Management Food Waste in Indonesia: A Review

Nadya Ul Haq Mahmud[1], *IDAA* Warmadewanthi[1*], *Arseto* Yekti Bagastyo[1], and *Dang* Vu Bich Hanh[2]

[1]Department of Environmental Engineering, Faculty of Civil Engineering and Planning, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia
[2]Department of Environmental Engineering, Faculty of Environment and Resources, Ho Chi Minh City University of Technology, Ho Chi Minh, Vietnam

Abstract. Food waste is a global problem of considerable magnitude, and in Indonesia, the households account for 80% of the 23–48 million tons of food waste produced per year, which is equal to 155–184 kg/person. One of the main aims of this study is to investigate the problem of food waste generation in Indonesia in depth, both with regard to its patterns and causes. It is also an objective of the study to assess food waste management practices critically, as well as to determine the potential influence of the "Makan Bergizi Gratis" program on future waste accumulation. The research applies a rigorous scientific methodology and brings together the official records of the National Waste Management Information System of the Indonesian Ministry of Environment and Forestry and national databases. The study discusses both direct and indirect factors that contribute to food loss and waste, including poor harvesting practices, ineffective supply chains, consumer behavior, and policy limitations. The paper aims to support the transition towards a sustainable food system through essential policy areas and real initiatives by offering a comprehensive overview of the food waste dynamics in Indonesia.

1. Introduction

Food waste is a significant global challenge, with around 1.3 billion tons of edible food being lost or discarded each year, which accounts for roughly one-third of all food produced for human consumption (Saliem et al., 2021). This phenomenon results in approximately 3.3 billion tons of carbon dioxide equivalent emissions, accounting for 8-10% of human-caused greenhouse gas emissions, and leads to significant environmental challenges, such as climate change, eutrophication, water scarcity, and excessive land use (Zulkifli et al., 2025). From an economic perspective, it leads to annual losses surpassing one trillion US dollars. Socially, it worsens food insecurity for approximately 828 million individuals globally, directly opposing Sustainable Development Goal 12.3, which seeks to reduce per capita global food waste at the retail and consumer stages by half by the year 2030 (Martianto et al., 2024; Saliem et al., 2021).

In Indonesia, the issue of food waste is particularly severe, with households responsible for approximately 80% of the 23–48 million tons produced each year from 2000 to 2019. This amounts to 115–184 kilograms per person annually, placing the country second worldwide with 300 kilograms per capita, as reported by the Economist Intelligence Unit (Saliem et al., 2021; Cahyana et al., 2024). Recent data from the Sistem Informasi Pengelolaan Sampah Nasional (SIPSN; National Waste Management Information System) indicate that food waste comprised 41.7% of total solid waste in 2023, while organic waste, largely

* Corresponding author: warma@its.ac.id

food-related, constitutes 40–62.95% of municipal solid waste. In Depok City in 2021, food waste formed 62.95% of 310,443 tons generated from a population of 2.085 million (Waluyo & Kharisma, 2023; Zulkifli et al., 2025). These figures underscore households as the primary source, followed by food services and retail, with edible portions reaching 44% (Saliem et al., 2021).

Studying the patterns and causes of food waste in Indonesia is essential for devising effective interventions, as inefficiencies span the supply chain from poor harvesting and inadequate storage to consumer behaviors like over-portioning and policy shortcomings (Cahyana et al., 2024). Amid rapid urbanization and population growth exceeding 260 million, such analyses bridge data gaps in SIPSN reporting, align with national targets like Presidential Regulation Number 97 of 2017 for 30% waste reduction by 2025, and support circular economy transitions to mitigate environmental, economic, and social impacts (Zulkifli et al., 2025).

This review paper aims to comprehensively investigate food waste generation patterns, causes, current management practices, and the potential impacts of the "Makan Bergizi Gratis" program on waste accumulation in Indonesia, drawing from SIPSN records, national databases, and peer-reviewed international and national journals up to 2025. The scope focuses on quantitative data across supply chain stages, challenges, and sustainable strategies to inform evidence-based policies for a resilient food system.

2. Food Waste in Indonesia

Food waste in Indonesia predominantly arises at the downstream stages of the food supply chain, encompassing retail, food services, and particularly households, where it is characterized by the discard of safe and edible food portions resulting from behavioral decisions such as overbuying, excess cooking, inadequate storage, aesthetic rejections, and plate leftovers (Martianto et al., 2024). According to Food and Agriculture Organization (FAO) guidelines, this contrasts sharply with upstream food losses by emphasizing intentional human actions influenced by urbanization, rising disposable incomes, and cultural practices that promote prestige-driven overconsumption, with households globally responsible for 61% of total food waste and similarly dominating at 80% in Indonesia (Martianto et al., 2024). Indonesia's per capita food waste ranks it second globally at 115-300 kg/year, equivalent to 5-19 million tons annually from households alone between 2000-2019, rising from 39% to 55% of overall waste with a trend underscoring the urgency of SDG 12.3 to halve retail and consumer-level waste by 2030 through targeted education, planning, and nudges (Saliem et al., 2021; Martianto et al., 2024).

2.1 Key Food Waste Statistics in Indonesia

Indonesia faces a food waste problem of considerable magnitude, contributing significantly to global environmental concerns. Annually, 23–48 million tons of food waste are produced in the country, with households contributing a substantial 80% of this total, equating to an average of 155–184 kg per person per year (Martianto et al., 2024; Saliem et al., 2021). This massive volume represents not only a loss of valuable resources but also a significant environmental burden, as food waste constitutes a large portion of Indonesia's overall waste stream. For instance, in 2021, Indonesia generated 30 million tons of waste, with 40% being organic food waste. In a broader context, food waste can constitute as much as 41% of the nation's overall waste, amounting to roughly 12.89 million tons each year as of 2022 (Audrey & Rukmini, 2024). Jakarta, the capital city, is expected to produce around 4,050 tons of food waste each day, accounting for roughly 54% of its overall daily waste (Bhaskara, 2023).

Table 1. Summary of food waste data in indonesia

Description	Value	Source
Annual Food Waste Production	20.9–48 million tons	Cahyana et al., 2024; Martianto et al., 2024
Household Contribution to Food Waste	80%	Martianto et al., 2024
Food Waste Per Capita Per Year	77–184 kg	Saliem et al., 2021; Cahyana et al., 2024
Food Waste as Percentage of Total Waste	41% (12.89 million tons in 2022)	Audrey & Rukmini, 2024
Daily Food Waste in Jakarta	4,050 tons (54% of total waste)	Bhaskara, 2023

Through direct empirical measurements, a comprehensive quantification was achieved, as demonstrated by a cross-sectional study involving 215 households in Bogor Regency. This study utilized waste compositional analysis and beverage diaries, uncovering that the average household generates 77 kg of food waste per person annually. Of this, 37.7% is edible, amounting to 29 kg, while 62.3% is inedible, totaling 48 kg (Martianto et al., 2024). Urban households produced significantly more at 79.4 kg/capita/year compared to 45.8 kg in rural areas, reflecting disparities driven by accessibility and lifestyles, while city-specific data highlight hotspots: Surabaya generates 0.37 million tons annually, and Depok's 2021 municipal solid waste of 310,443 tons included 62.95% food waste (~195,000 tons) (Martianto et al., 2024; Zulkifli et al., 2025). These figures align with national estimates placing households at 80% of consumption-stage waste (74 kg/capita globally benchmarked), positioning Indonesia among top producers and necessitating data-driven prevention amid stalled 30% waste reduction targets by 2025 (Martianto et al., 2024).

Table 2. Household Food Waste Quantities

Household Food Waste Quantities (kg/capita/year)	Urban	Rural	Total	Edible %
Edible Portion	-	-	29	37.7%
Inedible Portion	-	-	48	62.3%
Total Waste	79.4	45.8	77	-

3. Patterns and Causes of Food Waste in Indonesia

Indonesia is one of the leading nations contributing to the significant global problem of food waste. Data from the SIPSN indicates food waste comprises about 40.5% of Indonesia's total waste, exceeding 29 million tons yearly (Kusumawardani et al., 2023; Waluyo & Kharisma, 2023). This massive volume represents a substantial loss of resources and a major driver of environmental degradation. The decomposition of this organic material, especially in landfills, releases potent greenhouse gases like methane (25 times more powerful than CO_2), significantly contributing to climate change (Kusumawardani et al., 2023).

Food waste patterns in Indonesia are primarily driven by households and inefficiencies throughout the food supply chain. Rice/cereals and vegetables are major edible waste contributors, while fruits mainly contribute inedible waste from peels and spoilage (Martianto et al., 2024). In cities such as Jakarta and Depok, food waste makes up a significant portion of their municipal solid waste, highlighting the substantial environmental challenge it poses for urban waste management.(Bhaskara, 2023; Ulfah et al., 2023).

Table 3. Summary of Key Food Waste Quantities and Proportions (Martianto et al., 2024)

Description	Quantity/Proportion
National Total (annual estimate)	23–48 million tons
Per Capita/Year	155–184 kg
Household Contribution	80% of total

Factors amplifying environmental damage include consumer behavior and policy limitations. Household waste is significantly influenced by consumer behaviors such as purchasing more than needed, making impulsive buys, serving overly large portions, and storing items incorrectly (Kusumawardani et al., 2023; Cahyana et al., 2024). Low public awareness about food waste's environmental consequences further compounds the issue (Audrey & Rukmini, 2024). Existing policies, like Presidential Regulation No. 97/2017, often lack specific targets, clear measurement indicators, and robust monitoring to effectively reduce food waste's GHG contribution (Waluyo & Kharisma, 2023). This regulatory gap leads to suboptimal waste management, causing environmental problems like water and soil pollution from open dumping (Cahyana et al., 2024).

Current food waste management, predominantly landfilling, has the highest environmental impact. However, there is high potential for valorizing food waste into bioenergy via Black Soldier Fly larvae processing, composting, and biodigesters, significantly reducing its environmental footprint (Ulfah et al., 2023). Adopting circular economy strategies in the food industry can cut greenhouse gas emissions by as much as 30%, curb carbon output, and prevent land degradation. Critical assessment of practices, including programs like "Makan Bergizi Gratis," is essential to ensure food security initiatives also align with environmental sustainability.

4. The Role of the “Makan Bergizi Gratis (MBG)” Program in Food Waste Management

The "Makan Bergizi Gratis" program represents a significant Indonesian government initiative, having been officially launched in early 2025 with far-reaching goals for national welfare (Agustini & Mulyani, 2025). The program's primary objectives are multifaceted, specifically aiming to address prevalent nutritional deficiencies, enhance the overall quality of human resources across the nation, and ensure greater educational equity by consistently providing nutritious meals in schools. This comprehensive initiative strategically targets vulnerable demographics, including schoolchildren, toddlers, pregnant, and lactating mothers, underscoring its broad social and public health impact. Through these crucial provisions, the program endeavors to significantly improve the health outcomes of its beneficiaries, boost learning concentration among students, elevate academic achievement, and effectively reduce existing social disparities that hinder national progress (Qomarrullah et al., 2025).

A critical analysis of the "Makan Bergizi Gratis" program reveals a notable discrepancy between its commendable stated objectives and the tangible outcomes observed during its real-world implementation, particularly concerning its pervasive impact on food waste accumulation. The initial phases of MBG implementation have unfortunately introduced a new and pressing problem: a significant increase in food waste. This rise in waste is primarily attributed to the perceived low quality and, consequently, the poor acceptance of the provided meal menus by recipients, leading to a substantial portion of the food not being fully consumed. Such a scenario underscores a critical disconnect between the program's noble goals of enhancing food security and its practical execution, as evidenced

by persistent issues in food access, utilization, and stability within the target groups (Komara et al., 2025). Moreover, external factors such as the menu's suitability, the overall duration of the program, and the precise sizing of meal portions have been identified as crucial variables that significantly influence the ultimate amount of food waste.

The "Makan Bergizi Gratis" program, despite its positive intentions to improve nutrition, has regrettably not led to a reduction in food waste; instead, initial reports indicate an increase in discarded food. This counterintuitive outcome highlights a significant challenge for a program designed to enhance both nutrition and food security, suggesting that resources are not being utilized as effectively as intended (Komara et al., 2025). The phenomenon of increased waste generation underscores a critical area for program re-evaluation and adjustment, moving beyond mere provision to address the complexities of food consumption.

Several interconnected factors explain why the MBG program is currently contributing to food waste:

- **Low Quality and Poor Acceptance of Meals**: A primary reason for the increased food waste within the MBG program stems from the quality and palatability of the meals provided to students. If the food offered is not appealing or does not meet the taste preferences of the children, they are significantly less likely to consume it, leading directly to higher plate waste (Komara et al., 2025). Studies on school meal services emphasize that the sensory attributes of food, particularly taste and texture, play a crucial role in meal acceptance and directly influence the amount of food wasted. Enhancing food service management practices, such as careful menu planning, sourcing, preparation, and cooking, is seen as an effective approach to increase acceptance and minimize waste (Setyaningtyas et al., 2022).
- **Implementation and Operational Challenges**: Operational shortcomings and structural issues within the program's implementation significantly contribute to the accumulation of food waste. These challenges can encompass inconsistencies in how nutritional standards are met, uneven distribution of meals, and inadequate coordination among various stakeholders involved in the program's delivery (Agustini & Mulyani, 2025). Such logistical deficiencies can result in meals being unsuitable or unavailable when needed, further increasing the likelihood of food being wasted. Historically, school feeding programs in Indonesia have faced similar difficulties with resource allocation, diverse geographical needs, and management issues, which can lead to limited program coverage and overall ineffectiveness (Rimbawan et al., 2023).

5. Challenges and Obstacles in Food Waste Management in Indonesia

Indonesia faces significant challenges in managing food waste, stemming from technical, social, and policy constraints. A major technical hurdle is the inadequate waste management infrastructure, with limited recycling efforts often hampered by a lack of public knowledge and underutilized advanced technologies like anaerobic digestion for energy generation (Handayati & Widyanata, 2024). Socially, there is slow adoption of waste management practices by the public, with participation often discontinuing without consistent support, alongside a general lack of public understanding regarding effective food waste handling (Bhaskara, 2023; Handayati & Widyanata, 2024). From a policy perspective, existing regulations, such as Presidential Regulation 97/2017, are often

insufficient to meet ambitious reduction targets, lacking specific metrics for measurement, monitoring, and evaluation, and offering no clear roadmap for reducing household food waste (Ulfah et al., 2023).

Furthermore, limitations in data collection and information systems pose significant obstacles to effective management. Waste generation data is often incomplete, primarily focusing on food leftovers and excluding other organic forms, which skews the overall picture. The National Waste Management Information System struggles with inconsistent reporting from various districts and cities, making comprehensive analysis difficult (Kusumawardani et al., 2023). Critically, the specific amounts of urban food waste from different sources (food services, markets, households and retail) remain unknown because data are often combined, hindering precise targeting of interventions (Cahyana et al., 2024). These data gaps prevent a thorough understanding of food waste dynamics and impede the development of evidence-based policies.

Implementation of food waste management programs also encounters various barriers. The government alone cannot effectively manage all waste responsibilities due to infrastructure deficits and logistical complexities (Handayati & Widyanata, 2024). There are also challenges in scaling and commercializing food waste valorization initiatives, such as converting waste into bioenergy, due to issues with technological feasibility and integrating supply chains. Without robust infrastructure and clear logistical pathways, even well-intentioned programs struggle to achieve their full potential, leading to inefficiencies and continued waste accumulation.

6. Recommendations and Strategies for Sustainable Food Waste Management

To foster sustainable food waste management in Indonesia, a multi-pronged approach involving robust policies, practical initiatives, and active stakeholder engagement is essential. Policy recommendations include formulating a national strategy with clear targets for food loss and waste reduction, complemented by a national data system to track progress accurately (Saliem et al., 2021). Adopting circular economy principles, as successfully implemented in other nations, can provide a comprehensive framework for addressing waste and promoting sustainability (Waluyo & Kharisma, 2023). Specific policies should also target household food waste reduction through awareness campaigns, behavioral change initiatives, and guidance on both preventive measures and waste management techniques (Martianto et al., 2024).

The active participation of various stakeholders is paramount for successful food waste management. The government should lead by implementing comprehensive education programs, improving solid waste services, and developing clear guidelines for all actors involved (Cahyana et al., 2024). They must also be responsive, adaptive, and committed to transparent and participatory teamwork. The community is urged to become more involved in waste management by actively participating in reduction initiatives with ongoing support and engaging in educational campaigns about food waste (Saliem et al., 2021; Handayati & Widyanata, 2024). The private sector can assist by supplying material resources or by serving as buyers for waste products that have been processed by communities. An integrated approach where all stakeholders collaborate effectively is vital for achieving national waste management goals.

7. Conclusion

The "Makan Bergizi Gratis" program, initiated by the Indonesian government to enhance nutrition and human resource quality, has unfortunately led to an increase in food waste during its initial implementation. This unexpected outcome stems primarily from issues such as the low quality and poor acceptance of the meals provided, coupled with various implementation and operational challenges including inconsistent nutritional standards and uneven distribution. Children's taste preferences and program design elements like portion sizes also contribute significantly to this waste.

This situation occurs within a broader context of significant food waste in Indonesia, where households are major contributors. To address this, effective food waste management requires overcoming technical, social, and policy hurdles, including improving data collection and strengthening program implementation. Future strategies must involve robust policies with clear targets, practical initiatives focusing on high-waste categories and behavioral change, and active collaboration between communities, government, and the private sector to ensure a sustainable and efficient food system.

Funding

This study was funded by the Directorate General of Science and Technology Resources and Higher Education, Kemendiktisaintek through the scholarship “Master's to Doctorate Education Program for Excellent Undergraduates (PMDSU) Batch VII” (038/E5/PG.02.00.PL/2024).

References

A. S. Cahyana, I. Vanany, N. I. Arvitrida, I. Gunawan, Modeling the relationships among the driving factors of food waste in indonesian city. Journal of Industrial Engineering and Management, **17**, 1 (2024).https://doi.org/https://doi.org/10.3926/jiem.6012

A. Ulfah, I. D. A. A. Warmadewanthi, Y. Fransiscus, A. U. Farahdiba, E. Rosyidah, J. Hermana, A. Yuniarto, The present and proposed sustainable food waste treatment technology in indonesia : a review. Environmental Technology & Innovation, **32**, 103256 (2023). https://doi.org/10.1016/j.eti.2023.103256

C. P. Komara, S. Pitriani, D. S. Sari, D. Yulianti, Free nutritious meal program amidst the food waste crisis. E-Sospol. Electronical Journal of Social and Political Sciences, **12**, 2 (2025). https://doi.org/https://doi.org/10.19184/e-sospol.v12i2.53789

D. Kusumawardani, N. A. Hidayati, A. Martina, K. S. Agusti, Y. Rahmawati, Y. Y. Amalia, N. F. Ramdaniyah, Household food waste in indonesia: macro analysis. Polish Journal of Environmental Studies, **32**, 6 (2023). https://doi.org/10.15244/pjoes/163157

D. Martianto, R. Diana, Y. F. Baliwati, D. Sukandar, A. Hendriadi, The quantity and composition of household food waste: Implications for policy. PLoS ONE, **19**, 6 (2024). https://doi.org/10.1371/journal.pone.0305087

G. I. Bhaskara, Religious values of chefs in bali and food waste awareness : a preliminary study food waste in developing countries. E-Journal of Tourism, **10**, 1 (2023). https://doi.org/https://doi.org/10.24922/eot.v10i1.100744

H. P. Saliem, S. Mardianto, Sumedi, E. Suryani, S. M. Widayanti, Policies and strategies for reducing food loss and waste in Indonesia Policies and strategies for reducing food loss and waste in Indonesia. Earth and Environmental Science, **892** (2021). https://doi.org/10.1088/1755-1315/892/1/012091

M. Audrey, E. Rukmini, Food waste warriors : Indonesian communities engage through workshops and social media education. International Journal of Public Health Science (IJPHS), **13**, 2 (2024). https://doi.org/10.11591/ijphs.v13i2.23660

R. Qomarrullah, Suratni, W. S. Lestari, M. Sawir, The long-term impact of the free

nutritious meal program on health and educational sustainability. Indonesian Journal of Intellectual Publication, **5**, 2 (2025).

R. Rimbawan, R. Nurdiani, P. H. Rachman, Y. Kawamata, Y. Nozawa, School lunch programs and nutritional education improve knowledge, attitudes, and practices and reduce the prevalence of anemia: a pre-post intervention study in an indonesian islamic boarding school. Nutrients, **15** (2023). https://doi.org/https://doi.org/10.3390/nu15041055

S. W. Setyaningtyas, A. N. Arimbi, R. Diana, Exploration of school meal food service management : a case study of a full-day school. International Journal of Public Health Science, **11**, 3 (2022). https://doi.org/10.11591/ijphs.v11i3.21331

S. Zulkifli, A. Jayanegara, B. P. Noorachmat, M. R. Fahmi, T. Tandio, Sustainability analysis of environmental waste alleviation through bioconversion using black soldier fly larvae: a case study in depok city, indonesia. Journal of Natural Resources and Environmental Management, **15**, 1 (2025). https://doi.org/http://dx.doi.org/10.29244/jpsl.15.1.19

U. Agustini, S. Mulyani, Effectiveness and challenges of free nutritious meal program policy as an educational intervention in indonesia. Jurnal Kiprah Pendidikan, **4**, 3 (2025).

Waluyo, D. B. Kharisma, Circular economy and food waste problems in Indonesia: Lessons from the policies of leading countries. Cogent Social Sciences, **9**, 1 (2023). https://doi.org/10.1080/23311886.2023.2202938

Y. Handayati, C. Widyanata, Effective food waste management model for the sustainable agricultural food supply chain. Scientific Reports, **14**, 10290 (2024). https://doi.org/10.1038/s41598-024-59482-w