

ZERO WASTE MARKET THROUGH MAGGOT CULTIVATION: AN EXPERIMENT FORM NIRMALA MARKET

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Abstract - *This research aims to assess the potential of zero waste market innovation as an effort to process and reduce organic waste, then this also supports the achievement of one of the Sustainable Development Goals (SDGs) through maggot cultivation at Nirmala Market. This research uses qualitative methods with PICO analysis, observation and interviews at Nirmala Market which has implemented an organic waste treatment system using maggots. The results show that maggot cultivation is not only able to significantly reduce the volume of organic waste in Nirmala Market but also provides added economic value through the production of organic fertilizer and maggot as high-quality animal feed. In addition, the active participation of traders and market managers in the program indicates an increased environmental awareness and good collaboration between academia, the community, and the private sector. This study recommends the development of policies and programs that support the implementation of maggot cultivation in traditional markets as one of the strategies to achieve the SDGs holistically and sustainably.*

Keywords: *Zero Waste Market, Maggot Farming, Organic Waste, Traditional Market.*

1. INTRODUCTION

Indonesia is the fourth most populous country in the world after China, India and the United States. Data from the Central Statistics Agency (BPS) states that Indonesia's population in 2023 has reached 278,696.2 million people. With so many people, surely the Indonesian state cannot be separated from the waste problem. The waste problem is almost felt in all regions of Indonesia. According to the Director General of PSLB3, based on KLHK data in 2022, the amount of waste generation in Indonesia reached 68.7 million tons per year with a waste composition dominated by organic waste, especially food waste which reached 41.27%. The volume of waste that continues to increase from year to year is also happening in the Special Region of Yogyakarta. This is evidenced by the news that the Yogyakarta Piyungan Landfill (TPA) was initially only temporarily closed but in April 2024 it was even permanently closed, this is because the Piyungan TPA is overloaded and can no longer accommodate the waste generated by the people of Yogyakarta (Raharjo, 2021).

The permanent closure of the Piyungan landfill has resulted in a lot of community waste that cannot be transported, only piling up almost all of Yogyakarta's roads and even causing unpleasant odours to residential areas. Therefore, the people of Yogyakarta are required to be creative and rack their brains to be able to process the waste produced. This also happens in traditional markets such as the Nirmala Market in Kasihan District, Bantul, Yogyakarta Special Region. In this market, after our research, the most waste generated by traders is organic waste such as vegetables and food scraps. Besides that, the traders are also still confused about how to process the waste. Inorganic waste such as cardboard, bottles and others can be sold to waste collectors but organic waste has no selling value. Then the existence of a depot or landfill that has not been able to operate and is only a stalled building in the Nirmala market creates an opportunity that can be utilized to overcome this by making it a zero-waste laboratory for the Nirmala market.

Zero waste is a concept that emphasizes reduction or reuse, recycling and redesigning a product so that all materials used can be processed or reused without leaving an indecipherable residue. So of course the concept of zero waste is in line with the Sustainable Development Goals (SDGs) which are 17 global goals to achieve sustainable prosperity for all people in the world by taking into account social, economic and environmental aspects. Departing from this, the solution that will be used in the Nirmala Market is to utilize the organic waste in the Nirmala market as a medium for maggot cultivation commonly known as BSF (Black Soldier Fly).

Maggot is an organism that comes from the eggs of the Black Soldier Fly and is one of the decomposing organisms because it consumes organic materials to grow such as food scraps, vegetable scraps to kitchen waste. so that it will make the market zero waste. The life phases of the Black Soldier Fly include maggot or lava, prepupa, pupa and adult insects (Ananta & Novieta, 2018). The selection of this maggot cultivation method is more effective in reducing organic waste because apart from the maggot which has a high economic value and can be used as an alternative feed that can be given directly or as additional feed for fish and livestock because it contains protein around 39.95%, besides that it also contains antimicrobial and anti-fungal so it is very good (Bibin et al., 2021).

Not only that, the dung from maggot cultivation can also be used as compost which has various advantages. One of the advantages of maggot compost is that it does not cause pollution ranging from water pollution, and air pollution, besides that compost from maggot is also fast and has an affordable price (Yulianto et al., 2024).

Therefore, the maggot cultivation carried out at Nirmala Market is highly appreciated. This is certainly because it can answer problems related to organic waste which initially has no use value, with the cultivation of maggot will also be very effective in reducing and processing organic waste generated in the Nirmala market because all components of maggot have benefits, where maggot and compost fertilizer produced can provide economic value because they have a profitable selling value and good prospects in the market. That way it will simultaneously empower the Nirmala market community and its surroundings sustainably into additional income land for the Tirtonirmolo Village community.

2. IMPLEMENTATION METHOD

A. Data Collection Technique

a. Observation

Observation is a data collection technique that involves direct observation of the object or phenomenon being studied. Observations in observation are carried out systematically, purposefully, and according to the aim to record the observed phenomena in detail and objectively. According to Creswell (2014), "Observational research involves the systematic noting and recording of events, behaviours, and artifacts (objects) in the social setting chosen for study." This study helps researchers understand the social context and human behaviour in depth (Creswell, 2014)..

In this research data collection technique, the first observation carried out was located at Pasar Nirmala, Kasihan, Bantul. The topic of observation is to understand the environmental conditions of Pasar Nirmala the population of traders and the types of merchandise in Pasar Nirmala. Observations were made by visiting the location and approaching the traders of Pasar Nirmala to find out more about the historical and geographical conditions of Pasar Nirmala.

Furthermore, the second observation was carried out using an observation study. An observation study is a research method that involves observing and recording behaviour or phenomena without intervening in the subject under study. In observation studies, researchers collect data directly from the subject's natural environment, which makes it possible to obtain authentic information and is not influenced by researcher intervention.

The observation study was conducted at TM BSF (Black Soldier Fly Maggot Farm) located in Pleret, Bantul. The purpose of this observation study is to identify the need to learn organic waste management and maggot cultivation as a basis for program plans at Pasar Nirmala. On November 17, 2023, the team coordinated with the manager of TM BSF to learn first-hand the techniques of waste management and maggot cultivation. The visit started with the observation of organic waste sorting and maggot

cultivation process, from egg hatching to harvesting. The team learned maggot cultivation techniques, including maintenance, growth monitoring, quality checking, and cleanliness of the cultivation area. The maggots produced have economic potential as organic fertilizer and animal feed.

The results of the visit showed an increase in the team's understanding of organic waste management and maggot cultivation. Interactive discussions and hands-on observations equipped the team with practical skills and concrete solutions, making them feel ready to implement this knowledge at Pasar Nirmala.

b. Interviews

The next data collection technique is to conduct intensive interviews with market traders and the surrounding community to gather information about the amount of waste generated, waste disposal patterns, challenges faced, and traders' responses regarding waste management. The interviews were conducted for 7 days by the Nirmala Market School Field Study and Community Services (KKN) Team. The results of this interview obtained data on the volume and type of waste generated per day, which is shown in the table below.

Table 1 Trader Waste Quantity

No	Type of Trade	Amount of Organic Waste	Amount of NonOrganic Waste	Total Waste
1	Vegetables & Fruits	4,5 kg	0,35 kg	4,85 kg
2	Basic Necessities	1 kg	4,25 kg	5,25 kg
3	Food & Beverages	12,5 kg	5,50 kg	18 kg
4	Meat/Fish	0 kg	1,60 kg	1,60 kg
5	Coconut (Degan)	140 kg	3 kg	143 kg

Based on the table above, it can be seen that Nirmala Market traders generate significant organic and inorganic waste. This data was obtained through the separation of the waste objects to be studied, namely organic waste and inorganic waste. Information regarding the amount of waste generated was collected through interviews with traders, according to their type of merchandise.

The sample results show that vegetable and fruit traders generate 4.5 kg of organic waste per day, grocery traders 1 kg, food traders 12.5 kg, meat/fish traders produce no organic waste, and young coconut (degan) traders 140 kg. For inorganic waste, vegetable and fruit traders produce 0.35 kg, basic food traders

4.25 kg, food traders 5.50 kg, meat/fish traders 1.60 kg, and young coconut traders 3 kg. In total, the waste generated by both organic and inorganic is as follows: vegetable and fruit traders 4.85 kg, basic food traders 5.25 kg, food traders 18 kg, meat/fish traders 1.60 kg, and young coconut traders 143 kg.

B. Data Processing and Analysis Techniques

The data analysis technique is the process of arranging the order of data, organizing it into a pattern, category, and basic description unit so that themes can be found and working hypotheses can be formulated as suggested by the data. This process involves simplifying raw data into a form that is easier to understand and interpret (Sugiyono, 2015). The data analysis used in this study, namely.

a. Descriptive Analysis

Descriptive analysis is the process of using statistics to summarize data from a sample into a more understandable form, such as frequency tables, graphs, and other descriptive measures such as mean and standard deviation. This technique assists researchers in understanding and interpreting the patterns of the data collected.

Table 2. Average Trader Waste

No	Type of Trade	Amount of Organic Waste (kg/day)	Amount of Non-Organic Waste (kg/day)	Total Waste (kg/day)
1	Vegetables & Fruits	4,5	0,35	4,85
2	Basic Necessities	1	4,25	5,25
3	Food & Beverages	12,5	5,50	18
4	Meat/Fish	0	1,60	1,60
5	Coconut (Degan)	140	3	143
Total		158	14,70	172,70

Based on this data, it shows that Nirmala Market produces an average of 172.70 kg of waste every day, with most of it in the form of organic waste reaching 158 kg and the rest being non-organic waste of around 14.70 kg. Meanwhile, for nonorganic waste such as bottles and plastics, most traders have managed themselves into recycled goods or sold them to waste collectors. Similarly, 140 kg of degan traders' organic waste has been able to be processed independently into economic value. Meanwhile, 18 kg of organic waste, such as food scraps and other organic materials, has great potential to be decomposed and utilized by Maggot BSF (Black Soldier Fly) as feed. Looking at how people perceive waste management, some see it as a shared responsibility to keep the environment clean, while others may not prioritize it. The amount of organic waste generated has the potential to be used as feed for Maggot BSF in the Maggot BSF cultivation program at Nirmala Market Depot. Organic waste that has not been managed, can be decomposed by Maggot BSF, this program can help reduce the amount of waste that goes to landfills. Waste management through the Maggot BSF cultivation program will also support environmental sustainability and economic potential.

2. Qualitative Analysis

Creswell explains that qualitative data analysis involves the process of examining and organizing textual or visual data to understand the meaning it contains. This process usually includes several steps such as reading through the data, coding the data, finding themes or patterns, and presenting the results in a coherent narrative. The goal is to provide an in-depth interpretation of the phenomenon under study (Creswell, 2014b).

From the interview data conducted by the Nirmala Market School team, several main themes were identified. First, challenges in waste management at Nirmala Market include the high volume of waste, especially organic waste generated by young coconut, vegetable, and fruit vendors. Other challenges include the lack of awareness and knowledge of traders on good and sustainable waste management. Secondly, the potential benefits of maggot cultivation are clear, both in terms of reducing the volume of organic waste and the economic aspect. Maggot, or Black Soldier Fly (BSF) larvae, can decompose organic waste quickly and efficiently, and the result can be used as animal feed or organic fertilizer with high economic value.

Based on observation and interview data, the current waste management in Nirmala Market still faces various obstacles. Observations show that most traders still dispose of waste carelessly without proper segregation. However, some traders, especially those who produce large amounts of waste such as young coconut traders, have started to manage their organic waste independently for further utilization.

Interviews with traders revealed that they are aware of the problem with waste accumulation, but many find it difficult to address this issue due to a lack of facilities and knowledge on efficient waste management. However, they showed great interest in the maggot cultivation program introduced by the team. They see the potential economic benefits of maggot cultivation, both as an additional source of income through the sale of maggots as animal feed and as a solution to reduce waste management costs.

C. Training Techniques 1. Focus Group Discussion (FGD)

The implementation stage through training techniques was first carried out by holding a Focus Group Discussion (FGD) with market traders and the community on November 25, 2023. This FGD aims to provide education about maggot cultivation. FGD participants included market traders, market managers, representatives of surrounding hamlets, Mr Tomi as a presenter, Field Supervisors, and the Nirmala Market School team.

In the FGD, participants were introduced to the concept and benefits of maggot cultivation, which is the larvae of the Black Soldier Fly (BSF). They learned about maggot's natural habitat, optimal conditions for growth, maggot's life cycle, and the role of each stage in cultivation. The FGD is expected to help market residents understand maggot cultivation as a sustainable solution for organic waste management and local economic development. After the FGD, the team recruited permanent managers of Depo Nirmala for organic waste management and maggot cultivation. About four managers, drawn from traders and residents around Nirmala Market, are needed to ensure the sustainable operation of Nirmala Depot.

a. Training

Maggot cultivation at Nirmala Market Depot is managed by employees who are selected through recruitment and given training before work. The training was conducted on January 14, 2024, and attended by the manager of Nirmala Market Depot, market managers, Market School Field Supervisors, Nirmala Market School team, and Mr Tomi, a maggot cultivation expert from TM BSF Pleret, Bantul.

The training included the introduction of tools and materials for maggot cultivation, such as egg-hatching containers and larval cages. Participants gained practical knowledge from Mr. Tomi on the process of maggot cultivation, from egg hatching to daily care. They were also taught how to make waste slurry as larval feed using a waste processing machine, with the right technique and proportion.

During the training, participants learned the daily care of maggots, including temperature regulation, humidity, and feed quality monitoring. The pre-pupal separation stage is carefully conducted to prepare the larvae to become adult flies. In addition, the training covers the harvesting techniques of BSF fly eggs and the roasting process of maggots to produce final products, such as organic fertilizer or animal feed. Through this training, participants are expected to be able to implement maggot cultivation properly, supporting effective and sustainable waste management in Nirmala Market.

3. RESULT AND DISCUSSION Process of cultivation stages

Maggot is a very effective creature in decomposing organic waste due to its ability to absorb all the liquid contained in the waste. Maggot has a high protein content and can be used as feed for catfish, birds, and chickens (Sukemi, 201). BSF larvae have a high protein content, around 40-50%, and high-fat content, around 29-32%, which makes them one of the many insects that can be used as feed (Yuwono & Mentari, 2018). In addition, spent maggot, or decomposed maggot waste, can be used as organic fertilizer for crops (Habib, 2021; Kunusa & Ibayu, 2020).. The Black Soldier Fly (BSF), also known as *Hermetia illucens*, is a species of fly of the order Diptera, family Stratiomyidae, and genus *Hermetia*. BSF is a global fly native to the Americas. BSF grows in natural ecosystems in Maluku and Irian Jaya Indonesia, according to Hem (2011). BSF larvae cannot live at temperatures below 7°C or above 45°C; the best temperature for growth is between 30°C and 36°C (Hem, 2011: 9).

1) Hatching Maggot Eggs

Maggot eggs are produced from BSF flies. BSF flies have a stocky black body and are 15-20 mm long; visually, they are similar to wasps (Maslo et al., 2017). To lay eggs, female flies are attracted to the odour of fermenting organic matter. To become maggot larvae, female flies can produce 500 eggs and hatch in 4 days (Wahyuni et al., 2017). How to hatch maggot eggs as practised by the Nirmala Market School Batch 4 Team is by 1) Weighing maggot eggs as much as 10 grams and then placed on a piece of tissue. 2) Fold the tissue to cover the entire maggot egg. 3) Mix 50 grams of rice bran with water until smooth. 4) Shape the rice bran dough using tinwall then place it on a small biopond. 5)

Cut out the plastic following the shape of the dough. Then place the plastic on top of the dough. 6) Place the tissue containing maggot eggs on the plastic. 7) Sprinkle bran on the side of the pond. 8) Cover the bio pond with wire to protect it from other animals.

Figure 1. Maggot Egg Hatching Process



2) Daily Care of Maggot Eggs

Maggot eggs that have been stored, must be treated every day until the eggs hatch into small maggots. The treatment methods are: 1) Make sure that the rice bran that has been placed in the bio pond is always moist every day. To be able to maintain the moisture of the bran, the thing to do is to remove the tissue containing the maggot eggs and the plastic that is above the bran first. Spray with water. Then put the tissue and plastic back. Spray until the maggot eggs hatch into baby maggots. 2) Transfer the hatched baby maggot into a larger bio-pond.

Figure 2. Maggot Egg Care Process



3) Making and Feeding Maggot Slurry

A maggot is an animal that eats organic waste in the form of kitchen scraps and fruits. In feeding maggots in the productive period, there are several steps, namely: 1) Separate organic waste from inorganic waste. 2) Then put the organic waste into the shredder using a sutil. 3) Give enough water. 4) When finished turn off the machine and

move the slurry into a place. 5) Set aside kasgot or maggot food waste to the side of the bio pond. 6) Pour 500 grams of porridge into the centre of the bio pond so that the maggot can reach it. Maggots will continue to be fed every day until they enter the prepupa phase, which is 25 days after being moved into the bio pond.

Figure 3. Maggot Feeding Process



4) Maggot Daily Care

Maggots that have been moved into the bio pond must get daily care such as: 1) Before feeding, make sure to always clean the maggot or maggot food waste. 2) Dried maggot can be moved into a different container to be used as fertilizer. 3) Make sure the bio pond is tightly covered by a net so that it is not disturbed by other animals.

Figure 4. Maggot Daily Care Process



5) Pre-Pupa Separation and Pupa Transfer Process

Several things must be done after the maggot has undergone the prepupa phase, namely: 1) Choose maggots that are 25 days old and have not eaten. 2) Choose maggots that are ready to enter the jug, namely maggots that are already dark in colour. 3) Maggots that have become pupae or black can be moved into the jug. 4) When transferring the pupa into the drum, make sure there is rotten food in the drum to attract flies to reproduce and make sure there are wooden blocks that can be used to lay eggs. 5) Remove any debris from the jug.

Figure 5. Pre-Pupa Separation and Pupa Transfer Process



6) Oven Maggot After Harvesting

After the maggots have been harvested, to get maggots that are durable, an oven process is needed. The steps of the oven process that must be done are: 1) Weigh the maggot before drying. For example 100 gr / pan. 2) Oven with a temperature of 200° c within 30 minutes. 3) When finished, store the oven-dried maggot in a container and the maggot is ready for packing.

Picture 1.6 Maggot Baking Process



7) Harvesting Maggot Eggs

When BSF flies produced by maggot pupae have reproduced and produced eggs, the eggs can be harvested by cra: 1) Prepare the media for harvesting, namely brushes and tissues. 2) Take the media used by BSF flies to lay eggs. Separate one by one slowly. Then harvest the eggs using a brush. 3) Store the eggs in the prepared tissue.

Figure 7. Maggot Egg Harvesting Process



The Role and Participation of the Market Community

The role and participation of the market community in this case, namely the Nirmala Market School Team Batch 4, starts from observing the waste problem that occurs. Through this waste problem, the Market School Team held a Forum Group Discussion (FGD) which was held by presenting presenters from the Market School Team and also the manager of the Piyungan TPS Maggot Cultivation. The event was attended by the community around the Nirmala market, the Nirmala market manager, the market school supervisor, and also Mr Tomi as the speaker. This FGD resulted in an interactive discussion about maggot cultivation that will involve the Tirtonirmolo village community.

Figure 8. FGD Maggot



In addition to conducting FGDs, the Market School Team also participated in maggot cultivation training as a follow-up activity to the FGDs. In this activity, prospective maggot cultivation workers received training on how to cultivate maggots until harvest. This activity is a manifestation of the participation and role of the market community which seeks to have a real impact by empowering the surrounding community to solve the waste problem with a sustainable solution to maggot cultivation. Gambar Pelatihan Budidaya Maggot.

Figure 9. Maggot Cultivation Training



Then, after conducting maggot cultivation training which aims to provide direct training to prospective workers who are residents around the Nirmala market, another form of the Market School Team's role is to carry out Monitoring activities as an evaluation activity for the work of maggot cultivation workers. In this activity, the workers and the Market School Team held an interactive discussion by providing information to each other about activities during maggot cultivation which were accompanied by the Market School Team during the cultivation activities. Problems that occur are accommodated and discussed together.

Figure 10. Maggot Cultivation Monitoring



Benefits to the Environment and Economy from Maggot Cultivation

Maggot cultivation, particularly of the Black Soldier Fly (BSF), has proven to provide numerous benefits from both environmental and economic perspectives. The implementation of this technology at Nirmala Market serves as a tangible example of how innovative approaches to waste management can positively impact many aspects.

1. Benefits for the Environment

Maggot farming utilizes organic waste produced by market vendors, thereby significantly reducing the volume of waste that needs to be managed. Based on the data we obtained, maggots can consume up to 60% of the weight of the organic waste provided within 24 hours. For example, before the implementation of maggot farming, Pasar Nirmala produced about 158 kg of organic waste per day. After implementation, the volume of organic waste entering the landfill can be significantly reduced. This helps reduce the burden on the city's waste management system and minimizes the negative environmental impact of organic waste accumulation.

The decomposition process by BSF maggots produces less methane gas compared to traditional composting methods. Methane is one of the greenhouse gases that is more potent in causing global warming compared to carbon dioxide. Therefore, maggot farming contributes to the reduction of greenhouse gas emissions, which is an important step in mitigating climate change. In addition, the residue from maggot cultivation known as frass or kasgot (maggot waste) can be used as high-quality organic compost. This compost is rich in nutrients and has a good structure to enhance soil fertility without polluting the environment. The use of compost from maggots in Nirmala Market can support organic farming in the surrounding area, improve soil quality, and increase crop yields.

2. Benefits to the Economy

With the cultivation of maggots, the costs typically incurred for transporting and processing organic waste can be reduced. The Nirmala market, which produces around 158 kg of organic waste per day, can process this waste independently, thereby reducing dependence on external waste processing facilities and saving on operational costs.

BSF maggots have a high protein content (around 39.95%) and can be used as an alternative feed for livestock such as chickens and fish. This can reduce feed costs for local farmers and provide a sustainable source of protein. For example, at TM BSF Pleret Bantul, the use of maggots as animal feed has been proven to reduce feed costs by up to 40% while simultaneously increasing livestock productivity.

The final product of maggot farming, both in the form of the maggots themselves and the compost produced, has a high market value. The community around Nirmala Market can take advantage of this as an additional source of income, making maggot farming a promising venture. This also opens up new business opportunities for the local community, which ultimately supports the circular economy and enhances the well-being of society. Maggot farming supports the concept of a circular economy where organic waste is transformed into highvalue products that can be reused within the economic system. Thus, it creates a sustainable cycle and reduces negative impacts on the

environment. This circular economy model is not only environmentally beneficial but also creates jobs and new sources of income.

Through the implementation of maggot farming at Pasar Nirmala, it can be seen that this innovation not only aids in more efficient waste management but also brings significant economic benefits to the local community. This approach demonstrates that sustainable environmental solutions can go hand in hand with the improvement of the economic well-being of communities.

Evaluation of Relevant SDG Target Achievements

The goal of the United Nations Sustainable Development Agenda, or SDGs, is to achieve sustainable human well-being worldwide. The sustainable development mission includes seventeen goals and at least 169 targets that must be achieved by the year 2030. Currently, we measure a country's development achievements based on the success of its economy. However, the latest criterion for development success is the country's ability to maintain and preserve its environment, in line with the goals of the Sustainable Development Goals (Budiman, 2000:65).

Waste management is a topic that encompasses many disciplines affecting various aspects of society and the economy, and can thus be considered a "gateway" to achieving the Sustainable Development Goals (Madaniya, 2024). Waste management encompasses all actions related to waste from start to finish, including collection, transportation, processing, and final disposal, as well as monitoring and regulating the waste management process (Wilson et al., 2015).

The maggot farming carried out at the Nirmala Market Depot is a tangible effort in managing organic waste, aiming to serve as a platform for sustainable community development. With the cultivation of maggots, the waste problem faced by traders and residents of Nirmala Market can be addressed with a renewable solution that not only saves the environment but also serves as a platform for the economic development of the community. The economic development of the community is not only reflected in the sale of maggot products but also in the creation of new job opportunities that can increase the income of the people. This indicates that the achievement of the SDGs, especially SDGs 1, 8, and 12, can be influenced by sustainable waste management. In addition, the goal of SDG 15, which is to protect terrestrial ecosystems, is related to environmental conservation (Madaniya, 2024).

The Long-Term Impact of Maggot Farming

The existence of maggot farming has implications for society and the environment. The benefits of maggot cultivation include serving as an additional source of income due to its economic value, acting as a decomposer of organic waste, providing feed for livestock, and being usable as both solid organic fertilizer and liquid organic fertilizer (Zahro et al., 2023). Meanwhile, maggots (black soldier fly larvae) according to Rini et al. (2015) in (Firmansyah&Taufiq, 2020). are beneficial in the decomposition of organic waste in a shorter time, have dewatering properties (absorb water), can create burrows for waste aeration, are tolerant to pH and temperature, serve as a control for house flies,

and can be used as an alternative animal feed due to their relatively high protein content, reaching up to 45%.

By combining the concept of waste banks with maggot farming, communities can manage organic waste more sustainably and productively (Yanto & Fatkhuri, 2024). This initiative also provides new economic opportunities for the community, as maggots and their by-products can be sold to generate additional income (Nurhidayah et al., 2023). The optimization of waste banks through maggot cultivation not only helps address local environmental issues but also empowers the community to actively participate in better and more sustainable waste management (Cahyarani, 2022).

Based on the results of the interviews conducted by the team, the findings are as follows:

Table 3. Market Trader Interview Results

No.	Name	Maggot Cultivati Provides Econon Benefits to the Community	Maggot Cultivation Encourages Community Participation in Waste Management	Maggot Cultivation Becomes a Solution to Waste Issues
1.	Margono	Agree	Agree	Agree
2.	Siswanto	Agree	Less Agree	Agree
3.	Meni	Agree	Less Agree	Agree
4.	Fitriana	Agree	Agree	Agree
5.	Wati	Agree	Agree	Agree
6.	Siti Rejeki	Less Agree	Agree	Agree
7.	Sumarsih	Less Agree	Agree	Agree
8.	Ustadi	Agree	Agree	Agree
9.	Mudiyono	Agree	Less Agree	Agree
10.	Listia	Agree	Agree	Agree

Based on the results of the interviews conducted, it can be concluded that the majority of the community agrees that maggot farming provides economic benefits to the community, allows the community to contribute to waste management, and can serve as a solution to the waste problems that occur. This aligns with the research conducted by Sukmareni et al. (2023), which states that the processing of organic materials for maggot cultivation not only provides a solution to environmental waste issues but also creates significant added value for the community. The growth of economic value through maggot farming can address two main issues: waste management and the increasing scarcity of livestock and fish feed, which is driving prices up. The efficiency in maggot farming not only impacts the reduction of production costs for fish and poultry farming but also produces maggot waste that has high economic value. Used maggot containers can be turned into liquid organic fertilizer (POC) and compost, providing dual benefits in the effort to maintain environmental balance.

Potential for Replication Elsewhere

The innovative idea in the optimization program of waste banks through maggot cultivation lies in the combination of a simple technology approach with sustainable community empowerment. The main innovation is utilizing Black Soldier Fly (BSF) larvae to decompose organic waste quickly and efficiently, a process that significantly reduces the volume of waste that needs to be transported to landfills (Qowasmi, Sudarti, & Yushardi, 2023). According to Mahmudi et al. (2022), there is potential for replicating maggot cultivation elsewhere, as evidenced by the success of the program at Dharma Alam, which has attracted the attention of other communities interested in adopting a similar approach. Several community groups from the surrounding area have visited Dharma Alam to learn about maggot cultivation and waste bank management.

The public's awareness of the importance of managing waste and turning it into environmentally friendly business opportunities makes maggot farming a viable solution for smart waste utilization. The cultivation of maggots found in the Nirmala market is still relatively new, and the surrounding community has yet to fully understand maggot farming. Community efforts to engage with the surrounding society continue to be implemented to ensure that maggot farming remains sustainable. Community participation and concern for continuously supporting the development of maggot farming is greatly needed. With the existing infrastructure and human resources, it is hoped that the maggot cultivation found in the Nirmala market can serve as an example and can be replicated elsewhere.

4. CONCLUSION

The maggot cultivation program implemented by students by Student Community Service Program (KKN) Conversion program at Pasar Nirmala represents an innovative solution to address the issue of accumulated organic waste in traditional markets. By utilizing Black Soldier Fly (BSF) larvae, this program successfully reduces the buildup of organic waste typically generated by market activities. In addition to helping manage

waste more effectively, maggot cultivation also provides added economic value to the market community through its potential use as livestock feed. Some of the key benefits achieved through this program include a reduction in organic waste, economic potential, and increased environmental awareness, particularly among market residents. Overall, the maggot cultivation program by KKN Conversion students at Pasar Nirmala is a strategic step toward realizing sustainable organic waste management, while also providing positive impacts on the environment, economy, and the local community.

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