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Organic Waste Management in Markets Based on Waste Characteristics: A Case Study of Markasan Market in Nanga Pinoh, Melawi

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ABSTRACT
Traditional markets are key centers of economic activity and major sources of organic waste generation in Indonesia. This study aims to analyze the volume, density, and composition of organic waste at Markasan Market, Nanga Pinoh, and to identify traders' participation in waste management. The research employed a quantitative approach through direct measurement and surveys involving 58 traders representing four main commodities: vegetables, fish, poultry, and fruits. Data were collected using observation, interviews, and questionnaires, then analyzed descriptively. The results show that waste generation is dominated by organic waste (>80%) with an average density of 104.68 kg/m³ and a generation rate of 2.74 kg/unit/day. The largest composition comes from poultry feathers, while the smallest is vegetable residue. Traders' knowledge, facilities, and compliance with waste management are categorized as moderate. The main issues include limited waste facilities, low awareness among traders, and weak regulatory enforcement. The study recommends improving waste storage facilities, formulating stricter regulations, conducting continuous training and awareness programs, and implementing incentive and penalty systems. Additionally, utilizing organic waste for compost, animal feed, or biogas is considered a promising strategy to support 3R (reduce, reuse, recycle) principles and Sustainable Development Goal 12 (Responsible Consumption and Production). This research contributes to developing effective, healthy, and sustainable waste management models for traditional markets and provides a practical reference for local governments and market managers.

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INTRODUCTION

Waste is commonly understood as a discarded material with no remaining utility; however, improper waste handling poses substantial risks to environmental quality and public health. Traditional markets have been identified as major contributors to municipal solid waste generation due to continuous and intensive trading activities. Previous studies have noted that traditional markets produce one of the highest volumes of waste within daily life

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settings, and these locations are often perceived as unsanitary and malodorous because waste is inadequately managed and dispersed throughout market areas (Widodo, 2013). As trading activity expands, the quantity and characteristics of wastelargely influenced by the types of commodities solddemand systematic and environmentally compliant management practices. When waste is not treated using appropriate and eco-friendly methods, the effects extend beyond human health risks, leading to significant ecological disturbances in residential environments, agricultural land, rivers, and marine ecosystems (Suarna, 2008).

Market waste typically decomposes rapidly, creating specific challenges for sanitation management and increasing the urgency for proper waste handling to prevent pollution around market facilities. Despite the continuous growth and diversification of waste generated by traditional markets, current management practices remain inadequate, allowing substantial waste accumulation and the persistence of environmental and sanitary problems. This issue is evident at Pasar Markasan in Nanga Pinoh, a Type C traditional market that produces mixed waste daily from routine trading activities. Frequent observations of waste accumulation indicate that improper management has become a serious concern for traders, market operators, and surrounding communities, as accumulated waste negatively impacts environmental cleanliness, public comfort, and community health outcomes.

According to data from the Melawi District Cooperative, Small and Medium Enterprises, and Trade Office (2023), Pasar Markasan hosts 236 registered traders; however, its waste management system does not yet comply with the standards established under Indonesia's Waste Management Act (Undang-Undang Nomor 18 Tahun 2008). Ideally, waste should be segregated based on type, quantity, and waste characteristics prior to disposal. The absence of such segregation results in all waste being disposed of in a single temporary storage facility, generating foul odors and attracting pests such as rats and insects (Soemirat, 2011). These challenges demonstrate the urgent need for improvements in waste handling systems, infrastructure, and regulatory enforcement.

To support sustainable development, waste management in Pasar Markasan must adopt an environmental perspective that promotes both ecological protection and economic resilience. A clean market environment can improve community health conditions and enhance consumer comfort, encouraging increased purchasing activity that may ultimately benefit traders economically. Given the substantial amount of organic waste generated primarily from vegetables, fruits, fish, and poultry there is a crucial need for a detailed analysis of organic waste characteristics. Comprehensive data regarding waste volume, density, and composition are essential for designing appropriate waste processing technologies capable of generating value-added products such as compost, livestock feed, maggot biomass, and biogas.

Additionally, generating accurate data on organic waste characteristics can support waste-to-resource initiatives aligned with circular economy principles. Such initiatives can reduce the burden on the existing final disposal site (Tempat Pembuangan Akhir) in Tanjung Tenggang and create new opportunities for local economic development. Transforming organic waste into beneficial products can shift the market's current linear waste

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management model based on collection, transport, and disposal toward a more sustainable and integrated system. This transition will contribute to broader governmental efforts to enhance environmental governance and strengthen traditional market sustainability.

Overall, these conditions underscore the need for further empirical research focused on the characteristics of organic waste produced at Pasar Markasan and on identifying effective, context-appropriate strategies for its management. Such research can inform the development of sustainable waste management systems that reduce environmental impacts, support local economic growth, and enhance the long-term resilience of traditional markets.

METHODE

Location and Time Research

Research Location

This research was conducted at Markasan Market, covering an area of 3.59 hectares. It is a traditional market classified as type C, which is a market where buying and selling activities take place every day. It is located on Jalan Markasan, Tanjung Niaga Village, Nanga Pinoh Subdistrict, Melawi Regency, West Kalimantan Province. The location map of the research is shown in Figure 1, and the condition of the research location is shown in Figure 2 below.

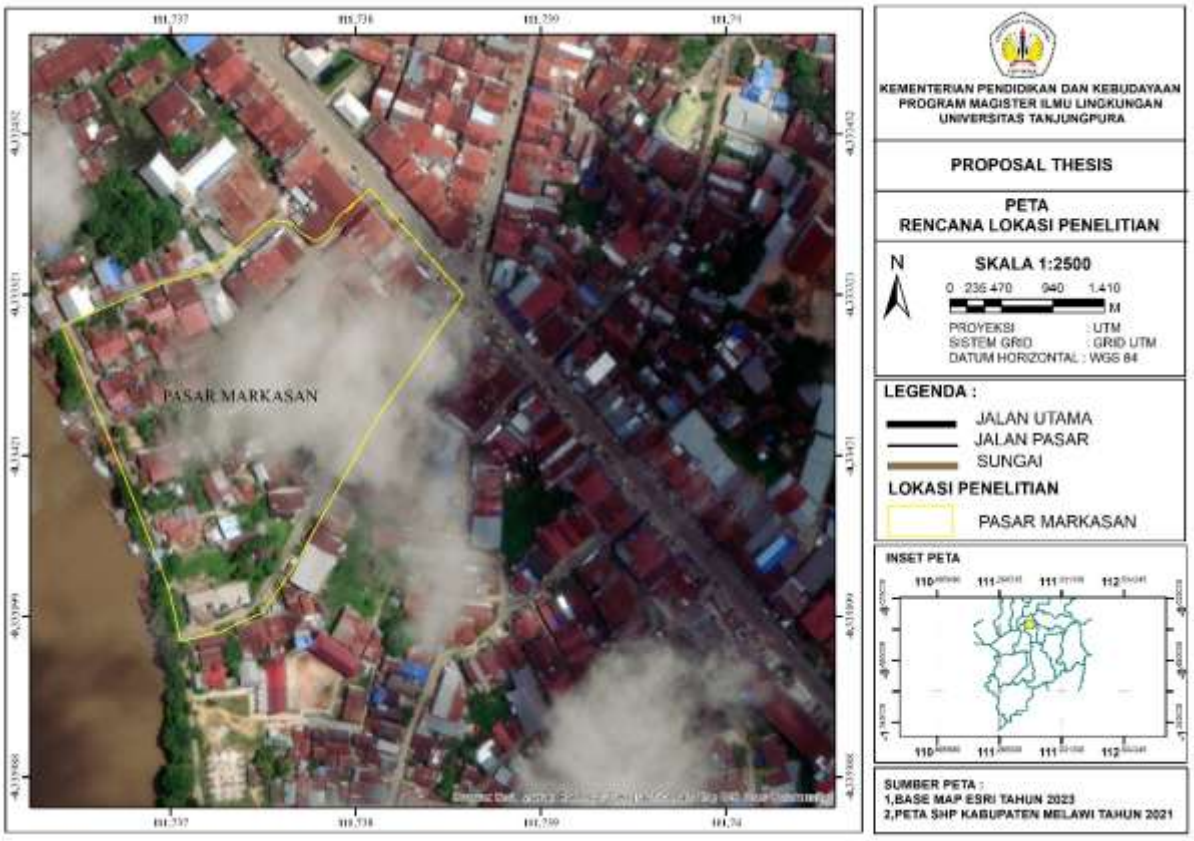

Figure 1. Research Location Map

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Tim Research

This research process was conducted in stages. The research was conducted between June 2023 and November 2023. During this period, various research methods were applied to collect relevant and significant data related to the research topic.

Figure 2. Market Conditions in Nanga Pinoh

Data Collection Techniques

Data and Data Sources

Data is something obtained through a data collection method that will be analyzed using a specific method, which will then produce something that can describe or indicate something. All information related to the research objectives. Data sources in research are subjects from which data can be obtained using questionnaires or interviews. In this study, the data sought concerns the role of market traders in organic waste management at Markasan Market. The data sources collected in this study include primary and secondary data.

Primary data is research data obtained directly from the original source without an intermediary. Primary data is obtained through interviews and direct observation. The primary data for this study was obtained from traders selling at Markasan Market. Secondary data is data obtained indirectly, through an intermediary. The secondary data for this study was obtained from the Markasan Market management and the sanitation agency that handles waste at Markasan Market.

Data Collection Techniques and Instruments

Data collection techniques are the most strategic step in research, as the primary goal of research is to obtain data. Without understanding proper data collection methods, researchers will be unable to gather data that meet established standards. Data can be collected in various settings, from multiple sources, and through different approaches. The data collection techniques used in this study are as follows:

1. Observation

   Observation is a data collection method conducted by directly observing an object, phenomenon, or specific activity in the field in a systematic and planned manner. In research, observation does not only involve watching, but also recording, classifying,

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and interpreting the observed data to support the research objectives. In this study, observations were carried out on traders at Markasan Market regarding their knowledge, roles in organic waste management, the condition of waste management facilities, and other relevant activities related to traders' involvement in organic waste management at Markasan Market.

2. Interview
   In this study, data were also collected through interviews with respondents. The type of questionnaire used was an open-ended interview format. Open-ended interviews allow respondents the freedom to express their answers. They are considered open-ended when the questions do not provide predetermined answer options, requiring respondents to formulate their own responses.
   The use of interviews in this study was chosen due to limited human resources and the large number of trader respondents. The list of questions in the written questionnaire for traders was essentially the same as those used in the interviews, but presented in written form.
3. Dokumentation
   The next step in this research involved collecting data through documentation. Additional methods such as document analysis were also employed to facilitate obtaining accurate data relevant to the research focus in the field. Documents may include personal notes, letters, special records, audio recordings, video recordings, photographs, and other related materials.
4. Literature Review
   The literature review is an essential component of this research. The types of literature used include books, journals, articles, theses, and various statistical data sourced from printed and electronic media related to issues of ethnicity in politics. These sources were examined and summarized by the researcher to identify relevant information. This process assisted the researcher in understanding how waste management is carried out at Markasan Market.

RESULTS AND DISCUSSION

Traders' Knowledge

1. Traders' Knowledge of the Need for Waste Bins
   A total of 58.6% of traders understand the importance of providing waste bins to maintain cleanliness and prevent the spread of diseases. However, observations show that many traders still use non-standard containers such as sacks or used plastic bags, causing waste to leak or scatter easily. Adequate waste bins help maintain hygiene, reduce unpleasant odors, and create a more comfortable environment for customers.
2. Traders' Knowledge of Organic and Inorganic Waste
   About 27.6% of traders are aware of the difference between organic waste (biodegradable materials such as food scraps and vegetables) and inorganic waste (non-biodegradable materials such as plastics and metals. Despite this, traders still

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often mix both types of waste in the same container, indicating limited understanding of waste segregation. Education is needed to help traders separate waste properly to support sustainable waste management practices.

3. Traders' Knowledge of Environmental Impacts of Improper Waste Disposal
   Approximately 27.6% of traders know that improperly disposed waste can lead to disease because it becomes a breeding ground for vectors such as mosquitoes, flies, and rats. Traders' behavior in managing waste collecting it properly, disposing of it in designated places, maintaining cleanliness, and avoiding clogged drains directly affects the environment. Market management must enforce regulations for traders who are not yet disciplined.
4. Traders' Knowledge of Waste Management Education or Socialization
   A total of 32.8% of traders understand that socialization or training can improve their ability to manage waste. Participation in waste segregation remains low, indicating the need for continuous education, such as training on the 3R principles (reduce, reuse, recycle), ecobrick-making, and transforming plastic waste into creative products. The role of market authorities and the government is crucial in guiding both traders and buyers.
5. Traders' Knowledge of Waste Management Practices
   About 30.1% of traders understand that organic waste, especially vegetable residues, can be processed into compost or fertilizer. Separating organic and inorganic waste is necessary to facilitate proper waste handling. In addition, traders need to maintain cleanliness of their stalls, minimize plastic use, and support recycling activities to ensure the market remains clean and comfortable for customers.

Waste Management Efforts

1. Waste Segregation
   Traders at Markasan Market carry out waste segregation by providing separate bins for organic and inorganic waste. A total of 29.3% (18 respondents) dispose of waste according to its type to facilitate sorting by waste workers. Organic waste such as vegetables, fruits, and leaves is utilized as compost or livestock feed, which helps reduce feeding costs. Meanwhile, non-organic waste such as plastic is recycled, reused, or sold if still valuable; unrecyclable plastic is transferred to the temporary waste disposal site (TPS) for transport to the final disposal site (TPA).
2. Waste Collection
   Waste collection is performed by traders and transported to the TPS, where it is already separated into organic and inorganic types. Collection typically occurs during midday or late afternoon when market activity decreases. Waste is transported using carts or tossa vehicles to the TPS and is then hauled daily by municipal trucks such as dump trucks or arm roll vehicles to the TPA.
3. Markasan Market has two TPS units in the form of containers; however, storage capacity remains limited, requiring regulated transport schedules to prevent waste accumulation for more than three days. The system in place is an "individual indirect"

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system, in which waste is first collected at traders' stalls, then moved to the TPS, and subsequently transported to the TPA by the relevant agency.

4. Waste Processing

Waste management follows the 3R concept (Reduce, Reuse, Recycle), but its implementation remains low due to limited trader awareness; 39.6% do not understand the 3R principles. A total of 36.21% (21 respondents) use organic waste as livestock feed, while 29.31% (17 respondents) conduct waste processing to reduce waste volume, and another 29.31% (17 respondents) practice reuse. Organic waste has economic potential as feed or compost, but it must be cleaned and processed to prevent decomposition and health risks.

Key challenges include low trader awareness, limited facilities (such as segregated TPS and processing equipment), budget constraints, lack of an integrated management system, minimal stakeholder collaboration, and technical issues such as odor and high moisture content in organic waste. Proposed solutions include education, facility provision, collaboration with waste banks or CSR programs, trader training, and the adoption of simple technologies such as composters, biopori, or biodigesters..

Table 1. Constraints, Impacts, and Solutions for Organic Waste Management Efforts at Markasan Market

No.	Constraint	Impact	Solution
1	Low awareness among traders and consumers	Waste is not segregated, accumulates, and becomes difficult to process	Continuous education, environmental campaigns, and incentives for traders who practice waste segregation
2	Limited facilities and infrastructure	Organic waste becomes mixed with inorganic waste, reducing its utilization potential	Provision of segregated waste bins, small-scale composting units, and scheduled waste collection
3	High operational costs and limited budget	Programs become unsustainable due to reliance on government funding	Partnerships with the private sector/CSR, waste banks, and development of composting and recycling enterprises
4	Non-integrated waste management system	Segregation is carried out without follow-up actions, resulting in accumulated waste	Establishing a complete management chain: segregation – collection – processing – utilization
5	Minimal collaboration among stakeholders	Waste management programs operate partially and inconsistently	Formation of a coordination forum between government, market managers, traders, and community groups
6	Social and cultural factors	Low community participation in waste	Socialization to shift public mindset, involvement of

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		management	community leaders, and enforcement of clear market hygiene regulations
7	Technical challenges (waste decomposes easily, produces odors, and attracts pests)	Causes air, water, and health pollution	Simple processing technologies (aerobic composters, biopori), and training in organic waste handling

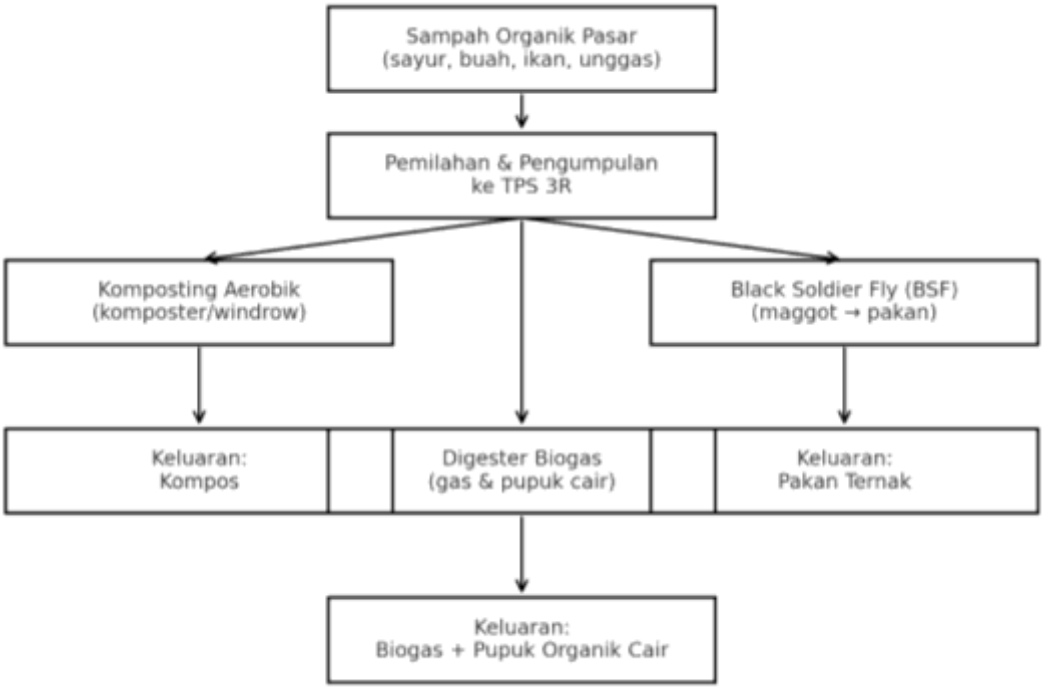

Figure 1. Flow Chart of Organic Waste Management Efforts at the Market

The flow of organic waste management in the market consists of three main processing pathways: aerobic composting, Black Soldier Fly (BSF) maggot cultivation, and biogas digesters. Each pathway produces environmentally friendly outputs.

1. System Flow
    1. Organic market waste (vegetables, fruits, fish, poultry) is collected from traders.
    2. The waste is sorted and gathered at the 3R Temporary Waste Collection Facility (TPS 3R).
    3. From the TPS 3R, the waste is processed through three pathways:
2. Aerobic Composting
    1. The process uses modular composters or the windrow method.
    2. Produces solid compost that can be used as organic fertilizer.
    3. Suitable for vegetable and fruit waste with high moisture content.
3. Black Soldier Fly (BSF)
    1. The process uses BSF larvae (maggots) to break down organic waste, especially fish and poultry residues.

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2. Produces maggots as a high-protein animal feed source.
3. BSF residue can be used as organic fertilizer.

4. Biogas Digester
   1. Anaerobic digestion in a biogas digester produces renewable methane gas.
   2. The byproduct is liquid organic fertilizer (LOF).
   3. Suitable for wet organic waste with high moisture content and large volume.
5. Main Outputs
   1. Compost → used to improve soil structure and fertility.
   2. Animal Feed (maggots) → an alternative protein source for fish and poultry.
   3. Biogas + Liquid Organic Fertilizer → renewable energy and environmentally friendly fertilizer.

Availability of Waste Management Facilities

1. Waste Containment Facilities
   Waste containment facilities are essential as the initial stage of waste management to prevent littering and facilitate collection. At Markasan Market, waste containment is dominated by individual containers such as bins or tubs placed at traders' stalls. However, there is still no separation between organic and inorganic waste. Many traders use makeshift containers such as used barrels or baskets with small capacities (approximately 10–50 liters). Based on the questionnaire, 36.21% of traders use small plastic bags or additional sacks as temporary containers. Ideally, markets should provide communal containers to support more efficient waste management.
2. Waste Storage Facilities
   Storage facilities such as temporary storage bins, containers, and TPS (temporary waste collection sites) play an important role in maintaining market cleanliness. However, management is not yet optimal due to limited TPS capacity, lack of discipline among traders and visitors in disposing of waste, and irregular waste collection schedules. As a result, waste frequently overflows and mixes without segregation. A total of 47.5% of traders stated that the available waste bins are insufficient to accommodate daily waste. To improve effectiveness, adjustments in TPS capacity, provision of waste segregation facilities, and education for traders and visitors are necessary.
3. Waste Collection Facilities
   Waste is collected from traders' stalls to the TPS using carts or tossa vehicles, then transported to the TPA using dump trucks or arm roll trucks. In some locations, the TPS is small, causing waste accumulation and unpleasant odors. Markasan Market has two container-type TPS units, but their capacity remains inadequate, resulting in some traders burning waste or disposing of it in rivers or vacant land. Waste transport is carried out daily using tossa vehicles with a capacity of 2.5 m^3 per unit, operating twice a day. The fleet is in reasonably good condition, but the distance from TPS to TPA and road conditions pose challenges for service efficiency. Refer to Table 2 below for the waste collection facilities.

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Table 2. Waste Collection Transport Facilities

No.	Type of Transport Equipment	Number of Units	Capacity per Unit (m³)	Frequency
1	Tossa	2	2.5	1

Source: Environmental Agency of Melawi Regency, 2022

From a technical perspective, waste collection in Nanga Pinoh City, particularly at Markasan Market, is carried out by collecting waste from each source and transporting it to:

1. Temporary Disposal Sites (TPS) / Waste Containers; or
2. Directly to the final disposal or processing site without any intermediate transfer.

The operational process of collecting and transporting waste from the source to the final processing site is carried out through two systems:

1. Direct system (door-to-door), and
2. Indirect system through transfer depots or containers.

At Markasan Market, the system used is the individual indirect system, in which waste from kiosks or stalls is first collected into each trader's own waste bin. The waste is then transported to the TPS using tossa vehicles operated by sanitation workers from the Environmental Agency of Melawi Regency.

Subsequently, waste from the TPS or containers is transported to the Final Disposal Site (TPA) using dump trucks or arm roll trucks. Waste transport is conducted daily, once every 24 hours, either in the morning or in the late afternoon during operational hours.

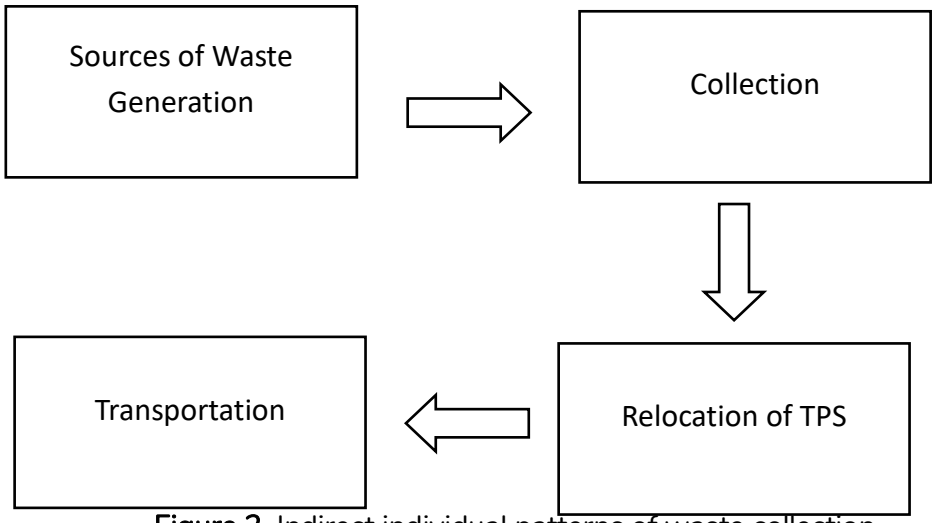

Figure 2. Indirect individual patterns of waste collection

1. Waste Transfer Facilities and Infrastructure

   Waste transfer is carried out to move collected waste to the transport vehicle that will take it to the processing or final disposal site. The purpose of this system is to reduce dependency between the collection and transportation processes so that both can operate efficiently. At Markasan Market, waste transfer is conducted at the TPS by sanitation workers, either manually or mechanically. Waste from the stalls is transferred to the TPS using arm roll containers (±4 m³) or dump trucks (±6 m³).

   However, field observations indicate several challenges:

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1. Transfer from tossa to TPS is mostly done manually, causing prolonged contact between workers and waste, frequent overflow of waste from the container, and excessive compaction.
2. At TPS facilities made of concrete structures, the transfer process is also performed manually and requires a long time, resulting in a large amount of scattered waste.

A potential solution is the development of **a** ramp-type transfer depot, allowing tossa operators to unload waste directly into dump trucks in rotation, reducing time and increasing transport frequency. If this cannot yet be implemented, waste may first be transferred into sacks to speed up loading and unloading.

2. Waste Transportation Facilities

Waste transportation is a subsystem responsible for moving waste from the TPS or waste sources to the next processing stage efficiently.

1. Manual Method, In the manual method, loading waste into transport containers is performed by collection workers. Their tasks include:
   1. Transferring waste from collection carts or waste bins (TPS) into truck containers.
   2. Transferring waste from roadside bins into transport vehicles.
2. Mechanical Method, In this method, container loading onto the arm roll truck is done mechanically (load–haul). The operational steps using an arm roll system include:
   1. Parking maneuver to place the empty container;
   2. Lowering the container onto the ground/platform;
   3. Maneuvering toward the full container;
   4. Lifting the full container onto the truck.
   5. Exiting the transfer location to proceed with transportation operations.

Based on questionnaire results, 55.9% (33 respondents) stated that the waste collection service schedule is running well, conducted twice a day: in the morning at 06:00 WIB and in the afternoon at 17:00 WIB. Waste transportation at Markasan Market is carried out using arm roll trucks and dump trucks. The task of the transport fleet is to collect waste from its sources following predetermined routes and schedules, and to transport it to the TPA (Final Disposal Site). Transportation is carried out according to the following operational hours::

1. Morning Shift:
   1. Monday – Thursday : 06.00 – 12.00 WIB
   2. Friday : 06.00 – 12.00 WIB
   3. Saturday – Sunday : 06.00 – 12.00 WIB
1. Afternoon Shift:
   1. Monday – Thursday : 13.00 – 16.00 WIB
   2. Friday : 13.00 – 16.00 WIB
   3. Saturday – Sunday : 13.00 – 16.00 WIB

Current Issues in Waste Transportation, at present, a major challenge is the limited number of waste transportation vehicles, which is not proportional to the volume of waste generated. This shortage leads to waste accumulation at TPS facilities and inside

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containers, causing odors and reducing the aesthetic quality of the area. Factors affecting the performance of waste transportation operations include:

1. The distance between the final collection point and the TPA;
2. The type and physical condition of transport vehicles;
3. Road conditions, including traffic density and road quality.

Based on available data, the average transport frequency is: 2–3 trips/unit/day for arm roll trucks, and 1 trip/unit/day for dump trucks, with a maximum total transport capacity of 58 m³/day. Currently, the transported waste volume has already reached 58 m³/day, meaning it is at maximum capacity. If waste volume increases beyond this limit, overflow and environmental pollution around the TPS are likely to occur.

3. Waste Processing Facilities

Waste processing facilities at Markasan Market are not yet available at the neighborhood scale, and the implementation of the 3R (Reduce, Reuse, Recycle) approach is still suboptimal. Waste reduction mainly depends on the activities of scavengers and collectors (approximately 4 collectors and 12 scavengers), contributing to a reduction of about 14.14 m³/day.

The lack of facilities results in a high volume of organic waste from market activities, and current management still faces multiple challenges. Therefore, more effective solutions are urgently needed.

Table 3. Constraints, Impacts, and Solutions for Organic Waste Processing Facilities at Markasan Market

No	Constraint	Impact	Solution
1	Limited infrastructure (no composter, biogas unit, or BSF)	Waste piles accumulate and are directly disposed of at the landfill	Provision of processing facilities: aerobic composters, BSF units, and market-scale biogas digesters
2	Minimal source separation (traders mix organic & inorganic waste)	Waste becomes difficult to process, increasing residual volume sent to the landfill	Provision of segregated waste bins for each market block + incentives for compliant traders
3	Limited transportation capacity	Waste accumulates in the market, causing odors and discomfort	Additional transport fleets specifically for organic waste & integration with 3R TPS
4	Lack of awareness and education among traders/visitors	Market environment becomes unhygienic, increasing health risks	Training for traders & staff, public awareness on the economic value of organic waste
5	Limited regional government budget	Circular economy potential is lost, organic waste value remains untapped	Collaborative funding: CSR, village/ward funds, partnerships with universities/NGOs
6	Absence of strict regulations in the market	Traders' behavior does not change, waste remains mixed	Establishment of market regulations requiring waste sorting + monitoring and sanctions

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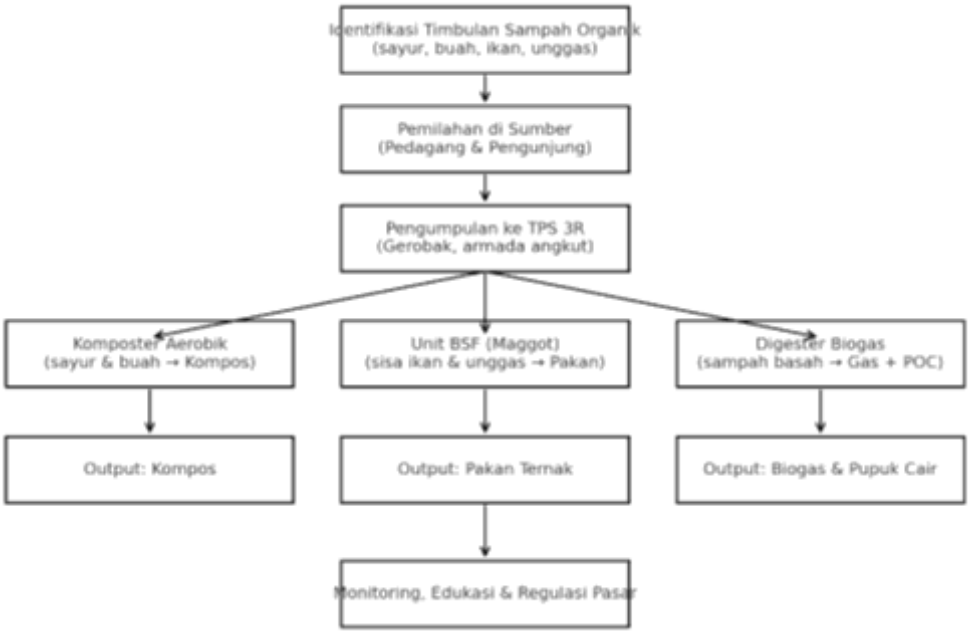

Figure 5. Flowchart of Organic Waste Processing Facility Provision at the Market

The flowchart in Figure 5 illustrates the process of providing organic waste processing facilities in the market, starting from identifying waste generation, source separation, and collection to the 3R TPS. Organic waste is then processed through three main pathways: aerobic composters producing compost, Black Soldier Fly (BSF) units producing animal feed, and biogas digesters producing energy and liquid fertilizer. The entire process is supported by monitoring systems, education programs, and market regulations to ensure sustainable, efficient, and economically valuable organic waste management.

Role of Market Traders

1. Provision of Waste Containers
   Traders at Markasan Market have implemented individual waste containment, but they have not practiced waste separation according to SNI standards (organic, inorganic, hazardous waste). A total of 58.2% of respondents stated that segregated waste bins are needed. The containers used are generally baskets, sacks, or plastic bags (36.2%), yet waste remains mixed, and some traders do not provide containers at all.
2. Maintaining Environmental Cleanliness
   Traders maintain cleanliness by sweeping and placing waste in the available containers, as well as paying cleanliness fees. However, 48.28% of traders only clean their stalls after finishing their sales activities, while others rely solely on sanitation workers because they feel they have already paid the fee.
3. Minimizing Waste
   Traders attempt to reduce waste by sorting leftover products that can still be utilized, such as giving them to the community or livestock farmers (29.3%), reducing the use of single-use packaging, and reusing crates or sacks as containers.
4. Paying Cleanliness Retribution Fees

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Traders are required to pay retribution fees to support the market's cleanliness operations. About 37.93% are willing to pay for the improvement of waste management services. However, implementation faces challenges because some traders feel the services are not optimal, segregated facilities are lacking, and there is minimal transparency regarding fund usage. Socialization, facility improvement, and transparency are needed to ensure that retribution effectively supports market cleanliness.

Further details can be seen in Table 4: Roles, Constraints, and Solutions for Providing Organic Waste Management Facilities at Markasan Market.

Table 4. The Role of Traders, Obstacles and Solutions for Providing Organic Waste Facilities at Markasan Market

No.	Traders' Role	Constraints	Solutions
1	Providing waste containers at each stall	Waste containers are makeshift (boxes, sacks, used plastic containers) and not separated	Provision of standardized and segregated waste bins in every block/stall
2	Sorting organic and inorganic waste	Low awareness of sorting waste from the source	Continuous socialization and education on the importance of waste segregation
3	Maintaining stall cleanliness by sweeping and tidying up	Assumption that cleanliness is solely the responsibility of market cleaning staff	Implementation of incentives and sanctions for traders related to market cleanliness
4	Paying cleanliness fees/retribution	Limited waste management facilities (composters, BSF units, TPS 3R not yet available)	Collaboration with communities/NGOs for organic waste processing
5	Reusing leftover goods (sold cheaply, given away, used as animal feed)	Limited time for traders to manage leftover goods	Regular assistance and transparency in managing cleanliness retribution

Cleanliness Regulations

Market regulations govern the obligations of traders and market administrators to ensure that the market remains orderly, clean, and comfortable. Traders are required to maintain the cleanliness of their stalls, provide waste containers, dispose of waste properly, and pay cleanliness fees. Meanwhile, market administrators are responsible for providing sanitation facilities and carrying out monitoring activities. These rules align with the Ministry of Health Regulation (Permenkes) No. 17 of 2020 on Healthy Markets, which mandates all business operators to keep their environment clean. Sanctions such as temporary suspension of selling activities may be imposed if traders violate these rules. However, some traders are not aware of these cleanliness regulations and assume that paying

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cleanliness fees is sufficient, thereby placing the full responsibility for cleanliness on market staff.

The regional legal basis, namely Melawi Regency Regional Regulation (Perda) No. 13 of 2017, requires every trader to clean any waste generated from their selling activities. Nevertheless, enforcement of these regulations in Markasan Market has not been optimal, and sanctions have not been firmly implemented. Based on the questionnaire, 39.6% of respondents agreed that sanctions could reduce the habit of littering. Sanctions and warnings are necessary not only as punishment, but also as an educational tool to encourage better discipline among traders and ensure that market cleanliness is maintained sustainably.

Evaluation of Waste Management in Markasan Market

The evaluation of waste management was conducted based on interviews and direct observations of existing conditions, focusing on several variables: traders' knowledge, traders' roles, waste management efforts, availability of waste management facilities, and market cleanliness regulations. A SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) was applied to assess the actual condition of organic waste management in Markasan Market by considering both internal and external factors that influence the system.

From the perspective of Strengths, the market already has sanitation workers who regularly carry out waste collection and transportation. In addition, some traders show awareness by providing waste containers, although they remain inadequate, and the cleanliness retribution system is already functioning as a basic funding source. These elements serve as an initial foundation for improving waste management efforts.

However, several significant Weaknesses persist. Sanitation facilities remain very limited, with only one temporary disposal site (TPS) that lacks a waste segregation system. Traders' waste containers do not meet the required standards, and their awareness remains low most do not separate waste and continue to dispose of waste indiscriminately, often justifying their behavior by claiming they have already paid the retribution fee. Furthermore, waste management is still focused solely on transporting waste to the landfill (TPA), with little to no implementation of the 3R principles (Reduce, Reuse, Recycle).

Externally, Markasan Market has substantial Opportunities. Approximately 80% of the waste generated is organic, which presents strong potential for processing into compost, maggot feed, or biogas. National and regional regulations such as the Ministry of Health Regulation (Permenkes) No. 17 of 2020 on Healthy Markets and Law No. 18 of 2008 on Waste Management—provide a solid legal framework. There are also opportunities for collaboration with universities, environmental communities, and CSR programs to support innovation in waste management. The reuse of unsold goods can also contribute to the development of a circular economy.

Nevertheless, several Threats may hinder program success. Resistance from traders remains relatively high, as many believe that paying the retribution fee fully absolves them from waste management responsibilities. The local government faces budget constraints for providing adequate facilities, while environmental and health risks from accumulated waste

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remain significant. Inconsistent supervision and weak enforcement of market regulations further exacerbate the situation.

Based on this assessment and the SWOT matrix strategy for Markasan Market, it is evident that waste management can be improved beyond simple transportation activities, progressing toward a more sustainable, environmentally friendly system that generates added value for the community.

Table 5. SWOT Matrix for Evaluating Waste Management at Markasan Market

Internal / External Factors	Opportunities	Threats
Strengths	SO Strategies 1. Utilizing 80% of organic waste for composting, maggot cultivation, and biogas processing with support from sanitation workers. 2. Optimizing cleanliness retribution funds as initial capital for circular economy programs. 3. Establishing collaboration with universities for research and training.	ST Strategies 4. Leveraging the role of sanitation workers to reduce environmental pollution risks. 5. Ensuring transparency in the use of retribution funds to reduce resistance from vendors. 6. Setting a routine supervision schedule to maintain consistent monitoring.
Weaknesses	WO Strategies 7. Increasing vendor awareness through education and outreach. 8. Addressing infrastructure limitations through regulatory support and CSR initiatives. 9. Developing a 3R Waste Processing Facility (TPS 3R) through multi-stakeholder collaboration.	WT Strategies 10. Enforcing strict sanctions for vendors who violate cleanliness regulations. 11. Gradually addressing infrastructure limitations to reduce dependency on the landfill (TPA). 12. Conducting regular outreach to improve vendor discipline and minimize pollution risks.

CONCLUSION

The findings indicate that waste management at Markasan Market remains suboptimal due to limited facilities, low trader awareness, and the absence of consistent regulatory enforcement, despite the fact that more than 80% of the waste generated is organic and highly suitable for various processing methods. These results highlight that the current system is still centered on transporting waste to the landfill without sufficient efforts toward reduction or utilization, leaving the potential for more sustainable management largely untapped. This study recommends improving waste separation facilities, providing on-site

organic waste processing units, strengthening trader education, and gradually enforcing market regulations to support long-term behavioral change. Future research is needed to assess the technical and economic feasibility of applying organic waste treatment technologies such as composting, Black Soldier Fly cultivation, and biogas digesters at market scale, as well as to explore effective multi-stakeholder collaboration models that can enhance the sustainability of waste management in Markasan Market.

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