



A Bibliometric Review of Approaches to Managing and Reducing Food Waste within Indonesia's HoReCa Industry

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ABSTRACT

This study aims to identify key concepts in food waste management and mitigation within Indonesia's Hotel, Restaurant, and Catering (HoReCa) sector through a bibliometric analysis approach. By employing keyword co-occurrence analysis, the research maps relevant literature using Google Scholar and the Publish or Perish 8 software, with search terms including "Food Waste," "HoReCa," "Handling," "Reduce," "Mitigation," and "Indonesia." Data from 222 publications were analyzed using VOSviewer 1.6.20 to generate bibliometric visualizations, focusing on three primary outcomes: network visualization, overlay visualization, and density visualization. This methodology provides a comprehensive overview of research patterns, trends, and gaps, offering actionable insights for developing evidence-based food waste reduction strategies in Indonesia's HoReCa sector. The findings serve as a critical reference for researchers and practitioners advocating sustainable practices and policy alignment with SDG 12.3 targets.

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1. INTRODUCTION

Food waste and food loss have emerged as critical international issues, attracting global attention in both developed and developing countries in recent years. According to the [FAO \(2020\)](#), food loss refers to the reduction in the quantity or quality of food resulting from decisions and actions taken by food suppliers within the supply chain. In contrast, food waste refers to a decrease in the quantity or quality of food caused by decisions and actions at the retail, food service, and consumer levels. It is estimated that more than one-third of all food produced globally is discarded each year ([FAO, 2020](#)), while millions of people around the world continue to suffer from hunger and malnutrition ([FAO, 2020](#); [Lipinski et al., 2013](#)). The United Nations Environment Programme (UNEP) released the Food Waste Index Report 2021, which reported that approximately 931 million tons of food are wasted annually. The primary drivers of food waste include overproduction, inefficient distribution practices, and wasteful consumer habits ([UNEP, 2024](#)). The impacts of food waste extend beyond social and economic dimensions, significantly affecting the environment through increased greenhouse gas emissions and excessive use of natural resources ([Gladyshev, 2021](#); [Mokrane et al., 2023](#)). One of the key issues contributing to food waste is the inefficient management of raw materials and food products, which renders a substantial amount of food unfit for human consumption. This inefficiency results not only in significant financial losses—estimated at around USD 1 trillion ([FAO, 2020](#))—but also poses serious environmental threats. The unsustainable use of food leads to overexploitation of natural resources such as land, water, fertilizers, and energy ([Razzaq et al., 2024](#); [Rutten, 2013](#)). Moreover, food waste has far-reaching negative consequences, notably by intensifying environmental pressures through greenhouse gas emissions generated from decomposing discarded food. It also represents a waste of the natural resources used during the production, processing, and transportation of food that ultimately goes unused ([FAO, 2020](#); [Zandonadi et al., 2021](#)). Globally, food waste contributes approximately 4.4 gigatons of greenhouse gas emissions annually. In addition to its environmental impact, food waste exacerbates social and economic inequalities by reducing the availability of food for those in need, while still-edible food is unnecessarily discarded ([Amicarelli et al., 2021](#); [FAO, 2020](#); [Seberini, 2020](#)). Consequently, food waste represents a major barrier to achieving sustainability in the global food sector.

Food waste is not only an international concern but also a pressing national issue for Indonesia. According to a report by BAPPENAS, Indonesia generated between 23 to 48 million tons of food waste annually during the 2000–2019 period, equivalent to 115–184 kilograms per capita per year ([BAPPENAS, 2022](#)). The resulting economic losses are substantial, amounting to approximately IDR 213–551 trillion per year, or about 4–5% of the country's GDP. On a social level, this corresponds to a loss of energy content equivalent to 61–125 million meals annually. Environmentally, food waste in Indonesia has contributed to an estimated 1,702.9 million metric tons of CO₂-equivalent emissions over the past two decades—approximately 7.29% of the country's average greenhouse gas emissions during that period ([Farahdiba et al., 2023](#); [Susilo et al., 2021](#)). Data from the National Waste Management Information System (SIPSN) indicate that Indonesia produced 19.45 million tons of waste in 2022, marking a 37.52% decrease from 31.13 million tons in 2021. Among the various types of waste, food waste constituted the largest share—about 41.55% of the total—followed by plastic waste at 18.55% ([BAPPENAS, 2022](#)). Of this waste, 61% originated from households, 26% from food services such as restaurants and cafés, and 13% from the retail sector. These figures reveal that approximately 17% of global food production is ultimately

discarded as waste, with households being the largest contributors. Studies also show that tourists account for around 15% of food waste generated within the hotel, restaurant, and catering (HoReCa) sectors (Wang et al., 2021). Another study by Filimonau and Coteau (2019) found that the hospitality sector in the European Union is responsible for about 12% of total food waste (excluding catering services), while Liu (2014) and Papargyropoulou et al. (2016) reported that the hospitality sectors in China and Malaysia produce more food waste than households. BAPPENAS data also confirm that the HoReCa sector ranks second in food waste generation, after households (BAPPENAS, 2022). In response, Indonesia has committed to improving food waste and food loss management in accordance with its National Strategy Guidelines (Presidential Regulation No. 97/2017), targeting a 30% reduction in food waste and 70% waste handling by 2025. This initiative aligns with Sustainable Development Goal (SDG) 12: "Ensure Sustainable Consumption and Production Patterns" (Buczacki et al., 2021; UNEP, 2024).

SDG 12 emphasizes reducing resource wastage, including food, and promoting sustainable consumption practices. In the context of food waste, achieving this goal requires systemic efforts to minimize waste across the entire food supply chain—from production and distribution to end-user consumption. This entails a holistic approach involving policy reform, technological innovation, and increased consumer awareness. Reducing food waste yields not only socio-economic benefits but also contributes to environmental preservation and the broader achievement of sustainable development. Given the growing volume of food waste within the HoReCa sector, effective solutions are urgently needed to address waste throughout the supply chain. In-depth research is essential for identifying mitigation methods, developing preventive strategies, and fostering both consumer awareness and supportive policies. A review of current literature on food waste management and mitigation in the HoReCa sector provides a critical foundation for identifying research gaps and guiding future studies (Gorzeń-Mitka et al., 2020).

This study offers a systematic literature review of current food waste management practices and challenges within the HoReCa sector, providing a clear portrayal of the existing landscape. A bibliometric analysis is recommended in the implementation of such reviews, as it provides a quantitative synthesis of diverse research findings. Systematic reviews aim to identify, select, and critically evaluate all relevant studies addressing a particular research question (Singh et al., 2023). The use of systematic literature review methodologies, incorporating bibliometric analysis and software tools for systematic and bibliometric reviews, is increasingly adopted to observe scholarly trends. These approaches enhance research precision and expand the potential to meet research objectives (Barbosa et al., 2019). Therefore, this article also serves as a potential guideline for future research, particularly on food waste management in the HoReCa sector.

2. METHODS

2.1. Data Collection and Processing

Google Scholar was selected as the primary database for this study due to its widespread use in accessing academic journals across various disciplines, including food waste management. For this research, Google Scholar was utilized to identify and review publications specifically addressing food waste management within the Hotel, Restaurant, and Catering (HoReCa) sector. The objective was to systematically analyze relevant studies on food waste management in HoReCa from 2014 to 2024 using visual mapping techniques. The literature search was conducted using the keywords "management and mitigation of food waste in the Hotel, Restaurant, and Catering sector" within the Google Scholar database.

Recognized as one of the most comprehensive academic databases globally, Google Scholar provides extensive access to scholarly publications spanning numerous fields, such as food technology, sustainability, and food service industries. This breadth makes it particularly valuable for supporting interdisciplinary and applied research on food waste management (Halevi et al., 2017; Martín-Martín et al., 2018).

2.2 Data Analysis

The collected data were analyzed using bibliometric methods. Bibliometric analysis leverages secondary data and examines it from a quantitative and objective perspective (Albort-Morant & Ribeiro-Soriano, 2016). As a quantitative approach, bibliometrics evaluates academic literature through citation data, enabling the description, assessment, and monitoring of research trends (Garfield et al., 1964). Furthermore, bibliometrics employs statistical and mathematical techniques to develop indicators that reflect the behavior and evolution of scientific fields, focusing on specific disciplines, areas, organizations, or countries (Boloy et al., 2021). The number of articles published and the citations they receive serve as indicators of their influence within a specific discipline, including interdisciplinary domains (Ding & Yang, 2022). Consequently, bibliometric methods not only reveal the landscape of existing research but also inform future research directions by mapping interactions among researchers (Gülmez et al., 2020).

A review analysis of scientific publications will also be conducted, providing a narrative overview of the current state of food waste in the HoReCa sector. The bibliometric analysis employs the Publish or Perish 8 software, followed by visual mapping using VOSviewer version

1.6.20. This process enables the identification of research trends and best practices in food waste management within HoReCa sector. The initial step involves determining the research topics of interest using Google Scholar as the data source. Subsequently, searches are performed in Publish or Perish 8 with keywords such as “Food Waste,” “HoReCa,” “Handling,” “Reduce,” “Mitigation,” and “Indonesia.” The next stage involves conducting a visual bibliometric mapping analysis using VOSviewer version 1.6.20. Through this methodology, data are gathered from multiple sources to achieve a holistic understanding of food waste issues in the HoReCa sector, as well as the potential for mitigation and reduction strategies as viable solutions.

3. RESULTS AND DISCUSSION

The results and discussion of this study present three primary findings: network visualization (mapping research keyword clusters), overlay visualization (highlighting recent trends in research keywords), and density visualization (showing keyword trends based on frequency). These findings pertain to the analysis of food waste management and mitigation within the HoReCa sector in Indonesia. Using the Publish or Perish application with the keywords “Food Waste,” “HoReCa,” “Handling,” “Reduce,” “Mitigation,” and “Indonesia,” a search was conducted for up to 500 articles, yielding 222 relevant publications. These publications were subsequently interpreted and mapped through bibliometric visual analysis.

3.1. Overview of Number of Publications

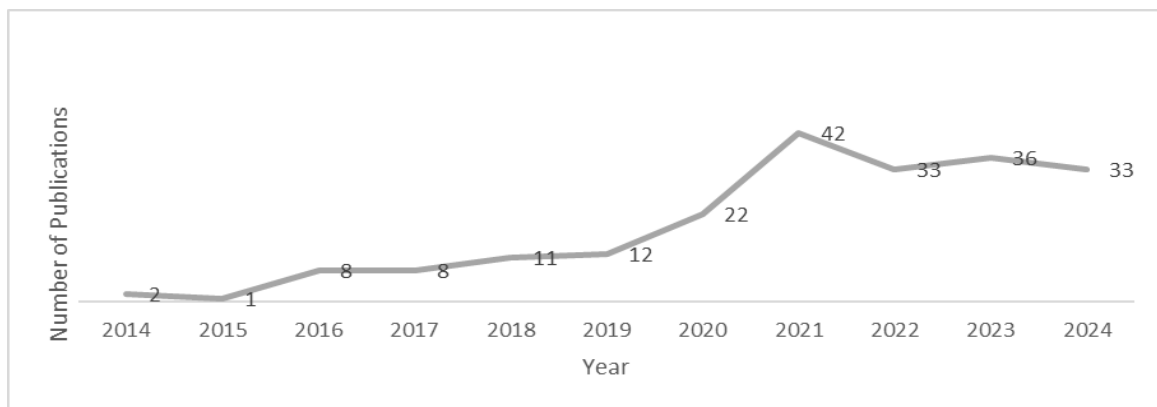


Figure 1. Number of Publications Over the Last Decade (2014–2024)

As illustrated in Figure 1, a bibliometric analysis of research related to food waste management and mitigation within the HoReCa sector from 2014 to 2024 reveals a total of 222 publications. This number reflects a growing academic interest and provides a concise overview of the research landscape in this domain (Geng et al., 2022). A closer examination of the figure shows that 2021 marked the peak in publication activity within the observed period. From 2014 to 2024, the trend in scholarly output exhibits a steady increase, with a particularly significant rise between 2019 and 2021. Although the number of publications plateaued somewhat in subsequent years, the elevated interest remains evident. This upward trajectory underscores the growing recognition of food waste—especially in the HoReCa sector—as a pressing environmental issue requiring urgent and systematic attention (BAPPENAS, 2022; Irianto & Arygunartha, 2019; Sheahan, 2017; Wang et al., 2021).

3.2. Analysis Based on the Most Cited Articles

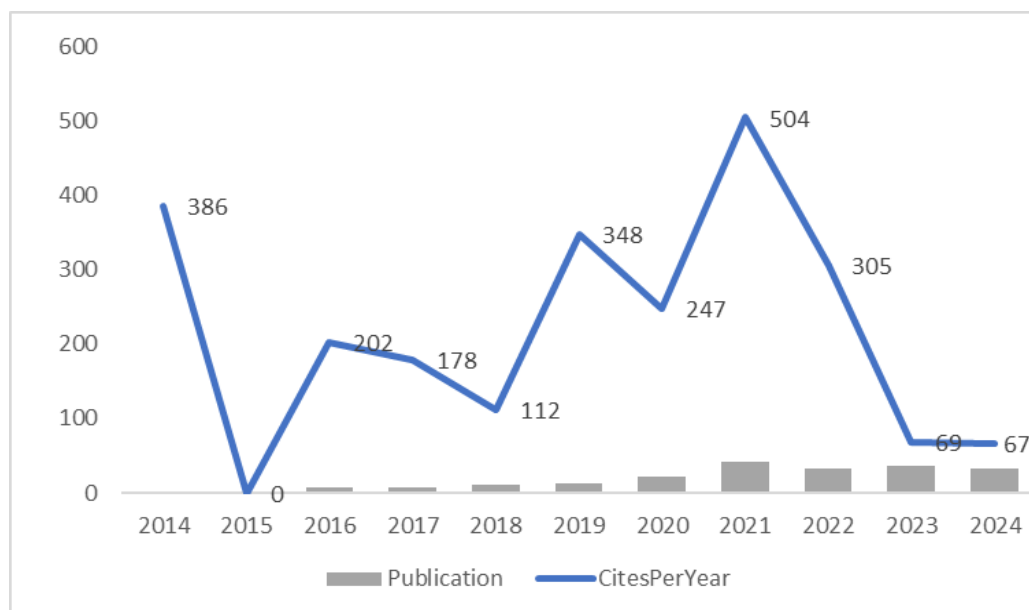


Figure 2. Number of Publications and Citations per Year (2014–2024)

Figure 2 illustrates that the total number of citations between 2014 and 2024 reached 2,418. The citation trend reveals five periods of decline and three periods of increase.

Citation decreases occurred during the intervals 2014–2015, 2016–2017, 2017–2018, and 2021–2023; while increases were recorded in 2015–2016, 2018–2019, and 2020–2021. Overall, 2021 recorded the highest number of citations, whereas 2015 marked the lowest, with no citations recorded. Consequently, the citation trend related to food waste management and mitigation in the HoReCa sector demonstrates a noticeable decline from 2021 to 2023.

3.3. Visualization of the Bibliometric Network Map on Food Waste Management and Mitigation in the HoReCa Sector in Indonesia

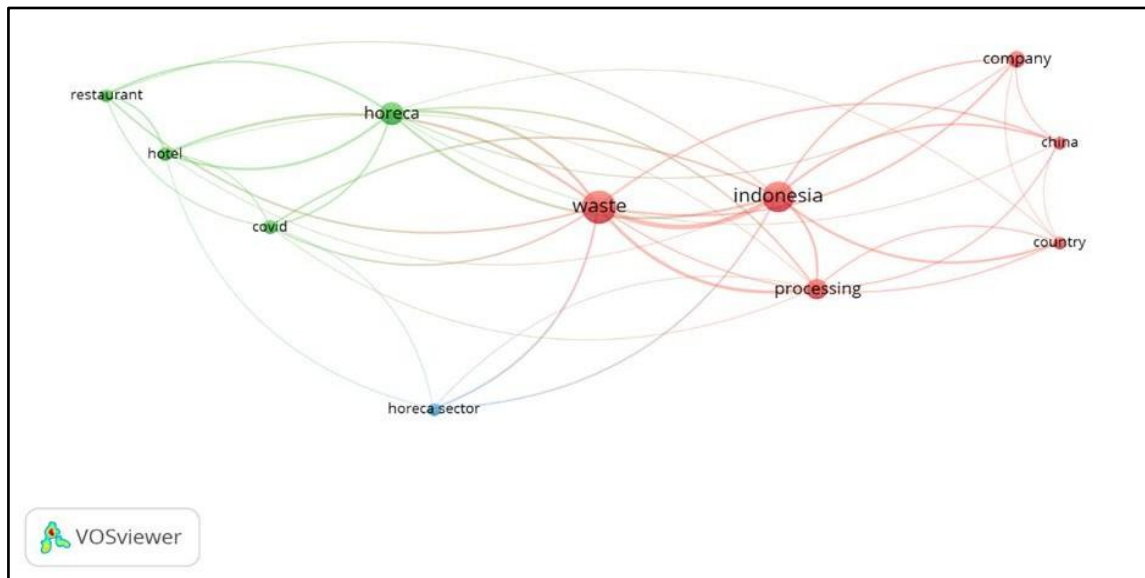


Figure 3. Co-occurrence Network Mapping of Keywords in This Study

As depicted in Figure 3, a total of 11 keywords were identified in the analyzed publications. Keywords serve as principal representations of the core research topics (Zeng et al., 2022). Furthermore, keywords generally reflect the main content and thematic focus of the articles, indicating emerging trends and critical areas of inquiry within the field (Seguí-Amortegui et al., 2019).

Figure 3 displays the keywords and their clustering under the overarching theme of food waste management and mitigation in the HoReCa sector. Out of the 222 analyzed articles, 11 keywords were identified and categorized into three distinct clusters. Cluster 1 includes the terms *China*, *Company*, *Country*, *Indonesia*, *Processing*, and *Waste*. Cluster 2 comprises *Covid*, *HoReCa*, *Hotel*, and *Restaurant*. Lastly, Cluster 3 contains a single keyword: *HoReCa Sector*.

Each cluster is visually distinguished by color, with each color representing one cluster. Closely related terms are grouped within the same cluster and color. The spatial proximity between terms indicates co-occurrence frequency; terms that appear closer together are more likely to have co-appeared in the titles and abstracts of the same articles.

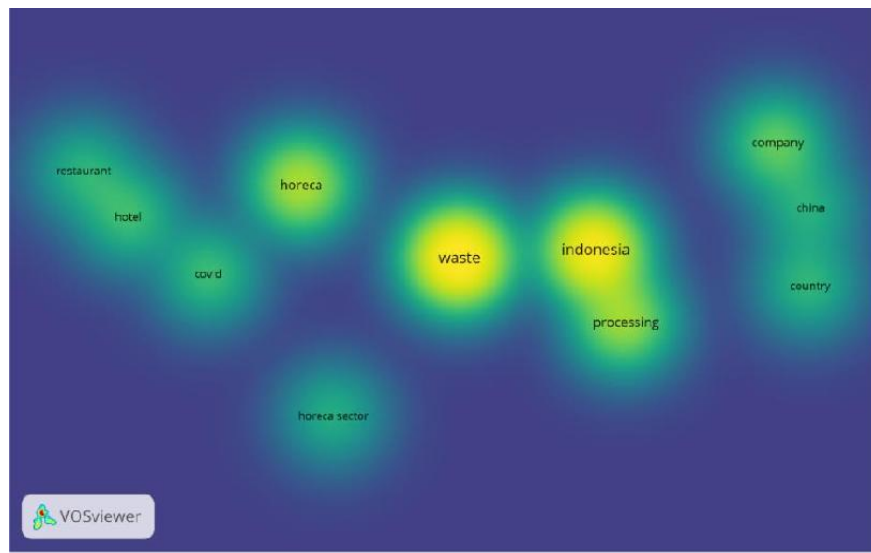


Figure 4. Keyword Co-occurrence Density Visualization in This Study

The circular nodes in Figure 4 represent the frequency of keyword occurrences within the publications. The keyword waste emerges as the most frequently used term, followed by Indonesia and then HoReCa. As illustrated in Figure 4, these keywords exhibit high density, surrounded by several other related terms. The closer proximity between keywords suggests an increasing volume of research focused on those topics. Conversely, keywords that appear farther apart reflect research areas that remain underexplored. The smaller the distance between keywords, the more frequently they co-occur in article titles and abstracts, indicating strong thematic linkages.

3.4. Policy Implications and Future Research Directions

The management and mitigation of food waste in the HoReCa sector are of critically important due to the sector's significant contribution to global food waste generation (Filimonau & Coteau, 2019; Liu, 2014; Papargyropoulou et al., 2016; Salsabila et al., 2023; Wang et al., 2021). The HoReCa sector is not only responsible for delivering food to consumers but also generates waste in the form of unused ingredients, food leftovers, and expired products. In light of increasing awareness of sustainability issues, it is imperative that this sector adopts improved waste management practices. Such efforts will not only reduce environmental impacts but also enhance operational efficiency and cost-effectiveness, ultimately providing financial benefits for businesses (Salsabila et al., 2023). Moreover, the efficient use of the Economic Order Quantity (EOQ) method is crucial in reducing food waste in the food and beverage industry. By calculating the optimal raw material order quantity based on demand, ordering costs, and storage costs, EOQ helps companies avoid over-purchasing materials that may expire or spoil before use (Fajri I & Maima A, 2020; Jannah et al., 2024). Additionally, implementing EOQ enables more planned and controlled inventory management, ensuring that stock remains fresh and aligned with production needs (Fadhyl et al., 2018; Fajri I & Maima A, 2020; Jannah et al., 2024; Sulaiman & Nanda, 2015).

In addition, research on food waste management and mitigation within the HoReCa sector can play a pivotal role in educating stakeholders about the importance of social and environmental responsibility. By understanding the far-reaching impacts of food waste, industry actors can implement more sustainable strategies such as supply chain

optimization, technological innovations in waste management, and collaborations with organizations focused on waste reduction. This research also offers valuable insights into best practices that can be adopted across various types of HoReCa businesses and supports the formulation of public policies that promote food waste reduction. Collectively, these efforts contribute to achieving the Sustainable Development Goals (SDGs) and fostering more environmentally responsible communities (Buczacki et al., 2021; UNEP, 2024). Moreover, the concept of food waste mitigation and reduction in the HoReCa sector continues to gain traction, with a growing body of research dedicated to this issue. This study, through bibliometric analysis, examined 222 academic articles on food waste management and mitigation in the HoReCa sector, retrieved from the Google Scholar database between 2014 and 2024 using the Publish or Perish 8 software. Visualization and interpretation were conducted using the VOSviewer mapping technique. This bibliometric study is essential for assessing the current state and development trajectory of the academic literature on food waste management.

The findings indicate that the highest number of publications occurred in 2021, with a total of 42 articles published between the 2014–2024 period. Notably, since 2019, the volume of publications increased by approximately three and a half times by 2021. This surge can be attributed to food waste becoming a prominent global issue (Dou et al., 2016; FAO, 2020; Sheahan, 2017) and a national priority in Indonesia (BAPPENAS, 2022). According to the Food Waste Index Report 2021, Indonesia ranks fourth globally and first in Southeast Asia for food waste generation. Projections by the FAO estimate that a 70% increase in global food waste by 2050 (FAO, 2020). Without effective management, this could result not only in financial losses but also in adverse social and environmental consequences. Food waste is closely aligned with the Sustainable Development Goals, and the development of effective and efficient food waste mitigation systems is integral to achieving all 17 goals (Buczacki et al., 2021; UNEP, 2024).

According to Ciccullo et al. (2021) and Papargyropoulou et al. (2016), prevention is the most effective strategy for reducing food waste and achieving optimal environmental outcomes. Thyberg and Tonjes (2016) identified four key reasons for prioritizing food waste prevention: environmental degradation resulting from production, storage, and transportation processes; economic losses; food security concerns; and the environmental impacts of waste disposal. While food waste cannot be completely eradicated, preventive strategies—implemented through policies, programs, public campaigns, and behavioral change—can significantly mitigate its effects. Research by Salsabila et al., (2023), further highlights that food waste reduction in the HoReCa sector can be approached through prevention and surplus food management. Prevention can be operationalized across three stages: planning, handling, and serving. Therefore, increased attention to waste mitigation efforts in the HoReCa sector is crucial. This study applies a bibliometric approach to systematically examine relevant literature, offering comprehensive insights into the current state of food waste management. The findings are expected to provide a broader understanding of intervention strategies for reducing food waste in the HoReCa sector and to inform both academic inquiry and policy development going forward.

4. CONCLUSION

In conclusion, addressing and mitigating food waste in the HoReCa sector is a crucial step that requires special attention, given this sector's significant contribution to food waste generation. With increasing awareness of sustainability, this study highlights the importance of improved waste management practices to reduce environmental impact and enhance operational efficiency. Mitigation approaches—such as prevention strategies, surplus food management, and supply chain optimization—are considered effective in supporting the

achievement of sustainable development goals, including the global reduction of food waste. Bibliometric analysis of the literature from the past decade also indicates that food waste has become a priority issue in many countries, including Indonesia. The findings of this study provide a comprehensive understanding of the development of research on food waste management and can serve as a foundation for stakeholders in the HoReCa sector to adopt sustainable strategies in their food waste management efforts.

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