so as to reduce the burden of the landfill and as a promising economic opportunity for the surrounding community (Diener et al., 2011).

In Tangerang City, organic (household) waste recycling activities have been carried out using the bioconversion method. Waste processing with the Bioconversion of Maggot Black Soldier Flies (BSF) is one form of regional innovation that has been implemented by the Environmental Service (DLH) which has been started since 2019. This maggot bioconversion is one of the innovations in DLH. However, to develop related to solid waste management, the Government cannot do it alone. For this reason, community involvement is needed to manage it. Together with the Job Training Center (BLK), the Government through DLH has organized community empowerment with training on maggot cultivation located in Poris Plawad Indah Village which was carried out in November 2020. This innovation is one of the environmentally friendly waste management. In Newton et al., (2005) the bioconversion process is carried out by converting organic waste (household waste) through fermentation with the involvement of living things to become a source of methane energy. The bioconversion technology carried out in waste management uses maggot or Black Soldier Flies (BSF), because in this BSF it has cellulosic activity in which bacteria are found in the intestines (Supriyatna & Ukit, 2016). The bacteria found in the intestines of BSF larvae will help the larvae in converting organic waste. In this case, BSF is able to convert organic waste (fruits and vegetables) into fat and protein in its body biomass (Newton et al., 2005).

Maggot or BSF, known by the Latin name *Hermetia illucens* is one of the insects from America that has spread to various tropical and subtropical areas (Rhode et al., 2020). The life cycle of this type of insect starts from an egg to a larva (maggot) then becomes a pupa and becomes an adult insect (Moretta et al., 2020). For more details, the maggot life cycle begins with BSF which undergoes mating. The male BSF will die after mating, while the female will lay eggs within 2 to 3 days after mating. Maggot eggs will hatch for 3-4 days. The maggot eggs will develop into baby larvae whose size is about 1 mm, which is almost invisible to the naked eye. Baby larvae develop into adult larvae aged 18-20 days with brownish characteristics. Adult larvae will develop into prepupa on day 21 and the color begins to turn black. Maggot prepupa does not eat and begins to move from wet media to dry media. The prepupa will develop into a pupa. The pupae will stay for 7 to 30 days and then metamorphose into BSF.

Maggot contains 40-50% protein and 29-32% fat (Bosch et al., 2014). In addition, maggot is a type of insect that has advantages because it contains high levels of amylase, lipase, and protease enzymes (Barragan-Fonseca et al., 2017). The large amount of nutrient content in maggot makes maggot an alternative animal feed with a high protein source (Schiavone et al., 2017). The processing system is to provide chopped organic waste as feed from maggot (feed can be directly given or fermented first), then the rest of this maggot can be used as fertilizer. After two weeks, the maggot phase which is used to process organic waste will turn into pupae which then become flies known as BSF. This BSF is safe because it does not become a vector of disease like flies in general.

The *Intermediate Treatment Facility* (ITF) of Tangerang City was built in 2018 at the West Region Waste Processing Unit, Jatiuwung District, which is a temporary waste management site before the residual waste that cannot be processed is sent to the Final Disposal Site (TPA). Initially, ITF was a waste management facility where activities carried out included sorting waste from organic and inorganic, composting conventionally. Along with the development of waste management technology, waste processing activities at ITF developed using Maggot BSF bioconversion for household organic waste processing. The first processing is done by incubating 10 grams of BSF eggs, then breeding in biopond by feeding organic waste gradually per day starting from 14 kg, 16 kg, 18 kg, 20 kg, 22 kg, 24 kg, up to 30 kg. Currently, the waste that has been processed using the BSF maggot bioconversion method reaches 1.5 tons of organic waste per day.

The feed ingredients obtained are market organic waste that has not been processed. The feed ingredients will be processed first, such as the process of counting, squeezing to reduce the water content and mixing several ingredients so that they can be used as food for maggot. The result of the waste that is processed with maggot bioconversion is in the form of used maggot fertilizer or commonly called "Kasgot". This is in line with the thoughts of Liu et al., (2019) that fertilizers produced from maggot contain more nutrients than fertilizers produced from composting organic waste.

In addition, maggot is currently also used by the community as a substitute for raw material for fish and poultry feed, as has been done by several catfish farmers in Tangerang City. The advantage of maggot as animal feed compared to ordinary animal feed is that its high protein content will produce quality livestock. In addition to animal feed, maggot can also be developed into derivative products such as Dried Maggot, Por Maggot, Maggot Pellets and maggot oil. With the many benefits of maggot, it is hoped that the community can carry out bioconversion of maggot from household organic waste because it is fairly easy with low and affordable production costs.

This is in line with studies conducted by Fajri & Harmayani (2020), Sholahuddin et al., (2021), Utami et al., (2020), Afkar et al., (2020), community empowerment has been carried out in the form of counseling and also training in managing the bioconversion of maggot from organic waste. In this case, waste management activities with maggot bioconversion are an appropriate technology in reducing environmentally friendly organic waste. Besides being cheap, organic

waste is also easily obtained. The results from the bioconversion are used as an alternative source of animal feed that is rich in protein and compost, so that in the future it can be used as an entrepreneurial idea for the surrounding community.

In addition, the government needs to know the extent to which the program's sustainability can be felt by the community. The benchmark of empowerment can be done by using the existing effectiveness theory. Effectiveness is a measure that can be used to translate the achievement of the goals to be achieved, where these targets already exist and are determined in advance (Handayaningrat, 1996). Determining the effectiveness requires careful observation and requires deepening, because effectiveness can be analyzed from various aspects depending on the focus to be achieved.

As stated by Ma'mun (2019), effectiveness can be measured by the results that have been achieved compared to predetermined plans. If a goal to be achieved has been met, then the activities/empowerment carried out have been running effectively. The essence of effectiveness is not about how much effort or cost is spent to achieve goals. However, effectiveness focuses on program processes or activities with measures of achieving goals. For this reason, it is necessary to know a measuring tool for the effectiveness of an activity. This is expressed by Duncan in Streers (2003) states in his book entitled "Organizational Effectiveness" that in measuring effectiveness can be seen from the aspect of goal achievement, integration, and adaptation. As revealed in Sari et al., (2018), the results of their research related to the effectiveness of community empowerment based on community associations in Pekanbaru City by measuring the stages of implementation based on aspects of achieving goals, integration and adaptation have been effective. However, the research conducted by Pujiono (2022) stated that the maggot empowerment process in Cipari Village, Cilacap Regency by measuring the empowerment process from the input/input, process, and output/output aspects was declared not optimal due to obstacles in its implementation, namely related to limitations in funding, quality of human resources, and network limitations in the resulting maggot marketing strategy.

From the description above, it is necessary to evaluate and consider strategies for implementing the effectiveness of community empowerment in Tangerang City regarding waste management. The benefits of this research are expected to be able to see the results and measure the achievement of the implemented programs and benefits for the community. In addition, in order to run more optimally in the empowerment process, assistance must be carried out that can increase the skills, awareness, and independence of the community.

B. RESEARCH METHODS

In this study using the *Participatory Rural Appraisal* (PRA) method, namely by studying participatively in community empowerment. Syahyuti (2006) stated the results of the PRA study as one of the research methods that carried out the principle of community empowerment and provided space for the community to participate. In this PRA method, it is carried out with a persuasive approach so that in the data collection process there are many techniques used. Several techniques were used, referring to Chambers & Conway (1992), including

secondary data collection, key informant interviews, semi-structured interviews, Focus Group Discussions (FGD), participatory mapping and modeling, transect walks (walking around with the community), making a timeline. For the research location, ITF Jatiuwung was chosen as one of the places that have started to manage waste using maggot bioconversion in Tangerang City. Data collection techniques used in this study were obtained through primary data and secondary data.

The primary data used include interviews with representatives of the Environment Agency, representatives of ITF managers/officers in Jatiuwung, representatives of environmental conservation activists (Benua Indah Lestari Indonesia), and representatives of the community who handle maggot, which includes perceptions and expectations regarding maggot cultivation as a an alternative for household organic waste processing. Secondary data collection is done by collecting published data and information from various sources such as books, documents, publications, and other supporting data sources. In addition, it was also obtained through a literature review by collecting data from the internet in various institutions/agencies related to maggot bioconversion.

The analysis method is carried out using a qualitative descriptive method, namely by describing the conditions and phenomena that occur as well as problems for further in-depth analysis and assessment related to research carried out logically, systematically and consistently (Sugiyono, 2017). In the use of methods with a qualitative approach can also explain describing the phenomena that exist in the field. This is supported by Moleong (2003) that the purpose of this research method is to be able to explain and photograph phenomena that occur based on data collection.

C. RESULTS OF DISCUSSION

Organic waste processing with maggot bioconversion has developed quite a lot. According to data in 2022, organic waste that enters and is processed until October is an average of 11,255 tons/day.

This encourages the government to provide motivation by involving community participation in organic waste processing through empowerment programs community with maggot bioconversion. The efforts that have been made are in the form of training activities to manage waste with maggot bioconversion. In evaluating these activities, it can be seen by measuring their effectiveness. For this reason, in looking at the success of the program that has been implemented by the Tangerang City Government in waste management by empowering the community through maggot bioconversion, the researchers tried to measure the effectiveness of the three aspects (goal achievement, integration, and adaptation) that have been described previously.

Table: Recapitulation of Maggot Bioconversion Waste Management

No	Monthly	Average Waste (kg/day)	Total Waste (kg)	Maximum (kg)	Minimum (kg)
1	January	4.761,29	147.600,00	9.515,00	1.355,00
2	February	7.729,32	216.421,00	13.990,00	-
3	March	7.815,40	234.462,00	11.259,00	2.420,00
4	April	8.623,97	258.719,00	9.850,00	7.140,00
5	May	7.779,19	241.155,00	9.650,00	2.495,00
6	June	8.599,80	257.994,00	16.750,00	7.110,00
7	July	5.040,03	156.241,00	10.591,00	2.110,00
8	August	5.885,45	182.449,00	9.630,00	2.410,00
9	September	6.930,43	207.913,00	12.750,00	2.530,00
10	October	11.255,03	348.906,00	13.752,00	2.430,00
11	November	-	-	-	-
12	December	-	-	-	-

Data Source: Dinas Lingkungan Hidup, 2022

Achievement Of Objectives

To clearly describe the results of community empowerment with maggot bioconversion, interviews with various related parties were conducted. The results of the interview from the first in achieving the goal, the first stage is that the Tangerang City government has taken steps to invite the community to play an active role in managing organic waste with maggot bioconversion. That is, starting with a webinar activity that brings in competent experts in the field of maggot breeding. In the seminar there was an active interaction with people who were interested in maggot cultivation. Furthermore, after a webinar or introduction to maggot bioconversion is held, the community is given training by bringing directly competent resource persons from the environmental community to explain in detail related to maggot cultivation. The Tangerang City Government collaborated with the Benua Lestari Indonesia Foundation as an expert/ resource person in training on maggot bioconversion cultivation. After the training was held, the community was invited to participate directly in the practice of cultivating maggot accompanied by experienced ITF officers. According to observations in the field, this empowerment program has not been effective due to the many technical obstacles that occur when implementing independent maggot cultivation by the community. The technical constraints are related to the lack of sunlight, the unavailability of maggot feed ingredients, resulting in the cycle of maggot being cultivated by the community experiencing a cycle break.

Interviews were also conducted with the second that the material provided during the training was very detailed and detailed. The community also plays an

active role in the understanding process. In this case, people are more interested in other advantages in cultivating maggot which can be used as animal feed. However, after independent practice in maggot cultivation, problems emerged in the technical process. One of the things mentioned is the problem of air pollution due to improper management of maggot feeding. Informant also expressed the same thing third, in the practice of maggot cultivation, the community has not been right in food processing, breeding patterns, and the feasibility of cages. From the results of interviews with several parties, community empowerment with maggot bioconversion has not been effective in independent practice carried out by the community. There is a lack of communication and understanding between the government and the community. This encourages researchers to dig deeper into other aspects that may be related to achieving goals.

Integrity

Integrity is seen from the ability of program integrity in aligning stakeholder attitudes/behaviors. The ability to juxtapose programs becomes a forum for realizing various aspirations of the community. In addition, integration can also be seen from the program's ability as a forum to realize various community expectations and as a node of cooperation between various parties concerned with community empowerment and environmental and infrastructure management. With community empowerment in waste processing with maggot bioconversion, it is hoped that the integrity that has been described can be seen and felt by the community. Interviews were conducted with the fourth, in this maggot cultivation training it provided new knowledge for the community to utilize household organic waste. The community also gets an accurate picture of the economic benefits that can be obtained if the maggot cultivation is successful. However, in the practice of cultivation, the community faces technical problems which in theory were not explained in the training. Such as the availability of maggot feed which is quite a lot, while household waste only has a small capacity. The community hopes that there will be further programs such as assistance in groups consisting of several community associations as a pilot project for maggot cultivation.

In terms of integrity, community empowerment with maggot cultivation is effective enough to encourage community behavior in processing household organic waste. The community empowerment program through maggot cultivation has encouraged collaboration between the government, urban villages, environmental care communities, the Environmental Service and the community to create collaboration in waste management. This collaboration will affect the sustainability of the program. According to Emerson et al., (2012), Himmelman states that collaboration in joint activities can improve the quality of actors involved in achieving common goals. This is in line with the research conducted by Asropi et al., (2022) where the activity participants received quality improvement in the form of resource support both in terms of budget, as well as increased capacity of human resources and other resources involved in the program.

The community empowerment program in processing organic waste with maggot cultivation will be more optimal if there are further programs such as the

profits obtained from processing waste with maggot bioconversion will produce animal feed ingredients or derivative products that have economic value. So that community empowerment with maggot cultivation will be a sustainable program.

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Adaptation

The program's adaptability can be observed as follows:

1. The program's adaptability can be seen from the program's ability to adapt to the situation and conditions of the community as well as the program's ability to stimulate the spirit of change to the community members. At the socialization stage, it can be observed changes in perspective and changes in community behavior in community empowerment programs in managing organic waste with maggot bioconversion. Furthermore, at the training stage, it can be observed from the spirit of mutual cooperation and the community's sense of belonging to the program they are planning.
2. Program adaptability at the planning stage can be seen from the suitability of the planning and program objectives with the needs and aspirations that develop in the community. Furthermore, at the implementing stage, the program's adaptability can be seen that the program is implemented by adjusting to the situation and conditions and according to community expectations. From the results of observations and interviews of community empowerment program participants in processing organic waste with maggot bioconversion, the adaptation aspect has not been optimally achieved.

   informant fifth in the implementation of the program, motivation has receded when in practice it failed to maintain the maggot cultivation cycle. This is of course not in line with the expectations of the people who participate in the community empowerment program in processing organic waste with maggot bioconversion. However, this program is able to motivate the community to jointly utilize organic waste that is around the environment as maggot feed ingredients and make the environment healthier. In this aspect of adaptation, the community empowerment program in processing organic waste with maggot bioconversion has not yet obtained effective results and is in accordance with community expectations.

From the three aspects described above, it can be seen the factors that become obstacles in the implementation of waste management with community empowerment. Therefore, this will be very useful as a consideration for the government to be able to carry out advanced programs on organic waste management with maggot bioconversion.

D. CONCLUSION

Based on the results of the research and discussion presented, it can be concluded that the implementation of community empowerment through processing organic waste with maggot bioconversion has not been effective. This

can be seen from the results of interviews from various parties, both local governments, institutions, ITF administrators or the community. The technical constraints faced during the independent practice carried out by the community were the result of an ineffective communication pattern. The mission of the local government has not been fully understood by the community participating in the empowerment program. This can be found through the results of interviews which stated that the emphasis of this program is the understanding of the community so that organic waste management using maggot can be applied in daily life. Meanwhile, the community hopes that with this program, they can get directions for new business areas in processing maggot processed products. Based on the research findings, several recommendations are formulated that can be submitted for the implementation of the next program as follows:

1. Submission of the views of local governments in waste processing with maggot bioconversion is expected to be carried out in stages so that acceptance in the community is in accordance with the objectives.
2. There is a need for assistance in community empowerment programs in organic waste management with maggot bioconversion so that the goals expected by the government and the community can be achieved.
3. Collaboration with institutions/academics is also an important factor in this empowerment program. The harmony of understanding between local governments and institutions, in this case the Benua Lestari Indonesia Foundation, will determine the sustainability of waste management programs. Institutions/academics can play the role of connecting the local government's mission to the community through mentoring. Because local governments have limited human resources who have comprehensive insight into environmental quality and maggot bioconversion.

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