International Conference on Rural Development and Entrepreneurship (ICORE 2026)
Proceedings
Vol. 08 Year 2026, 814 – 834

CIRCULAR ECONOMY ANALYSIS BASED ON MAGGOT CULTIVATION AND INORGANIC WASTE PROCESSING INNOVATION ON ECONOMIC VALUE ADDED AT TPST 3R REMPOAH VILLAGE

Sri Faizatul Choiriah[1*], Resti Puspa Dini[2], Dian Isnawati[3], Aldila Kresnaresanti[4]

[1-4]Economic Education, Jenderal Soedirman University, Indonesia

[*]Email corresponding author: sri.choiriah@mhs.unsoed.ac.id

Abstract

Increasing waste generation and limited waste management capacity have highlighted the need for systems that not only reduce waste accumulation but also create economic value. TPST 3R Rempoah Village implemented a circular economy approach through Black Soldier Fly (BSF) maggot cultivation for organic waste treatment and through sorting and baling activities for recyclable inorganic waste. This study aimed to analyze the implementation of a maggot-based circular economy and inorganic waste processing innovations in generating economic added value at TPST 3R Rempoah Village. A descriptive qualitative method was employed. Informants were selected using purposive sampling and consisted of TPST managers, operational workers, and users of waste-derived products. Data were collected through field observations, in-depth interviews, and documentation, and were analyzed using the Miles and Huberman interactive model supported by source and technique triangulation. The findings showed that organic waste was transformed into fresh maggots, BSF eggs and livestock feed with market demand and commercial value. The sorting and baling of inorganic waste increased the economic value of recyclable materials, with a processing capacity of approximately one ton per day. The waste management system also created approximately 28 employment opportunities while promoting resource recovery and material recirculation. The study concludes that the circular economy practices implemented at TPST Rempoah successfully convert waste into productive economic resources, generating economic, social, and environmental benefits while strengthening the sustainability of community-based waste management systems.

Keywords: circular economy, Black Soldier Fly maggot, inorganic waste processing, economic added value, TPST 3R Rempoah

INTRODUCTION

Population growth, changes in consumption patterns, and technological advancements have contributed to increasingly complex waste management problems over time (Alamsyahbana et al., 2024). The United Nations Environment Programme reported that global urban solid waste generation has reached 2.1 to 2.3 billion tons annually. Without sustainable management practices, this figure is projected to continue increasing (United Nations Environment Programme [UNEP], 2024). Indonesia is also facing similar challenges in waste management. According to SIPSN (2024) data from the Ministry of Environment and Forestry, total national waste generation in 2023 reached 56.63 million tons. Of this amount, only approximately 39.01% or 22.09 million tons was properly managed. Organic waste accounted for the largest proportion, approximately 40%, while plastic waste contributed 19%. The increasing volume of waste not only affects environmental quality but also places a significant burden on waste management systems across various regions. Law Number 18 of 2008 states that waste management should be conducted through systematic, comprehensive, and sustainable reduction and handling activities. However, conventional approaches are considered ineffective because they primarily focus on final disposal rather than transforming waste into valuable resources through recycling and recovery processes (Yustiani et al., 2019).

This issue is also experienced in Banyumas Regency, which has a population of nearly two million people. Based on interviews with the management of TPST Rempoah, Banyumas faced a waste emergency in 2018 due to the increasing volume of waste and the closure of the Final Disposal Site (*Tempat Pembuangan Akhir* or TPA) by nearby residents who considered it environmentally harmful. The closure of the TPA resulted in waste accumulation in several areas because no alternative disposal site was available. This condition encouraged the local government and the Environmental Agency to implement a new waste management system that no longer relied on landfill-based disposal. The policy shift was reinforced through Circular Letter of the Regent of Banyumas Number 660.1/7776/2018 concerning Waste Management in Banyumas Regency. This policy transformed the previous waste management pattern, which only involved collection, transportation, and disposal, into a community-based management system beginning at the waste source. Under this system, communities are actively involved in sorting, reusing, and processing waste residues. Provisions regarding waste segregation are also stated in Banyumas Regional Regulation Number 6 of 2016 Article 1, which regulates waste classification based on recycling potential and waste sources.

In 2020, the government established six Integrated Waste Processing Facilities (*Tempat Pemrosesan Sampah Terpadu* or TPST) in several areas of Banyumas Regency, one of which was TPST 3R Rempoah. The facility officially began operating on February 1, 2021, with the primary objective of reducing waste generation through an integrated community-based waste management system. Based on interviews with the Head of the Community Self-Help Group (*Kelompok Swadaya Masyarakat* or KSM) of TPST 3R Rempoah, Rempoah Village has a population of nearly 10,000 people. The volume of waste entering the facility reaches approximately 20 tons per day and may increase to 25 tons during holidays. Most of the waste received consists of organic waste, such as food scraps, fruits, and leaves, accounting for approximately 60% of the total waste volume. These conditions position TPST 3R Rempoah as an important facility in maintaining environmental cleanliness and reducing waste accumulation in Banyumas, which, according to the Head of the Banyumas Environmental Agency, Widodo Sugiri, is projected to reach 700 tons per day by 2025.

The limitations of conventional waste management systems have encouraged the emergence of the circular economy as an alternative approach to waste management. This concept emphasizes continuous resource utilization within the production cycle through activities such as reuse, recycling, and reprocessing into products with economic value (Kirchherr et al., 2017). In Indonesia, the implementation of the circular economy has begun to develop through 3R-based waste management policies consisting of *reduce, reuse, recycle* (Hilmiawan & Pratiwi, 2023). The Ministry of National Development Planning or Bappenas estimates that the implementation of a circular economy could generate economic benefits, including an increase in Gross Domestic Product of up to Rp638 trillion by 2030, the creation of 4.4 million new jobs, and a reduction in waste generation and greenhouse gas emissions (Bappenas, 2024). Therefore, waste is no longer viewed merely as residual material but also as a valuable resource capable of generating economic benefits when managed sustainably and innovatively.

The implementation of the circular economy at TPST 3R Rempoah is carried out through the reutilization of organic and inorganic waste into economically valuable products. Organic waste is utilized in the cultivation of Black Soldier Fly (BSF) maggots as a feed source, while inorganic waste with remaining economic value is processed through sorting and compaction before being sold to collectors. Maggot cultivation produces several products, such as fresh maggots and BSF eggs, which have relatively high demand among the community and business actors in the livestock and fisheries sectors. On the other hand, inorganic waste processing increases the market value of plastics, cardboard, and metals through sorting and compaction processes. These conditions demonstrate that waste management at TPST 3R Rempoah is not solely aimed at reducing waste generation but also at generating economic benefits through waste utilization.

Nevertheless, the optimization of economic value from waste management activities still faces various challenges. Based on interview findings, the management stated that TPST operations have not yet achieved their ideal targets. Several types of low-value waste cannot be processed optimally due to limitations in equipment, operational costs, production capacity, and processing space. The development of the Waste-to-Energy Power Plant (*Pembangkit Listrik Tenaga Sampah* or PLTS) program and the use of plastic shredding machines had previously been implemented to increase the economic value of inorganic waste. However, these programs have not operated optimally due to high operational costs and low economic efficiency. In addition, the low level of public awareness regarding household waste segregation has increased the burden of manual sorting at the TPST. The instability of recycled product market prices also affects revenue generated from waste processing activities.

Studies on circular economy-based waste management, BSF maggot cultivation, and inorganic waste processing have been conducted in several previous studies. Handayani et al. (2021) stated that BSF maggot cultivation is capable of reducing organic waste volume while simultaneously generating economic value through derivative products such as fertilizer, maggots, and animal feed. Rochaeni et al. (2024) explained that the implementation of the circular economy in maggot houses has the potential to generate income from organic waste processing, although it still faces challenges such as inadequate waste segregation, limited facilities, and suboptimal maggot production. Research conducted by Darmawan et al. (2025) also demonstrated that the utilization of maggots in circular economy-based Village-Owned Enterprises (*Badan Usaha Milik Desa* or BUMDes) can create business opportunities and increase rural community income through organic waste management. The study emphasized the importance of village government support, training, and community participation in the development of maggot cultivation. In terms of inorganic waste management, Yustyana et al. (2024) explained that plastic waste and scrap materials can be processed through sorting, shredding, and recycling processes, thereby generating new economic value, creating employment opportunities, and supporting the circular economy within rural communities. Furthermore, Dewi et al. (2025) demonstrated that innovations in processing plastic waste into household products and interior design materials are capable of increasing waste value added while simultaneously creating economic opportunities for the community.

Most previous studies have primarily focused on the technical aspects of waste management, community empowerment, or the effectiveness of waste management programs. Research specifically examining the relationship between maggot-based organic waste processing and inorganic waste processing in generating economic value added within TPST operations remains limited. In fact, TPST functions not only as a waste reduction facility but also has the potential to develop into an environmental economic unit. In addition, the condition of waste management in Banyumas Regency following the waste emergency and TPA closure in 2018 has not been widely explored in previous studies. From a theoretical perspective, this research is expected to enrich studies related to the circular economy and community-based waste management. From a practical perspective, the findings are expected to serve as evaluation material and recommendations for TPST managers, village governments, and local governments in developing a more effective, sustainable, and economically valuable waste management system. Therefore, this study is directed toward analyzing how the implementation of a maggot-based circular economy and innovations in inorganic waste processing can generate economic value added at TPST Rempoah Village.

LITERATURE REVIEW

Circular Economy in Waste Management

The concept of the circular economy refers to an economic system designed to replace the end-of-life model through the implementation of *reduce, reuse, recycle,* and *recovery* principles in production, distribution, and consumption processes. The implementation of this concept operates at three levels: the micro level, which includes consumers, companies, and products; the meso level, which relates to the development of environmentally oriented industrial areas; and the macro level, which involves regions, cities, and countries. Through the implementation of the circular economy, sustainable development is expected to be achieved while maintaining environmental quality, improving economic welfare, and creating social equity for present and future generations (Kirchherr et al., 2017).

The circular economy is not only understood as an effort to improve resource-use efficiency but also as a new paradigm for sustainable development. According to Geissdoerfer et al. (2017), the circular economy approach is capable of integrating environmental, economic, and social dimensions through the optimization of resource utilization and waste reduction. This approach encourages more sustainable resource use, thereby reducing environmental pressure while simultaneously enhancing economic and social benefits.

The Foundation (2013) explains that the circular economy is built upon three main principles: eliminating waste and pollution, circulating products and materials to maintain their use, and regenerating natural systems. Based on these principles, waste is no longer viewed as final residue but rather as a resource that can still be reutilized to generate economic value added. Meanwhile, (Alamsyahbana et al., 2024) state that the circular economy in waste management emphasizes waste reduction, product life extension, and effective material recycling processes.

In circular economy-based waste management, the recovery and reutilization of resources contained within waste constitute one of the key aspects of the system. This concept is implemented through the resource recovery approach, which aims to restore the utility value of various components that can still be utilized. (Kaza et al., 2018) explained that this process includes the recovery of recyclable materials, organic matter, nutrients, and energy derived from waste for reuse in various productive activities. Through this approach, waste is no longer regarded as the endpoint of a consumption cycle but rather as a resource that continues to possess economic value. Consequently, resource recovery contributes to improving resource-use efficiency while simultaneously reducing the volume of waste that must be managed at final disposal facilities.

BSF Maggot-Based Organic Waste Management

One method that can be applied in organic waste management is the utilization of Black Soldier Fly (BSF) maggots. BSF maggots are the larvae of the insect *Hermetia illucens*, which in Indonesia is commonly known as the black soldier fly. (Yuwono & Mentari, 2018) explained that BSF larvae are capable of utilizing various types of organic waste, such as food scraps, vegetables, fruits, and other organic waste materials as growth media. The decomposition process of organic waste by the larvae takes approximately 10–11 days. This process produces compost as well as fresh larvae and prepupae that can be used as highly nutritious animal feed (Monita et al., 2017).

The utilization of BSF maggots not only provides benefits in reducing organic waste but also offers economic prospects. Based on chemical analyses conducted by Yuwono & Mentari, (2018), the protein content of BSF maggots ranges from 29.9% to 36.4%. This protein content indicates that BSF maggots have the potential to serve as an economically valuable alternative source of animal feed.

Inorganic Waste Processing

Inorganic waste refers to waste originating from non-biological materials as well as the by-products of technological activities. Tchobanoglous et al. (1993) explained that this type of waste requires special handling because its decomposition process takes a considerably long time. In general, inorganic waste consists of plastics, glass, metals, and various other synthetic materials that can still be reprocessed through recycling and reuse activities.

According to Purba et al. (2023), the low level of inorganic waste management can increase environmental impacts, thereby requiring a more effective management system to ensure that reusable materials can be utilized again. One concept that has developed in inorganic waste management is *resource recovery*, which refers to the process of recovering waste materials so that they can be reused as resources with functional and economic value. The (United Nations Environment Programme, 2024) explains that waste reuse and recycling processes are not only capable of reducing environmental pressure but also have the potential to generate economic benefits. Inorganic waste management can be carried out through several stages, including waste sorting, reuse, and material recycling.

Theory of Economic Value Added

The concept of economic value added is associated with the increase in product value resulting from processing activities, changes in form, or improvements in product quality. (Hayami et al., 1987) explained that value added refers to the increase in the value of a commodity after it has undergone stages of production, transportation, and storage. In production activities, value added is obtained from the difference between the value of the final product and the costs of raw materials as well as other inputs used during the processing stage (Husniar et al., 2023).

The Hayami method is considered to have several advantages in value-added analysis. Aponno & Siahaya, (2023) also stated that the Hayami method is capable of demonstrating the amount of output and value added generated while simultaneously illustrating the level of compensation received by owners of production factors.

Value added can be used as one of the indicators for measuring business growth because it reflects an increase in the economic value of goods or services. The existence of value added enables a product or service to possess higher economic value, thereby creating opportunities for companies to increase product selling prices. (Bantacut, 2013) explained that value added refers to the increase in the value of a commodity that has undergone production, distribution, and storage processes within a business activity.

Integrated Waste Processing Facility (TPST)

An Integrated Waste Processing Facility (Tempat Pengolahan Sampah Terpadu or TPST) is a waste management facility designed to support comprehensive waste management activities, ranging from collection, sorting, reuse, recycling, and processing to final disposal. Based on Regulation of the Minister of Public Works Number 03 of 2013, TPST serves as a waste management facility aimed at reducing the volume of waste before it is transported to the final disposal site.

TPST management is carried out through several aspects, particularly technical aspects related to waste processing near the source of waste generation so that transportation costs can be minimized. In addition, the success of TPST management is also influenced by institutional support, financial systems, and effective operational management to ensure that waste management processes can operate optimally.

Presidential Regulation Number 97 of 2017 concerning National Policies and Strategies for Household Waste Management states that waste reduction based on the 3R principles can be implemented through TPST or TPS 3R facilities. Aryenti & Darwati, (2012) explained that TPST functions as a center for waste management based on *reduce, reuse,* and *recycle* principles through waste processing and the reutilization of both organic and inorganic waste, thereby minimizing the amount of residual waste disposed of at final processing facilities.

RESEARCH METHODS

This study employed a qualitative method with a descriptive approach to gain an in-depth understanding of waste management phenomena based on actual field conditions. This approach was applied to enable the researcher to obtain a comprehensive overview of waste management activities at TPST 3R Rempoah, ranging from waste sorting and processing to the utilization of waste management outputs. Descriptive qualitative research aims to systematically describe the various conditions, processes, and activities involved in waste management at the research site.

The research was conducted over a two-week period at TPST 3R Rempoah, located in Rempoah Village, Baturraden District, Banyumas Regency. Research interviews were conducted on May 15, 2026. The research location was selected based on the existence of TPST 3R Rempoah as an integrated waste management facility that implements various waste processing activities, including waste sorting, maggot management, composting, waste compaction, and the utilization of waste processing outputs involving multiple stakeholders in its operations.

The research data consisted of primary and secondary data. Primary data were obtained through field observations and in-depth interviews with parties directly involved in waste management activities at TPST 3R Rempoah. Informants were selected using a purposive sampling technique, namely the selection of informants based on specific considerations adjusted to the research objectives. The main informant in this study was the Head of the Community Self-Help Group (*Kelompok Swadaya Masyarakat* or KSM) of TPST 3R Rempoah, Mr. Nana Supriyatna. Supporting informants included maggot management officers, waste compaction officers, waste sorting officers, compost managers, equipment management officers, and poultry farmers who utilized the outputs of TPST waste processing. Meanwhile, secondary data were obtained from TPST operational documents, supporting data, scientific literature, and various other references relevant to the study.

Data collection techniques were conducted through observation, in-depth interviews, and documentation. Observation was carried out by directly observing waste management activities and facility conditions at TPST 3R Rempoah. In-depth interviews aimed to obtain detailed information regarding the waste management system, operational processes, challenges encountered, and various efforts undertaken in managing the facility. Documentation was used to complement the research data in the form of operational documents, activity photographs, facility conditions, and other supporting information.

Data analysis in this study employed the Miles and Huberman model, which consists of data collection, data reduction, data presentation, and conclusion drawing or verification. Data obtained from observations, interviews, and documentation were selected, simplified, and categorized based on the research focus before being presented in descriptive form to facilitate interpretation and conclusion drawing. To ensure data validity, this study applied source triangulation and technique triangulation by comparing information obtained from various informants as well as from observation, interview, and documentation results, thereby maintaining data validity.

RESULTS AND DISCUSSION

Overview of the Research Site

This research was conducted at TPST 3R Rempoah, located in Rempoah Village, Baturraden District, Banyumas Regency. The waste management facility began operations on February 1, 2021, and is managed by a Community Self-Help Group (*Kelompok Swadaya Masyarakat* or KSM) under the supervision of a Village-Owned Enterprise (*Badan Usaha Milik Desa* or BUMDes). Within its management structure, the KSM is responsible for carrying out all daily operational activities, while the BUMDes serves as the institution accountable to the village government. The volume of waste received by TPST 3R Rempoah reaches approximately 20 tons per day under normal conditions and can increase to as much as 25 tons per day during holiday periods. The waste originates not only from Rempoah Village but also from surrounding villages, tourist destinations, and various public service facilities. Most of the incoming waste consists of organic materials, such as food scraps, fruits, and leaves. Meanwhile, inorganic waste includes plastics, bottles, cardboard, metals, and mica. The dominance of organic waste has become one of the primary reasons for developing Black Soldier Fly (BSF) maggot cultivation as an alternative organic waste management strategy at TPST Rempoah.

Waste collection from the community is carried out directly by TPST personnel, with collection services conducted approximately twice a week in each service area. TPST operations are supported by various funding sources, including capital participation from BUMDes, community service fees, partnerships with neighboring villages, revenue from the sale of recycled waste products, maggot and poultry farming businesses, compost sales, benchmarking and study visit activities, as well as services for the manufacture and repair of waste processing equipment. Each household is charged a waste management service fee of Rp10,000 per month. Failure to fulfill this payment obligation may result in sanctions, including the suspension of waste collection services or restrictions on certain administrative services in accordance with applicable village regulations. In carrying out its operations, TPST 3R Rempoah employs approximately 28 workers, including management personnel. Job assignments are distributed according to the characteristics of the work and the capabilities of individual workers. Female workers are generally assigned to waste sorting activities because the work requires a high level of accuracy and attention to detail. Male workers, on the other hand, are more frequently involved in physically demanding tasks such as waste transportation and compaction.

TPST 3R Rempoah operates several integrated activity units, including waste sorting, inorganic waste compaction, BSF maggot cultivation, poultry farming, composting, and waste processing equipment manufacturing and repair services. All incoming waste is initially sorted manually. Organic waste is utilized as feed for maggots and poultry, while inorganic waste with economic value is processed through compaction before being sold to collectors. Residual waste that cannot yet be further utilized is transported to the BLE Kaliori Final Disposal Site (*Tempat Pembuangan Akhir* or TPA) for treatment at the regency level. In addition to performing its primary function in waste management, TPST 3R Rempoah has also developed several innovations. One notable initiative was the Waste-to-Energy Power Plant (*Pembangkit Listrik Tenaga Sampah* or PLTS), which was implemented through collaboration with Jenderal Soedirman University and Pegadaian. However, the program was eventually discontinued because it generated emissions that were considered potentially harmful to the environment.

The existence of TPST 3R Rempoah not only contributes to reducing waste generation but has also evolved into an environmentally based economic unit. Various economically valuable products have been generated from its waste management activities, including fresh maggots, BSF eggs, compost fertilizer, compacted plastic products, and outputs from poultry farming businesses. These conditions indicate that the waste management system implemented at TPST 3R Rempoah has embraced circular economy principles by reutilizing resources to generate economic value while simultaneously reducing environmental impacts.

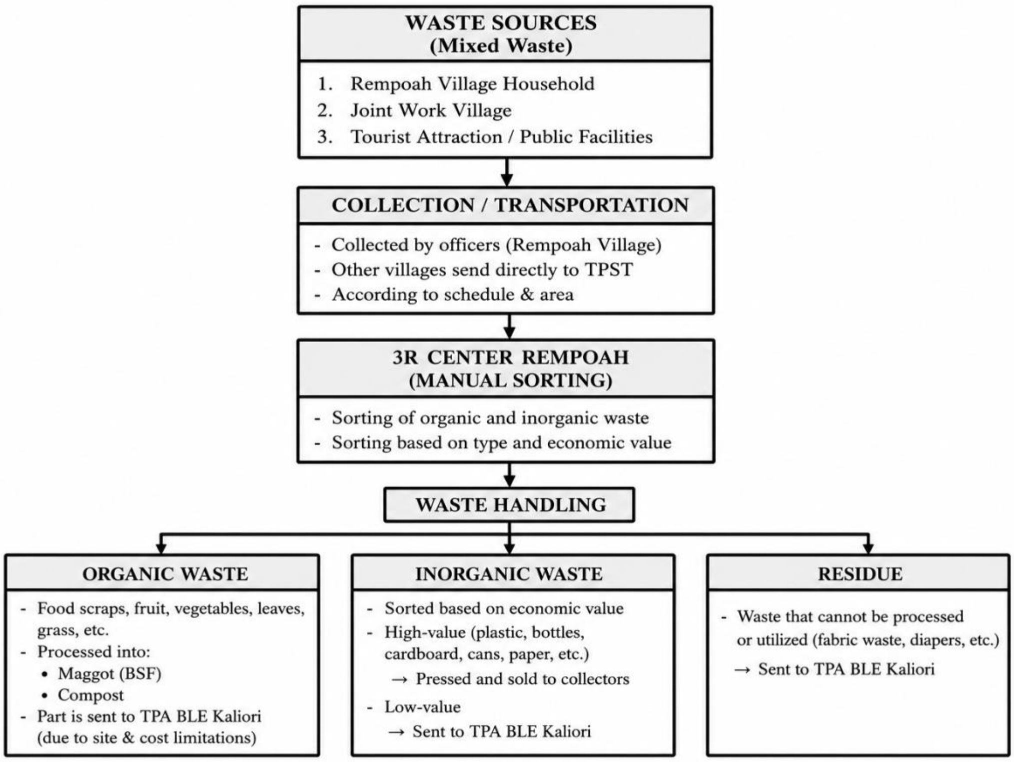

Figure 1. Waste Management Flow at TPST 3R Rempoah

Implementation of a BSF Maggot-Based Circular Economy

One form of circular economy implementation at TPST 3R Rempoah can be observed through the utilization of organic waste in Black Soldier Fly (BSF) maggot cultivation. Waste derived from food scraps, fruits, vegetables, and leaves is first sorted before being used as a feeding medium for the larvae. This practice demonstrates that materials previously regarded as waste can be reutilized as resources that support production processes. This utilization pattern aligns with the circular economy concept proposed by Kirchherr et al. (2017), which emphasizes the importance of keeping resources within the utilization cycle rather than allowing them to end directly as residual waste.

The utilization of organic waste in maggot cultivation is supported by its natural biodegradability. Taufiq and Maulana, (2015) as cited in Hilmiawan & Pratiwi, (2023), explained that organic waste can be rapidly decomposed through microbial activity. This characteristic makes organic waste a suitable medium for BSF larval growth. Furthermore Holmes et al. (2012), stated that the Black Soldier Fly is a tropical fly belonging to the family *Stratiomyidae*, possessing a high capacity for decomposing organic materials. Consequently, this species has been widely utilized in various bioconversion-based waste management systems. The findings of this study indicate that approximately 60% of the waste entering TPST 3R Rempoah consists of organic waste. This substantial proportion provides a significant advantage, as the feed requirements of the larvae can be met continuously. The abundant availability of raw materials enables waste processing to be carried out on an ongoing basis without requiring waste accumulation before treatment. According to Kim et al. (2015), the ability of maggots to decompose organic waste derived from both plant and animal sources is higher than that of several other insect species that have been studied. This capability makes maggots one of the most effective bioconversion agents for organic waste management.

The effectiveness of maggot cultivation as part of waste management is influenced by the biological characteristics of BSF larvae. According to (Supriyatna & Ukit, 2016, as cited in Handayani et al., 2021), explained that BSF larvae possess cellulolytic activity derived from bacteria present in their digestive system. These bacteria accelerate the decomposition of cellulose-containing organic materials, thereby enhancing the efficiency of the decomposition process. Through this mechanism, organic materials that initially have no economic value can be converted into biomass rich in protein and fat (Zheng et al., 2012, as cited in Handayani et al., 2021). This condition explains the ability of larvae to grow rapidly by utilizing organic waste as their primary source of nutrition. From a circular economy perspective, this process reflects a continuous resource utilization cycle in which waste does not end as residue but is transformed into a product with a new function and value. Maggot cultivation can also be regarded as a more environmentally friendly waste treatment technology compared with conventional disposal systems. In conventional systems, most waste is ultimately transported to final disposal facilities, whereas maggot-based processing enables waste treatment to occur directly at the management site. As a result, the volume of waste requiring disposal can be reduced, thereby decreasing the burden on final disposal facilities. Furthermore, local-level processing contributes to reducing long-term waste accumulation.

The research findings indicate that the maggot cultivation unit at TPST 3R Rempoah contributes to reducing the volume of organic waste that must be transported for treatment at the regency level. Although a portion of the waste still needs to be sent to the final disposal site due to production capacity limitations, maggot-based management continues to provide positive impacts in reducing waste accumulation. In addition to raw material availability, the success of maggot cultivation is also influenced by the relatively short life cycle of BSF. The life cycle of this insect consists of the egg, larval, prepupal, pupal, and adult fly stages. Based on the findings of this study, the period required from egg hatching to harvest-ready maggots at TPST 3R Rempoah is approximately 17 days. This finding is generally consistent with Julita et al. (2018), who reported that BSF eggs hatch within 2–4 days and develop into larvae until the prepupal stage within 18–24 days, depending on environmental conditions and the type of feed provided. Meanwhile, Tomberlin and Sheppard (2001) stated that the complete BSF life cycle lasts approximately 40–43 days. This relatively short life cycle represents one of the main advantages of maggot cultivation, as it enables repeated production cycles within a relatively short period.

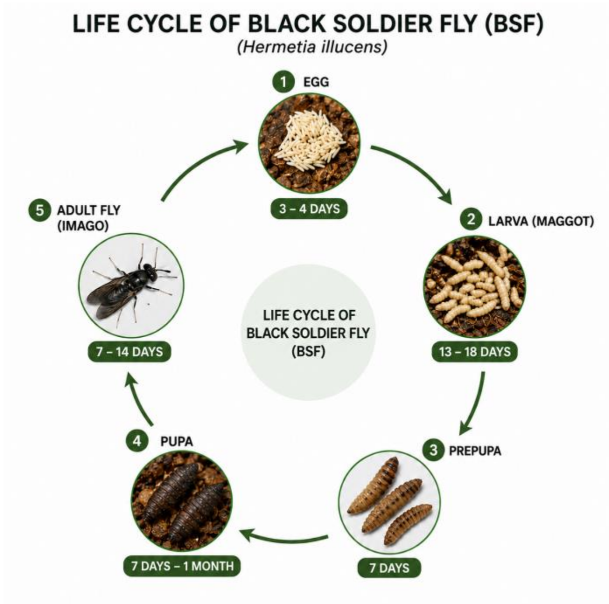

Figure 2. Life Cycle of Black Soldier Fly (BSF)

The high reproductive productivity of BSF also supports the sustainability of maggot cultivation. A single female fly can produce approximately 185–1,235 eggs in one reproductive cycle, and some studies have reported egg production reaching as many as 1,505 eggs (Tomberlin

& Sheppard, 2001). This high reproductive rate ensures a continuous supply of larvae stock, reducing dependence on external egg sources. However, the success of maggot cultivation is influenced not only by biological factors but also by environmental conditions. Based on interviews with maggot cultivation managers at TPST 3R Rempoah, excessively high temperatures represent one of the main challenges in the production process. Elevated temperatures cause maggots to become smaller in size and reduce the quality of their growth. To address this issue, managers routinely spray water in the morning and afternoon to maintain moisture levels in the rearing medium, thereby creating environmental conditions that support larval development.

These field findings support the study of Monita et al. (2017), which stated that temperature and humidity are important environmental factors affecting the growth of Black Soldier Fly (BSF). Qiaolin, L.; Tomberlin, (2008) explained that larval activity is strongly influenced by environmental temperature, with optimal conditions ranging between 27°C and 31°C. When temperatures exceed this range, larvae may experience physiological stress that can inhibit growth and development. Furthermore, Tomberlin and Sheppard (2001) emphasized that water availability plays a crucial role in the BSF life cycle. Adult flies experiencing dehydration tend to exhibit weakened physical conditions, resulting in reduced reproductive capacity. Consequently, the number of eggs produced decreases and may affect the continuity of maggot production. Therefore, maintaining appropriate moisture levels in the cultivation medium is a critical factor in BSF management.

In addition to temperature, humidity also plays an important role in supporting BSF reproductive success. McShaffrey (2016), as cited in Handayani et al. (2021) stated that approximately 80% of female flies are capable of laying eggs under humidity conditions exceeding 60%. Conversely, when humidity levels fall below this threshold, the egg-laying success rate decreases significantly. These findings indicate that environmental conditions directly influence BSF productivity and therefore require careful management. The advantages of BSF are not limited to its ability to process organic waste but also include its relatively high level of safety. BSF is not classified as a pest insect. The risk of disease transmission by BSF is lower than that associated with the common housefly. These characteristics make BSF safer to cultivate within community environments because it does not serve as a major vector of various diseases (Popa, 2012; Bullock et al., 2013, as cited in Widyastuti & Sardin, 2021).

The effectiveness of BSF as a waste management agent is further supported by its adaptability to diverse environmental conditions. According to Widyastuti and Sardin (2021), BSF can survive under a wide range of environmental conditions, demonstrates resistance to parasitic attacks, and is relatively unaffected by various microorganisms. This adaptability enables maggot cultivation to be implemented in different regions with varying environmental characteristics. From a circular economy perspective, the existence of the maggot cultivation unit at TPST 3R Rempoah reflects the principle of circulate products and materials proposed by the (Foundation, 2013). Organic waste that would otherwise reach the end of its consumption stage is not immediately treated as residual waste but is instead reused as a resource for decomposer organisms. Through the bioconversion process, these materials are transformed into new resources that retain both economic and ecological value.

The findings also indicate that the success of the maggot cultivation system is not determined solely by technological aspects but is also influenced by the availability of raw materials originating from the community. Most of the waste received by TPST 3R Rempoah still requires manual sorting because waste segregation at the source has not yet been optimally implemented by residents. This condition demonstrates that social factors play a crucial role in supporting the successful implementation of a circular economy through waste management. These findings are consistent with Rosdiana and Wibowo (2021), who emphasized that environmental education and behavioral change are essential elements of sustainable waste management. Marliani (2014) also explained that environmental awareness must be fostered through changes in attitudes, behavior, and community commitment to actively participate in solving environmental problems. In the context of TPST 3R Rempoah, the effectiveness of maggot cultivation would be further enhanced if households consistently practiced the segregation of organic and inorganic waste at the source.

Overall, the findings indicate that BSF maggot cultivation at TPST 3R Rempoah represents a form of circular economy implementation that integrates environmental, technological, and institutional aspects within a single waste management system. The role of maggots extends beyond that of decomposer organisms, serving as bioconversion agents capable of transforming organic waste into more valuable resources. This system contributes to reducing the volume of waste transported to final disposal sites while supporting the creation of a sustainable resource utilization cycle. These findings suggest that BSF larva-based waste management has significant potential to be implemented as an alternative waste treatment strategy in areas dominated by organic waste, particularly at the village and community levels.

Innovation in Innorganic Waste Processing as a Form Of Resource Recovery

In addition to utilizing organic waste through Black Soldier Fly (BSF) maggot cultivation, TPST 3R Rempoah also applies circular economy principles in the management of inorganic waste. This effort is carried out through waste sorting, compaction, and various processing developments aimed at keeping materials within the utilization cycle for as long as possible. From a circular economy perspective, this approach is known as *resource recovery*, which refers to efforts to recover materials that still possess utility value so that they do not immediately end up as residual waste in final disposal facilities (Kaza et al., 2018).

Based on the research findings, most of the inorganic waste received by TPST 3R Rempoah originates from household waste and community collection activities. The most commonly found materials include plastic bottles, plastic cups, cardboard, paper, mica, cans, and various types of plastic packaging. Upon arrival at the facility, all materials are manually sorted according to their respective categories. The sorting stage plays a crucial role because it determines both the quality of materials to be processed further and the market value that can be obtained. For plastic waste, separation is carried out according to specific characteristics to ensure greater acceptance by recycling industries and to increase its economic value. This sorting practice demonstrates that waste management at TPST 3R Rempoah is not solely oriented toward reducing waste volume but also toward recovering materials that can still be reutilized. Within the circular economy framework, the success of recycling processes is highly dependent on the quality of sorted materials. Materials contaminated or mixed with other waste types may reduce the quality of the final product and limit opportunities for further utilization.

The separated inorganic materials are subsequently grouped according to type before entering the compaction stage. Interview results revealed that the compaction capacity at TPST 3R Rempoah reaches approximately one ton per day, equivalent to around 18–20 bales of material. The weight of each bale varies depending on the characteristics of the processed material. Plastic and paper bales generally weigh around 60–70 kilograms, whereas plastic bottle bales weigh approximately 30 kilograms. Although relatively simple, the compaction process performs a strategic function in inorganic waste management. While it does not alter the fundamental form of the materials, it significantly reduces their volume. With a smaller volume, storage space requirements become more efficient and distribution costs can be reduced. This condition facilitates the marketing of recyclable materials to waste collectors and industries that will conduct further processing.

The findings indicate that innovation in waste management does not always depend on sophisticated technologies. At TPST 3R Rempoah, the combination of sorting and compaction has successfully improved the effectiveness of inorganic waste utilization. This strategy is consistent with the concept of *resource recovery*, which emphasizes the importance of material recovery based on local conditions, managerial capacity, and the availability of existing facilities and infrastructure. Among the various types of inorganic waste, plastic waste receives the greatest attention. This is due to both its dominant proportion within the waste stream and its resistance to natural degradation processes. Taufiq and Maulana (2015), as cited in Hilmiawan and Pratiwi (2023), explained that inorganic waste, particularly plastic, is not easily degraded by microorganisms, causing its decomposition process to take hundreds of years. This characteristic makes plastic one of the most significant challenges in environmental waste management.

The findings of this study indicate that most of the plastic waste received by TPST 3R Rempoah is not immediately classified as residual waste. Instead, the material is sorted and prepared for resale as raw material for the recycling industry. Plastic bottles are among the most sought-after materials because they possess relatively higher economic value compared to several other types of waste. This condition demonstrates that plastic is still regarded as a resource with economic potential, and efforts are therefore made to keep it within the utilization cycle. These management practices are consistent with the findings of Mardius et al. (2024) at the Kalpataru Main Waste Bank in Lumajang Regency. Their study showed that inorganic waste can be transformed into various economically valuable products, such as handicrafts, shredded plastic used as industrial raw material, and supplementary materials for road and asphalt construction. These findings illustrate that the potential applications of plastic waste are extensive when supported by adequate technology and processing facilities.

However, compared with the Kalpataru Waste Bank, plastic waste management at TPST 3R Rempoah remains focused on the material recovery stage through sorting and compaction. Most of the sorted plastic is not yet processed into new products at the TPST level but is instead marketed to external parties that possess more advanced processing facilities. Nevertheless, this system still reflects circular economy principles because recovered materials do not end up as waste but re-enter the production chain as secondary raw materials that retain economic value. The research findings also reveal that TPST 3R Rempoah previously developed plastic waste processing activities through the use of a plastic shredding machine. This technology was utilized to convert plastic waste into shredded material that could be marketed as raw material for the recycling industry. Conceptually, shredded plastic offers greater utilization potential because it is already in a form that is more readily processed by industrial users. In addition, shredded materials provide logistical advantages because they are easier to handle and transport than whole plastic waste.

Despite its promising potential, the plastic shredding machine could not be maintained over the long term. Based on interview findings, the technology was eventually discontinued because it failed to generate profits proportional to the costs incurred. In fact, operating the machine was considered financially disadvantageous, making its continued use economically unfeasible. This finding demonstrates that the success of innovation in waste management depends not only on technical performance but also on economic feasibility. These findings suggest that the implementation of waste-processing technologies must consider sustainability in a comprehensive manner. Technologies that are effective in processing waste may not remain viable if operational costs, maintenance expenses, and economic benefits are not balanced. Therefore, technology selection should be adapted to the social, economic, and institutional capacities of the organizations responsible for waste management.

In addition to the plastic shredding machine, TPST 3R Rempoah also developed an innovation in the form of a Solar Power Plant (*Pembangkit Listrik Tenaga Surya* or PLTS) integrated with an incinerator through collaboration with Jenderal Soedirman University and Pegadaian. The technology was designed to utilize waste as an energy source while reducing the volume of waste that is difficult to recycle. However, the facility operated for only approximately six months before being discontinued due to local government policies concerning the potential air pollution generated by the combustion process. This situation demonstrates that the development of waste management technologies cannot be separated from environmental and regulatory considerations. Within the circular economy framework, successful waste management is measured not only by its ability to reduce waste volumes but also by its capacity to maintain environmental sustainability. Consequently, every innovation must balance economic benefits, management effectiveness, and potential environmental impacts.

The findings of this study are consistent with the research of Mardius et al. (2024), which explained that the implementation of circular economy principles in waste management continues to face various challenges, particularly those related to limited facilities and supporting infrastructure. Yustyana et al. (2024) also noted that low levels of inorganic waste processing are often influenced by technological limitations and high operational costs. Furthermore, Yustiani et al. (2019) emphasized that one of the major challenges of waste management in Indonesia is the development of technologies capable of operating sustainably over the long term. However, the results from TPST 3R Rempoah indicate that the challenges encountered are not limited to technological factors alone. Regulatory frameworks, cost efficiency, institutional capacity, and market availability also play significant roles in determining the success of waste management innovations. Therefore, the effectiveness of a technology is highly dependent on its ability to adapt to the actual conditions faced by waste managers in the field.

Community participation is another important factor supporting the success of plastic waste management. Rosdiana and Wibowo (2021) explained that households constitute the primary source of waste generation; therefore, behavioral change and environmental education play essential roles in waste management systems. The practice of waste segregation at the source is necessary to maintain the quality of materials received by waste management facilities. This condition corresponds with the situation observed at TPST 3R Rempoah. The effectiveness of the sorting process is strongly influenced by the condition of waste received from the community. Waste that has already been separated at the household level is easier to process and requires less time. In contrast, mixed waste requires additional sorting, which consumes more labor and time. Consequently, the success of *resource recovery* depends not only on the performance of TPST but also on the participation of the community as waste generators.

Rosdiana and Wibowo (2021) further emphasized that plastic waste management requires collaboration among multiple stakeholders, including households, waste pickers, waste banks, collectors, and government institutions. A similar pattern can be observed in the management system implemented at TPST 3R Rempoah. Plastic materials that have been sorted and compacted are subsequently distributed to collectors for further processing. Thus, plastic waste management operates within an interconnected network rather than as an isolated activity. Furthermore, Dewi et al. (2025) explained that plastic waste has the potential to be transformed into various useful products, such as household equipment and interior design components. These findings indicate that opportunities for innovation based on plastic waste remain substantial. However, based on current conditions, waste management at TPST 3R Rempoah remains focused on material recovery through sorting and sales. Therefore, the development of plastic-based recycled products may represent a promising innovation opportunity for future consideration.

Nevertheless, the sorting and compaction system currently implemented remains the most appropriate alternative given the operational capacity of TPST 3R Rempoah. This strategy has proven effective in keeping plastic materials within the utilization cycle while reducing the volume of residual waste that must be transported to the regency level. In other words, although plastic waste is not yet fully transformed into new products at the TPST level, the material recovery process already reflects circular economy practices by preserving the utility value of waste. Overall, the findings demonstrate that inorganic waste management at TPST 3R Rempoah is carried out through a combination of sorting, compaction, and various plastic-processing technology initiatives that have been developed over time. These activities collectively reflect the implementation of *resource recovery*, which aims to maintain the utility value of materials within the economic cycle. Although various challenges remain, the system has contributed to reducing waste accumulation, improving the efficiency of plastic waste management, and supporting the implementation of the circular economy at the local level. The experience of TPST 3R Rempoah also demonstrates that the success of waste management innovation is determined by multiple interconnected factors, including technology, infrastructure support, operational costs, regulatory frameworks, and community participation in waste segregation at the source.

Economic Value Added From Waste Management at TPST 3R Rempoah

The findings of this study indicate that waste management activities at TPST 3R Rempoah are not solely oriented toward reducing waste generation but also generate economic benefits through the reutilization of materials that were previously considered valueless. From a circular economy perspective, the success of a waste management system can be assessed by its ability to transform waste into resources with economic value. The research findings demonstrate that this transformation occurs through the processing of both organic and inorganic waste, resulting in various marketable products while simultaneously creating employment opportunities and sources of income for individuals involved in waste management activities. This phenomenon can be explained through the value-added theory proposed by Hayami et al. (1987). According to this theory, value added emerges when a material undergoes a processing activity that increases its economic value compared to its original condition. In the context of TPST 3R Rempoah, waste that was initially perceived as an environmental problem and possessed no market value undergoes a transformation into products that can be traded commercially. Therefore, value added is generated not only from the final products produced but also from the process through which waste is converted into commodities with economic value.

These findings are also consistent with the perspective of Bantacut (2013), who argued that the value of a commodity can increase through production activities, processing, and transformation. At TPST 3R Rempoah, waste materials that were previously categorized as residual waste have been successfully transformed into various products with market value and consumer demand. This value creation is supported by a combination of factors, including processing activities, labor skills, the utilization of simple technologies, and managerial capabilities in managing material flows entering the waste processing facility. Based on the research findings, one of the primary sources of economic value added can be observed in the maggot cultivation unit. Before being utilized as a cultivation medium, organic waste in the form of food scraps essentially has no market value and even requires handling costs. However, after undergoing a bioconversion process using Black Soldier Fly (BSF) larvae, the material generates various products with economic value.

Table 1. Estimated Revenue Potential of Maggot Cultivation Products at TPST 3R Rempoah

Product	Selling Price	Demand Volume	Potential Revenue
Maggots (average)	Rp5.000/kg	20 kg/day	Rp100.000/day or approximately Rp2.600.000/month
Maggots	Rp5.000/kg	100 kg/day	Rp500.000/day or approximately Rp13.000.000/month
BSF Eggs (average)	Rp5.000/gram	50 grams every 2 days	Rp250.000 every 2 days or approximately Rp3.250.000/month
BSF Eggs	Rp5.000/gram	200 grams/order	Rp1.000.000 per transaction

Source: Authors' Analysis

Table 2. Value Added Generated from Maggot Cultivation

Product	Raw Material	Resulting Product	Seliing Price	Estimated Revenue
Organic waste	Does not have selling value	Maggots	Rp5.000/kg	Rp2.600.000-Rp13.000.000/month
Organic waste	Does not have selling value	BSF Eggs	Rp5.000/gram	±Rp3.250.000/month

Source: Authors' Analysis

These data indicate that materials that previously possessed no economic value can generate revenue after undergoing processing activities. The value created is influenced not only by the quantity of material processed but also by the functional transformation experienced by the material. Organic waste that initially had no market price is converted into products required by the livestock and fisheries sectors. This condition demonstrates that waste management not only generates new products but also creates market opportunities that previously did not exist. Therefore, the creation of value added in waste management is strongly influenced by the ability to connect waste resources with market demand. These findings support the results of Handayani et al. (2021), who explained that maggot cultivation can increase the economic value of organic waste through the production of high-protein animal feed, fertilizer, and various derivative products.

Value added is reflected not only in financial gains but also in the transformation of previously unproductive resources into commodities with economic value. The findings from TPST 3R Rempoah reinforce this perspective, as organic waste that initially had no economic value has been successfully converted into products with clearly identifiable markets and consumers. Economic value added was also identified in the management of inorganic waste. Before being sorted and further processed, mixed inorganic waste generally possesses low market value and attracts limited interest from collectors. However, after undergoing sorting based on material type and compaction according to market requirements, its economic value increases significantly.

Table 3. Estimated Revenue Potential from Inorganic Waste Processing at TPST 3R Rempoah

Component	Value
Pressing capacity	±1 ton/day (1.000 kg)
Seliing price of plastic	Rp1.500-Rp1.800/kg
Daily revenue potential	Rp1.500.000-Rp1.800.000/kg
Monthly revenue potential (26 days)	Rp39.000.000-Rp46.800.000/kg

Source: Authors' Analysis

Table 4. Value Added Generated from Inorganic Waste Processing

Material Condition	Material Form	Economic Value
Before sorting and pressing	Mixed inorganic waste	Low selling value or difficult to market
After sorting	Materials separated by type	Selling value increase due to better quality
After pressing	Sorted and compressed materials	Easier to market and have a higher selling price
Potential sales output	±1 ton/day	Rp1.500.000-Rp1.800.000 per day

Source: Authors' Analysis

Although these figures remain estimates because not all processed materials consist of high-value plastics, the data demonstrate that sorting and compaction activities substantially increase the economic value of waste materials. Without these processes, most inorganic materials would retain relatively low market value because their quality would not meet market standards. Therefore, sorting and compaction represent crucial stages in creating value added within inorganic waste management systems. The findings further indicate that increasing economic value in waste management does not necessarily depend on sophisticated technologies. At TPST 3R Rempoah, value added is generated through relatively simple processes that enhance the quality, functionality, and marketability of materials. This condition demonstrates that the implementation of a circular economy is not solely focused on waste reduction but also on creating economic benefits through the optimization of resources that were previously regarded as having little or no value.

These findings support the study of Rosdiana and Wibowo (2021), which explained that recycling activities have the capacity to transform waste into products with economic and commercial value. Material transformation is the core mechanism of value creation because it shifts waste from being perceived as useless material to becoming a resource with economic value. This condition can be observed in the waste management practices implemented at TPST 3R Rempoah, where sorting and compaction activities improve material quality and consequently increase its market value. The value added generated by TPST 3R Rempoah is reflected not only in revenue from product sales but also in its contribution to job creation. The findings indicate that the facility employs approximately 28 workers distributed across various management units. The presence of this workforce demonstrates that waste processing activities generate not only economically valuable products but also direct benefits for the local community through employment opportunities.

These findings are consistent with the research of Yustyana et al. (2024), which stated that waste management and recycling industry activities have the potential to create new employment opportunities while increasing community income. According to Yustyana et al. (2024), the economic benefits of waste management should not be assessed solely based on the market value of the products generated but also on the broader economic impacts experienced by individuals involved in these activities. Therefore, the benefits generated by TPST 3R Rempoah are not limited to the managing institution itself but are also experienced by workers engaged in its operational activities. The economic value added identified in this study can also be explained through a circular economy perspective. Kirchherr et al. (2017) explained that the circular economy seeks to preserve the value of materials for as long as possible through reuse, recycling, and resource recovery activities. In a linear economic system, materials that become waste typically end up in disposal facilities without generating further economic benefits. In contrast, the system implemented at TPST 3R Rempoah treats waste as a resource that can still be utilized, thereby generating new economic value.

This perspective is reinforced by Morseletto (2020), who argued that the circular economy aims to improve resource-use efficiency by transforming waste into raw materials that can be reused to generate both economic and social benefits. The findings of this study indicate that this principle has been implemented through various processing activities that utilize waste as a production input for products with market value. Therefore, the value added generated does not originate solely from the products produced but also from the system’s ability to optimize the utilization of resources that would otherwise be discarded. Nevertheless, the findings reveal that the creation of value added is not always accompanied by stable profits. Based on interview results, TPST 3R Rempoah has become capable of meeting its operational needs independently; however, the income generated remains subject to fluctuations. This condition is influenced by changes in market prices, relatively high operational costs, equipment maintenance requirements, and labor expenditures. Consequently, a high level of value added does not automatically guarantee profit stability if operating costs also increase.

These findings support the research of Hilmiawan and Pratiwi (2023), which explained that the implementation of a circular economy requires substantial investment, operational costs, and time before achieving long-term sustainability. According to their study, the economic benefits of waste management should be evaluated comprehensively by considering the balance between costs incurred and benefits obtained. Therefore, the success of a waste management system should not be measured solely by the revenue it generates but also by its ability to maintain operational sustainability over the long term. In addition to generating direct economic benefits, the existence of TPST 3R Rempoah also produces positive social impacts for the surrounding community. The findings indicate that waste management activities conducted at the facility have increased public awareness regarding the importance of waste segregation and the reutilization of materials that still possess utility value. These findings are consistent with the study of Handayani et al. (2021), which stated that maggot-based waste management generates not only economic benefits but also non-monetary benefits, including increased public knowledge, behavioral changes toward waste management, and improvements in environmental quality. Therefore, the value added generated extends beyond financial income to include the enhancement of community social capacity in supporting sustainable environmental management.

Overall, the findings demonstrate that the value added created at TPST 3R Rempoah originates from its ability to transform waste into resources with economic value. This process generates various benefits, including increased income, job creation, and positive social and environmental impacts. These findings reinforce the value-added theories proposed by Hayami et al. (1987) and Bantacut (2013), which emphasize that processing activities are the primary factor in increasing the value of a commodity. Furthermore, this study shows that value added within the circular economy framework should not be measured solely by financial gains but also by resource-use efficiency, employment creation, community capacity building, and contributions to environmental sustainability. Therefore, TPST 3R Rempoah can be regarded as an example of a community-based circular economy practice that successfully transforms waste from an environmental burden into an asset with economic value and social benefits.

CONCLUSION

This study demonstrates that waste can be utilized as a resource capable of generating economic benefits when managed through a circular economy approach. At TPST 3R Rempoah, the implementation of this concept is carried out through Black Soldier Fly (BSF) maggot cultivation for organic waste processing, as well as through sorting, compaction, and resource recovery activities for inorganic waste. These activities generate various marketable products, including fresh maggots, BSF eggs, and recyclable materials. In addition to providing income for facility managers, the system contributes to waste reduction, job creation, and increased reutilization of materials that would otherwise become residual waste. Nevertheless, the findings indicate that the creation of economic value added has not yet reached its full potential. Several challenges remain, including limited processing capacity, high operational costs, fluctuations in recycled material market prices, and the relatively low level of household waste segregation practices within the community. These conditions suggest that the success of a circular economy system is determined not only by waste-processing technologies but also by social, economic, and institutional factors.

The findings of this study imply that circular economy-based waste management can serve as an effective alternative for reducing environmental burdens while simultaneously enhancing economic benefits at the local level. To support its long-term sustainability, improvements in managerial capacity, strengthening of processing facilities, and educational programs that encourage household-level waste segregation are required. Furthermore, collaboration among TPST management, village governments, local governments, and other relevant stakeholders should continue to be strengthened to ensure a more effective and sustainable waste management system.

This study also has several limitations. The research was conducted at only one location; therefore, the findings cannot yet be considered representative of TPST conditions in other regions. The qualitative approach employed in this study resulted in an analysis that focused primarily on the interpretation of field findings, while a quantitative measurement of economic value added was not undertaken. In addition, the limited research period did not allow for a more comprehensive examination of long-term operational development and economic sustainability.

Based on these limitations, future studies should incorporate quantitative analyses to measure economic value added more accurately, for example through the Hayami method or other economic approaches. Similar studies could also be conducted across multiple TPST facilities with different characteristics in order to obtain a broader understanding of circular economy implementation in waste management. Furthermore, research focusing on financial aspects, operational efficiency, and community behavior related to waste segregation should continue to be developed to support the establishment of sustainable and economically valuable waste management systems.

BIBLIOGRAPHY

Alamsyahbana, M. I., Utami, R., Kurnia, S., Maharani, Z., & Sesaria, M. I. (2024). Circular Solutions Driving Decent Work and Economic Advancement: Observations from SDG 8. *Collegium*, *1*(1), 1–5.

Aryenti, A., & Darwati, S. (2012). Peningkatan Fungsi Tempat Pengelolaan Sampah Terpadu. *Jurnal Permukiman*, *7*(1), 33. https://doi.org/10.31815/jp.2012.7.33-39

Bantacut, T. (2013). Pembangunan Ketahanan Ekonomi dan Pangan Perdesaan Mandiri Berbasis Nilai Tambah. *Pangan*, *22*(2), 93–107.

Bappenas. (2024). *Circular Economy Indonesia*. https://lcdi-indonesia.id/wp-content/uploads/2024/02/Circular-Economy-Indonesia.pdf

Chrestiana Aponno, & Septina Louisa Siahaya. (2023). Analisis Nilai Tambah Produk Keripik Salak Menggunakan Metode Hayami. *AKUA: Jurnal Akuntansi Dan Keuangan*, *2*(3), 206–212. https://doi.org/10.54259/akua.v2i3.1860

Cindy Theresia Purba, Abigail linia Fanny Lahagu, Juni Simamora, & Yordan Sihotang. (2023). Analisis Permasalahan Sampah Anorganik Di Pasar Sukaramai. *Jurnal Wilayah, Kota Dan Lingkungan Berkelanjutan*, *2*(2), 126–136. https://doi.org/10.58169/jwikal.v2i2.271

Darmawan, A., Hartono, M., Prayitno, H., Ambya, Andayani, S., & Lutviati, C. (2025). Enhancing the Economic Value of Waste with Maggot Utilization in Village-Owned Enterprises of Arthomoro Based on Circular Economy. *Community : Jurnal Pengabdian Pada Masyarakat*, *5*(1), 1–11. https://doi.org/10.51903/v375g469

Dewi, R., Sylvia, N., Retnowulan, S. R., & Akbar, S. J. (2025). Inovasi Pengolahan Limbah Plastik Menjadi Produk Bernilai Ekonomis di Desa Paya Gaboh Kecamatan Sawang Aceh Utara. *Jurnal Malikussaleh Mengabdi*, *4*(2), 419–430.

Foundation, E. M. (2013). *TOWARDS THE CIRCULAR ECONOMY* (pp. 1–8). https://content.ellenmacarthurfoundation.org/m/50c85a620a58955/original/Towards-the-circular-economy-Vol-2.pdf

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768. https://doi.org/10.1016/J.JCLEPRO.2016.12.048

Handayani, D., Naldi, A., Larasati, R. R. N. P., Khaerunnisa, N., & Budiatmaka, D. D. (2021). Management of increasing economic value of organic waste with Maggot cultivation. *IOP Conference Series: Earth and Environmental Science*, *716*(1). https://doi.org/10.1088/1755-1315/716/1/012026

Hayami, Y., Kawagoe, T., Morooka, Y., & Siregar, M. (1987). Agricultural Marketing and Processing in Upland Java A Perspective From A Sunda Village. In *CGPRT Centre* (Number 8).

Hilmiawan, G. A., & Pratiwi, N. (2023). Ekonomi Sirkular Untuk Efisiensi Biaya dan Manfaat dalam Pengelolaan Sampah. *Jurnal Akuntansi (Ja)*, *11*(2), 117–131. https://doi.org/10.30738/ja.v11i2.4029

Holmes, L. A., Vanlaerhoven, S. L., & Tomberlin, J. K. (2012). Relative humidity effects on the life history of hermetia illucens (Diptera: Stratiomyidae). *Environmental Entomology*, *41*(4), 971–978. https://doi.org/10.1603/EN12054

Husniar, H., Sabahannur, S., & Rasyid, R. (2023). Analisis Nilai Tambah Dan Kelayakan Usaha Kerupuk Amplang Ikan. *Wiratani: Jurnal Ilmiah Agribisnis*, *6*(1), 45. https://doi.org/10.33096/wiratani.v6i1.115

Julita, U., Suryani, Y., Kinasih, I., Yuliawati, A., Cahyanto, T., Maryeti, Y., Permana, A. D., & Fitri, L. L. (2018). Growth performance and nutritional composition of black soldier fly, Hermetia illucens (L), (Diptera : Stratiomyidae) reared on horse and sheep manure. *IOP Conference Series: Earth and Environmental Science*, *187*(1), 0–7. https://doi.org/10.1088/1755-1315/187/1/012071

Kaza, S., Yao, L. C., Bhada-Tata, P., Van Woerden, F., & Levine, D. (2018). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1329-0

Kementerian Lingkungan Hidup/Badan Pengendalian Lingkungan Hidup. (2025, June 22). KLH-BPLH tegaskan arah baru menuju Indonesia bebas sampah 2029 dalam Rakornas Pengelolaan Sampah 2025. https://www.kemenlh.go.id

Kim, W., Bae, S., Park, H., Park, K., Lee, S., Choi, Y., Han, S., & Koh, Y. (2015). The larval age and mouth morphology of the black soldier fly, Hermetia illucens (Diptera: Stratiomyidae). *International Journal of Industrial Entomology*, *6*(6), 1059–1065.

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, *127*, 221–232. https://doi.org/10.1016/J.RESCONREC.2017.09.005

Mardius, Y. S., Irfany Rupiwardani, & Yusup Saktiawan. (2024). Evaluasi Pengelolaan Sampah pada Bank Sampah Induk Kalpataru Kabupaten Lumajang dalam Mendukung Ekonomi Sirkular. *Jurnal EnviScience (Environment Science)*, *8*(2), 1–14. https://doi.org/10.30736/jev.v8i2.780

Marliani, N. (2014). Pemanfaatan Limbah Rumah Tangga (Sampah Anorganik) Sebagai Bentuk Implementasi. *Formatif*, *4*(2), 124–132.

Monita, L., Sutjahjo, S. H., Amin, A. A., & Fahmi, M. R. (2017). PENGOLAHAN SAMPAH ORGANIK PERKOTAAN MENGGUNAKAN LARVA BLACK SOLDIER FLY (Hermetia illucens). *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan (Journal of Natural Resources and Environmental Management)*, *7*(3), 227–234. https://doi.org/10.29244/jpsl.7.3.227-234

Morseletto, P. (2020). Targets for a circular economy. *Resources, Conservation and Recycling*, *153*. https://doi.org/10.1016/j.resconrec.2019.104553

Peraturan Daerah Nomor 06 tahun 2016

Qiaolin, L.; Tomberlin, J. k. (2008). Black Soldier Fly (Diptera: Stratiomyidae) Larvae Reduce Escheria coli in Dairy Manure. *Environ Entomol*, *37*(6), 1525–1530. https://doi.org/10.1093/besa/28.1.101b

Rochaeni, A., Ardianti, D., Suryana, P., Ardiani, W. P., Habibie, P. A., Fadhlan, M. R., Nurnazmi, A., & Syahrani, A. P. (2024). Analysis of the Circular Economy's Implementation at Maggot House Mengger Sub-District Bandung City. *Journal of Community Based Environmental Engineering and Management*, *8*(2), 209–220. https://doi.org/10.23969/jcbeem.v8i2.18759

Rosdiana, A., & Wibowo, P. A. (2021). Waste Recycling Assistance Program as an Effort to Reduce Environmental Pollution through Transformation for Added Economic Value. *KUAT : Keuangan Umum Dan Akuntansi Terapan*, *3*(2), 95–100.

SIPSN, K. (2024). *Sistem Informasi Pengelolaan Sampah Nasional*. https://sipsn.menlhk.go.id/sipsn/

Tchobanoglous, G, Theisen, H, & Vigil, S. A. (1993). *Integrayed Solid Waste Management: Engineering Principles and Management Issues*. McGraw-Hill.

Tomberlin, J. K., & Sheppard, D. C. (2001). Factors influencing mating and oviposition of black soldier flies (Diptera: Stratiomyidae) in a colony. *Journal of Entomological Science*, *37*(4), 345–352. https://doi.org/10.18474/0749-8004-37.4.345

Undang-Undang Nomor 18 Tahun 2008

United Nations Environment Programme. (2024). *Global Waste Management Outlook 2024 - Beyond an age of waste: Turning rubbish into a resource*. United Nations Environment Programme. https://doi.org/10.59117/20.500.11822/44939

Widyastuti, S., & Sardin. (2021). PENGOLAHAN SAMPAH ORGANIK PASAR DENGAN MENGGUNAKAN MEDIA LARVA BLACK SOLDIER FLIES (BSF) Program Studi Teknik Lingkungan , Fakultas Teknik , Keywords : compos , larvae black sholdier fly , , wet organic waste , Jurnal Teknik WAKTU Volume 19 Nomor 01 – J. *Jurnal Teknik WAKTU*, *19*(1), 1–13.

Yustiani, Y. M., Rochaeni, A., & Aulia, E. (2019). Konsep Pengelolaan Sampah Di Desa Babakan Kabupaten Bandung. *EnviroScienteae*, *15*(1), 121. https://doi.org/10.20527/es.v15i1.6332

Yustyana, P., Oktabrina, I. Z., Selviana, P. M., Nafisah, K., Maghfiroh, D. A. Al, & Suyudi, M. D. (2024). Pengelolaan Bisnis Komunitas UMKM Limbah Plastik Desa Bulurejo. *ABISATYA:*

Journal of Community Engagement, *2*(2), 104–112. https://journal.unesa.ac.id/index.php/abisatya/article/view/31679%0Ahttps://journal.unesa.ac.id/index.php/abisatya/article/download/31679/12462

Yuwono, A. S., & Mentari, P. D. (2018). Penggunaan Larva (Maggot) Black Soldier Fly (BSF). In *Journal Of Innovation And Applied Technology* (Vol. 7, Number 2). https://biotrop.org/publication/show/penggunaan-larva-maggot-black-soldier-fly-bsf-dalam-pengolahan-limbah-organik