

FOOD WASTE GOVERNANCE AND CIRCULAR ECONOMY AS A PUBLIC VALUE MANAGEMENT MODEL FOR FOOD SECURITY, CULINARY MSME EFFICIENCY, AND URBAN SUSTAINABILITY

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ABSTRACT

Food waste has become a critical issue in urban food systems because it is not only related to environmental burden, but also to operational inefficiency, food cost leakage, weak demand planning, and the loss of potential public value. Globally, food waste at the retail, food service, and household levels reached approximately 1.05 billion tonnes in 2022, while Indonesia faces significant food loss and waste that creates economic, environmental, and food security consequences. Culinary Micro, Small, and Medium Enterprises (MSMEs), restaurants, catering businesses, hotels, markets, and food service providers often generate food waste from damaged stock, overproduction, unsold food, consumer leftovers, and unmanaged organic waste. This article aims to formulate a public value management model for food waste governance and circular economy to strengthen food security, culinary MSME efficiency, and urban sustainability. This study employs a conceptual qualitative approach through narrative literature review, policy document analysis, and contextual synthesis of food waste practices in culinary MSMEs and urban food service ecosystems. The findings indicate that food waste should not be treated merely as a waste management problem, but as a managerial issue involving stock control, demand forecasting, portion standardization, food cost monitoring, surplus food redistribution, and circular waste processing. This article proposes an integrative model based on seven pillars: food waste literacy, operational waste control, digital food waste monitoring, surplus food redistribution, circular waste processing, food cost efficiency, and urban public value. The contribution of this article lies in positioning food waste governance as a strategic management approach that connects culinary MSME efficiency, food security, social redistribution, circular economy, and sustainable urban governance.

Keywords: Circular Economy, Culinary MSME Efficiency, Food Security, Food Waste Governance, Urban Sustainability

1. INTRODUCTION

Food waste has become one of the most urgent issues in contemporary urban food systems. It is no longer sufficient to view food waste merely as discarded food or organic waste.

Food waste reflects weaknesses in planning, production, inventory control, distribution, consumption behavior, cost efficiency, and governance. In urban areas, food waste can originate from households, restaurants, culinary MSMEs, catering businesses, hotels, markets, supermarkets, food events, and institutional food services. When food is wasted, the loss is not only physical waste, but also economic value, labor, energy, water, land use, logistics costs, and potential nutrition that could have supported food security.

The global scale of food waste is significant. The UNEP Food Waste Index Report 2024 estimates that 1.05 billion tonnes of food waste were generated in 2022 at the retail, food service, and household levels. This represents approximately 19% of food available to consumers, with households contributing 631 million tonnes, food service 290 million tonnes, and retail 131 million tonnes. UNEP also highlights that this is equivalent to more than one billion meals wasted every day globally.

In Indonesia, food loss and waste also represent a major national problem. The national study by Bappenas estimates that Indonesia generated approximately 23–48 million tonnes of food loss and waste annually during 2000–2019, equivalent to 115–184 kg per capita per year. The economic loss is estimated at Rp213–551 trillion per year, equivalent to around 4–5% of Indonesia's GDP. The same estimate suggests that if the lost and wasted food could be recovered, it could potentially support the food needs of 61–125 million people, or approximately 29–47% of Indonesia's population.

These figures show that food waste is not only an environmental problem, but also a food security, economic efficiency, and public value problem. For culinary MSMEs, food waste directly affects business efficiency because wasted ingredients and unsold products represent hidden financial losses. Damaged stock, overproduction, excessive portioning, poor demand forecasting, and unmanaged leftovers may increase food costs and reduce profitability. Therefore, culinary MSMEs need food waste governance not only to support environmental sustainability, but also to improve operational efficiency and business resilience.

Recent studies have increasingly connected food waste with circular economy. Circular practices in the hospitality sector are seen as pathways to prevent waste, preserve resources, and support SDG 12.3, which aims to halve food waste by 2030. Studies on restaurants and hospitality also emphasize that food waste management should be integrated into operational processes, staff training, kitchen guidelines, measurement systems, and circular economy practices such as donation, composting, animal feed, and waste conversion.

In the Indonesian culinary MSME context, food waste management remains highly relevant because MSMEs play an important role in employment, local economic activity, and urban food service ecosystems. However, many culinary MSMEs still lack systematic stock control, food cost monitoring, digital recording, waste measurement, surplus food redistribution, and circular waste processing. This creates an opportunity to develop a management model that integrates operational control, financial efficiency, circular economy, digital monitoring, and public value.

The novelty of this article lies in formulating food waste governance as a public value management model. Unlike previous studies that tend to discuss food waste as an environmental

issue, consumer behavior issue, or waste management practice, this article positions food waste as a managerial, financial, social, and public governance problem. This article integrates food waste literacy, operational waste control, digital food waste monitoring, surplus food redistribution, circular waste processing, food cost efficiency, and urban public value into one conceptual model.

The research question of this article is: How can food waste governance and circular economy be formulated as a public value management model to strengthen food security, culinary MSME efficiency, and urban sustainability?

The objective of this study is to formulate a conceptual model of food waste governance that can help culinary MSMEs, local governments, food service providers, communities, and urban stakeholders reduce food waste, improve cost efficiency, redistribute surplus food, process organic waste through circular economy mechanisms, and create public value for sustainable cities.

Figure 1. Research Framework



Source: Author's elaboration, 2026.

2. LITERATURE REVIEW

2.1 Food Waste as a Management and Public Value Problem

Food waste refers to food intended for human consumption that is discarded, lost, or left unused at various stages of the food system. In urban food service settings, food waste may appear in the form of raw material damage, kitchen waste, preparation waste, unsold food, plate waste, and organic waste. Although often treated as an environmental issue, food waste is closely related to management failures in planning, inventory control, production scheduling, portioning, and cost monitoring.

From a public value perspective, food waste represents a loss of potential social benefit. Food that is still edible but not redistributed becomes a missed opportunity to support vulnerable groups, food banks, social communities, and urban food security. Food that is no longer edible but not processed through circular economy mechanisms becomes an additional burden for municipal waste systems and landfills.

Therefore, food waste governance should be understood as a management approach that connects business efficiency, environmental responsibility, social redistribution, and public value creation. This approach is particularly relevant for culinary MSMEs because small businesses often operate with limited resources, narrow margins, and weak financial recording systems.

2.2 Circular Economy in Food Waste Management

Circular economy emphasizes reducing resource use, extending product value, recovering materials, and converting waste into productive resources. In the food sector, circular economy can be implemented through waste prevention, surplus food redistribution, composting, animal feed, biogas, black soldier fly processing, and used cooking oil recycling.

Research on circular practices in hospitality shows that circular economy can help mitigate food waste by preventing waste, preserving resources, and encouraging regenerative practices. Cardenas et al. (2024) identify circular practices as an important pathway for food waste reduction in the hospitality sector, especially because restaurants and food services are major contributors to food waste.

In Indonesia, circular economy is increasingly linked to food and beverage industries. The ILO report on circular economy in the food and beverage industry explains that circular economy reduces material use and resource intensity while recapturing waste as a production input. This supports the argument that food waste should be transformed from a disposal problem into a resource management opportunity.

2.3 Culinary MSME Efficiency and Food Cost Control

For culinary MSMEs, food waste directly affects business efficiency. Ingredients that are overpurchased, improperly stored, damaged, or not converted into sales represent financial losses. Similarly, unsold food, excessive production, and uncontrolled portions increase operational costs.

Food cost control is therefore a critical managerial instrument. Food waste must be recorded not only in kilograms or portions, but also in monetary value. By translating waste into cost, culinary MSMEs can understand that waste is not only an environmental issue, but also a profit leakage. This perspective helps business actors make better decisions on purchasing, storage, production volume, pricing, and menu design.

Studies on culinary MSMEs and sustainable supply chains indicate that sustainability practices can support firm performance when they are integrated with operational and economic considerations. This reinforces the need to connect food waste reduction with MSME competitiveness, cost efficiency, and business sustainability.

2.4 Digital Monitoring and Technology for Food Waste Reduction

Food waste cannot be governed if it is not measured. Digital monitoring allows food businesses to record the type, quantity, cause, and cost of waste. In the hospitality industry, technology-driven food waste management may include real-time inventory management, smart kitchen systems, waste tracking, predictive analytics, and food waste conversion tools.

Studies on technology in hospitality food waste management highlight the role of digital tools in reducing waste, lowering operational costs, and improving sustainability efforts. Recent developments also show the use of AI-based tools, smart scales, cameras, and predictive analytics to monitor, categorize, and reduce food waste in hotels and restaurants.

In the context of culinary MSMEs, digital monitoring does not need to be complex. It can begin with simple digital logbooks, daily waste recording, surplus food reporting, stock expiration tracking, and financial loss estimation. The main purpose is to transform invisible waste into measurable managerial information.

2.5 Surplus Food Redistribution and Social Value

Not all food waste should become waste. Some surplus food remains safe and edible but is not sold or consumed due to overproduction, event leftovers, or demand mismatch. Surplus food redistribution can transform edible surplus into social value by supporting vulnerable citizens, food banks, orphanages, shelters, pesantren, and community kitchens.

However, redistribution requires governance. It must be supported by food safety standards, packaging procedures, time limits, traceability, recipient records, and accountability mechanisms. Without governance, redistribution may create food safety risks. Therefore, surplus food redistribution should be positioned as part of food waste governance, not merely charity.

The food rescue approach in Indonesia emphasizes the importance of collaboration among government, business actors, civil society organizations, and communities to reduce food waste and support food security.

2.6 Urban Sustainability and Public Value Governance

Food waste affects cities through landfill pressure, greenhouse gas emissions, waste transportation costs, and environmental degradation. At the same time, urban food waste

reduction can contribute to food security, MSME efficiency, social solidarity, and sustainable city governance.

Public value governance emphasizes that public problems should be addressed not only through technical solutions, but through collaborative systems that generate social benefits. In food waste governance, public value is created when businesses reduce losses, communities receive edible surplus, organic waste is processed into productive resources, and cities reduce environmental burdens.

Thus, food waste governance requires multi-actor collaboration involving culinary MSMEs, restaurants, hotels, markets, local governments, waste processors, food banks, universities, communities, and digital platform providers.

2.7 Research Gap and Novelty Position

Existing studies have discussed food waste, circular economy, hospitality waste management, restaurant food waste, digital technology, and sustainability practices. However, several gaps remain. First, many food waste studies focus on environmental or consumer behavior perspectives, while the managerial and financial dimensions of culinary MSMEs are less emphasized. Second, circular economy practices are often discussed as waste processing solutions, but not fully integrated with food cost efficiency, surplus redistribution, and public value creation. Third, digital monitoring is often discussed in hospitality or large business contexts, while simple digital food waste monitoring for culinary MSMEs remains underdeveloped. Fourth, food waste governance is rarely positioned as a public value management model that connects business efficiency, food security, circular economy, and urban sustainability.

Therefore, this article fills the gap by proposing an integrative model of food waste governance and circular economy as a public value management model for culinary MSMEs and urban food systems.

Table 1. Literature Mapping and Article Position

Research Area	Common Focus in Literature	Research Gap	Position of This Article
Food waste studies	Waste volume, household behavior, environmental impact	Managerial and financial aspects of culinary MSMEs are less emphasized	Positions food waste as a management and cost efficiency issue
Circular economy	Composting, recycling, organic waste processing	Not always connected to food security and MSME efficiency	Integrates circular economy with public value management
Hospitality food waste	Restaurants, hotels, kitchen waste, service operations	Often focused on formal hospitality businesses	Extends discussion to culinary MSMEs and urban food ecosystems
Digital food waste monitoring	Smart technology, AI, tracking systems	MSME-level simple monitoring remains underdeveloped	Proposes digital monitoring as a practical governance tool
Surplus food redistribution	Food rescue and donation	Requires stronger accountability and food safety governance	Positions redistribution as a public value mechanism

Research Area	Common Focus in Literature	Research Gap	Position of This Article
Urban sustainability	Waste reduction and environmental burden	Often separated from MSME financial efficiency	Connects food waste reduction with city sustainability and MSME performance

Source: Author's elaboration, 2026.

3. METHODS

This study employs a conceptual qualitative approach using narrative literature review, policy document analysis, and public value management model synthesis. This approach is selected because the article aims to formulate a conceptual model of food waste governance rather than to test statistical relationships among variables.

The data sources consist of three categories. First, recent academic literature published within the last five years on food waste, circular economy, hospitality food waste management, digital monitoring, sustainable supply chains, and culinary MSMEs. Second, institutional and policy documents from UNEP, Bappenas, GAIN, ILO, and related organizations discussing food loss and waste, circular economy, and urban sustainability. Third, contextual synthesis of food waste practices in culinary MSMEs, restaurants, catering businesses, hotels, markets, and urban food service ecosystems.

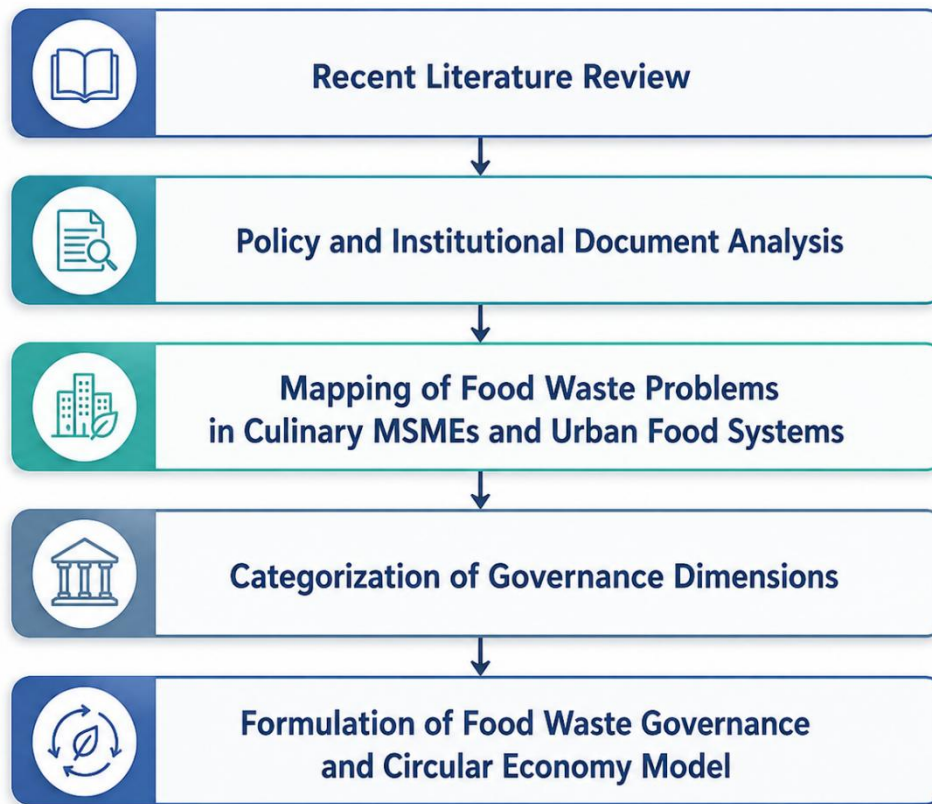
The analysis was conducted through four stages. First, identifying food waste problems in urban food service systems and culinary MSMEs. Second, mapping recent literature on food waste governance, circular economy, digital monitoring, and public value. Third, categorizing the issues into operational, financial, technological, social, and environmental dimensions. Fourth, synthesizing a conceptual model of food waste governance and circular economy as a public value management model.

Table 2. Research Analysis Stages

Stage	Analytical Activity	Expected Output
Issue identification	Identifying food waste problems in urban food systems and culinary MSMEs	Food waste problem map
Literature review	Reviewing food waste, circular economy, digital monitoring, and MSME efficiency studies	Conceptual foundation
Issue categorization	Grouping issues into operational, financial, technological, social, and environmental dimensions	Analytical framework
Model synthesis	Formulating a public value management model for food waste governance	Conceptual model

Source: Author's elaboration, 2026.

Figure 2. Conceptual Research Method Flow



Source: Author's elaboration, 2026.

4. RESULTS AND DISCUSSION

4.1 Food Waste as Hidden Cost in Culinary MSMEs

Food waste in culinary MSMEs is often invisible because it is not systematically recorded. Many businesses dispose of damaged ingredients, unsold food, and leftovers without calculating their financial value. As a result, food waste is treated as a normal operational consequence rather than a measurable cost leakage.

This study argues that food waste should be understood as hidden cost. When food waste is converted into monetary value, business actors can see how much capital is lost through poor stock control, inaccurate demand prediction, excessive portioning, or weak production planning. Therefore, food waste governance begins with awareness and measurement.

4.2 Operational Waste Control as the First Governance Layer

Operational waste control is the first layer of food waste governance. It includes demand forecasting, stock control, portion standardization, storage management, menu planning, and production scheduling. For culinary MSMEs, these practices can be implemented through simple tools such as daily sales records, stock cards, expiration lists, purchase planning, and portion standards.

Without operational control, circular economy efforts may only address waste after it has already been created. Therefore, prevention must be prioritized before redistribution or processing. The circular economy hierarchy should begin with reducing waste at the source, followed by redistribution of edible surplus and processing of inedible waste.

4.3 Digital Food Waste Monitoring

Digital monitoring is essential because food waste cannot be managed if it is not measured. Culinary MSMEs need simple systems to record food waste by type, quantity, cause, and estimated cost. This can be done through spreadsheet-based waste logbooks, point-of-sale integration, mobile forms, or digital dashboards.

Digital monitoring also helps classify waste into several categories: damaged raw materials, preparation waste, overproduction, unsold food, consumer leftovers, and organic waste. Each category requires a different management response. For example, damaged raw materials require better storage and purchasing control; overproduction requires demand forecasting; unsold food requires redistribution mechanisms; and organic waste requires circular processing.

Table 3. Food Waste Categories and Management Responses

Food Waste Category	Main Cause	Management Response
Damaged raw materials	Poor storage, overpurchasing, slow turnover	Stock control and storage SOP
Preparation waste	Inefficient cutting, poor kitchen skills	Staff training and preparation standards
Overproduction	Weak demand forecasting	Sales data analysis and production planning
Unsold food	Demand mismatch, menu planning weakness	Surplus food redistribution
Consumer leftovers	Excessive portioning, poor preference fit	Portion standardization and menu evaluation
Organic waste	Inedible scraps and expired food	Composting, animal feed, BSF, or biogas

Source: Author's elaboration, 2026.

4.4 Surplus Food Redistribution as Public Value Creation

Surplus food redistribution transforms edible surplus into social value. Instead of being discarded, safe and edible food can be redirected to vulnerable groups, community kitchens, food banks, orphanages, pesantren, shelters, or social organizations. This mechanism links food waste governance with food security and social solidarity.

However, redistribution cannot be implemented without governance. Food safety, packaging, traceability, storage time, and recipient accountability must be managed. Therefore, surplus food redistribution should involve clear SOPs, distribution records, and partnerships with trusted social organizations.

4.5 Circular Waste Processing for Inedible Food Waste

Not all food waste can be redistributed. Inedible food waste should be redirected into circular economy pathways. These may include composting, animal feed, black soldier fly

processing, biogas, and used cooking oil recycling. In this way, food waste is transformed from a disposal burden into a productive resource.

For urban governments, circular waste processing can reduce landfill pressure and waste transportation costs. For MSMEs, it can create new collaboration opportunities with compost producers, livestock farmers, maggot cultivators, recycling businesses, and environmental communities.

4.6 Multi-Actor Governance in Food Waste Reduction

Food waste governance requires collaboration among multiple actors. Culinary MSMEs cannot solve food waste alone because redistribution, circular processing, regulation, education, and monitoring involve various stakeholders. Local governments can provide policy support, incentives, and waste infrastructure. Universities can support research, training, and mentoring. Food banks and communities can manage redistribution. Digital platforms can support waste monitoring and reporting. Waste processors can convert organic waste into productive resources.

Table 4. Multi-Actor Roles in Food Waste Governance

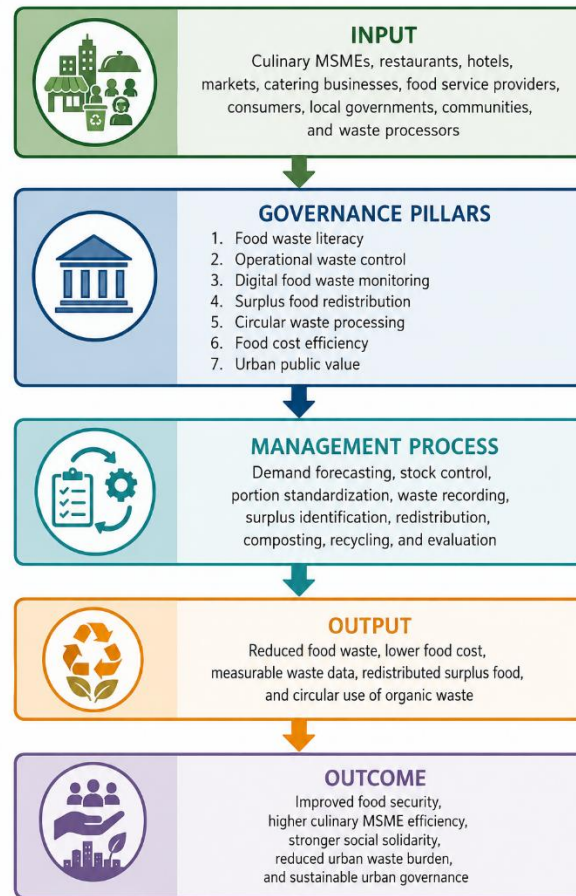
Actor	Main Role	Expected Contribution
Culinary MSMEs	Waste prevention, stock control, waste recording	Improved efficiency and reduced food cost
Local governments	Regulation, incentives, infrastructure, coordination	Stronger urban waste governance
Food banks and communities	Surplus food redistribution	Improved food security and social value
Universities	Research, training, mentoring	Knowledge transfer and capacity building
Digital platforms	Waste monitoring and reporting	Measurable and traceable waste data
Waste processors	Composting, animal feed, BSF, biogas	Circular economy implementation
Consumers	Responsible consumption and feedback	Reduced plate waste and behavioral change

Source: Author's elaboration, 2026.

4.7 Food Waste Governance and Circular Economy Model

Based on the analysis above, this article proposes an integrative model of food waste governance and circular economy as a public value management model. The model consists of seven pillars: food waste literacy, operational waste control, digital food waste monitoring, surplus food redistribution, circular waste processing, food cost efficiency, and urban public value.

Figure 3. Food Waste Governance and Circular Economy Model



Source: Author's elaboration, 2026.

4.8 Evaluation Indicators of the Model

To make the proposed model applicable, evaluation indicators are needed. These indicators can be used by culinary MSMEs, local governments, universities, and communities to assess the effectiveness of food waste governance.

Table 5. Evaluation Indicators of Food Waste Governance

Dimension	Evaluation Indicator	Purpose
Food waste literacy	Awareness of food waste impact among MSMEs and consumers	Strengthen behavioral change
Operational control	Stock records, portion standards, production planning	Prevent waste at the source
Digital monitoring	Waste type, quantity, cause, and cost records	Make food waste measurable
Financial efficiency	Estimated food cost loss and savings	Improve culinary MSME profitability

Dimension	Evaluation Indicator	Purpose
Surplus redistribution	Amount of edible surplus redistributed	Strengthen food security and social value
Circular processing	Amount of organic waste processed	Reduce landfill burden
Urban public value	Social benefit, reduced waste, and sustainability impact	Measure public value creation

Source: Author's elaboration, 2026.

5. CONCLUSION AND LIMITATION

Food waste governance and circular economy can be positioned as a public value management model for strengthening food security, culinary MSME efficiency, and urban sustainability. This article emphasizes that food waste is not merely an environmental issue, but also a managerial, financial, social, and governance problem. In culinary MSMEs and urban food service ecosystems, food waste reflects weaknesses in demand forecasting, stock control, production planning, portion standardization, waste recording, and cost monitoring. The proposed model integrates seven pillars: food waste literacy, operational waste control, digital food waste monitoring, surplus food redistribution, circular waste processing, food cost efficiency, and urban public value. This model contributes to management studies by connecting operational efficiency, financial control, circular economy, social redistribution, and sustainable urban governance. The limitation of this article lies in its conceptual nature because it has not yet empirically tested the model through field data. Future research should conduct surveys with culinary MSMEs, interviews with restaurant and catering managers, food waste audits, food cost analysis, digital monitoring trials, surplus redistribution case studies, and circular waste processing feasibility studies to test the effectiveness of the proposed model in real urban contexts.

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