

# Combating Food Losses and Waste in Latin America's Agricultural Sector after COVID-19: Characteristics, Approaches, and Perspectives

Alfredina dos Santos Araújo, Luiz Fernando Lira Bacelar

Centro de Ciências e Tecnologia Agroalimentar da Universidade Federal de Campina Grande, UFCG Rua Jairo Vieira Feitosa, Pombal, Brasil

Email: [alfredina.santos@professor.ufcg.edu.br](mailto:alfredina.santos@professor.ufcg.edu.br), [luizbacelar@hotmail.com](mailto:luizbacelar@hotmail.com)

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## Abstract

This article explores the challenges and strategies for combating food loss and waste in Latin America's agricultural sector in the post-COVID-19 era. It critically examines the key drivers of food loss and waste across the production chain, emphasizing their environmental, economic, and social repercussions on a global scale. A central focus is placed on food waste quantification as a fundamental pillar for designing evidence-based policies and interventions. The study highlights innovative approaches such as reverse logistics, strategic public-private partnerships, and social innovation in food redistribution. Furthermore, it analyzes major global and regional initiatives aimed at waste reduction, with particular attention to Brazil's evolving policies and governance frameworks. By identifying emerging trends and emphasizing the role of international technical cooperation, this article underscores the necessity of integrated and coordinated efforts to achieve sustainable and resilient food systems.

## Keywords

Food Loss and Waste, Food Security, Sustainability, International Cooperation

## 1. Introduction

The contextualization of food waste in the world facilitates an understanding of the topic addressed in this article and an observation of the existing legal framework capable of reducing food losses and waste in the agricultural sector in Brazil and globally, particularly regarding the benefits that smallholder farmers and consumers could obtain. The following are some essential concepts relevant to this study.

According to the Food and Agriculture Organization of the United Nations (FAO), two main concepts are crucial for studying food losses and waste. The first concerns food loss, which involves reducing the quantity and quality of products intended for human consumption at various stages, from production to storage and transport. The second concept, also presented by FAO (2017), encompasses both the “loss” and “waste” of food, emphasizing that these occur throughout the food cycle and impact the quantity and quality of food that would initially be consumed by humans, regardless of the reason.

In addition, HLPE (2014) defines “food waste” as the disposal or deterioration of food that is fit for human consumption until it reaches the consumer without specifying the cause of this phenomenon.

Based on an understanding of these aspects, this study aims to demonstrate the importance of overcoming bottlenecks and proposing new solutions to food waste, which can be incorporated through international technical cooperation to benefit the most vulnerable populations in Brazil and other countries in the global South.

This work aims to discuss aspects related to reducing food losses and waste in the agricultural sector of Latin America, contributing to food security and a solidarity economy, particularly in the context of the post-COVID-19 era. From the elements raised in this demonstration, it will be possible to identify the roles of the public and private sectors in creating a system capable of facilitating the redistribution of food that would be lost or wasted throughout the production, transport, sale, and consumption processes, as a solution to the limitations encountered by small producers, generating increased income, as well as by consumers, developing access to cheaper products without having lost their usefulness.

Regarding the methodology, academic texts, official and business portals, and technical studies in the areas of agriculture and international relations were reviewed, which makes this work interdisciplinary. We sought to understand the production processes, methods, and value-added practices in agriculture, as well as the modalities and characteristics of international technical cooperation.

## 2. Bibliographic Review

The theoretical understanding of food loss and waste (FLW) is primarily grounded in the definitions established by leading international organizations. The Food and Agriculture Organization (FAO, 2017) and the United Nations Environment Programme (UNEP, 2024) distinguish between food loss—which occurs predominantly in the early stages of the agri-food chain—and food waste, which is concentrated in the final stages of marketing and consumption. This distinction is essential for guiding the development of targeted public policies at each point of the food supply chain.

Studies such as those by HLPE (2014) and Garske et al. (2020) underscore the lack of standardized methodologies, performance indicators, and systematized data, which hampers the effective mitigation of food waste. Recent literature also highlights the role of technological innovations—such as digital traceability systems and blockchain applications—as promising strategies to reduce food losses

(Marin et al., 2021; Subramanian et al., 2023).

From a sustainability perspective, authors like Goodwin (2023) and Shankar (2023) emphasize the environmental and economic impacts of FLW, particularly within the broader context of climate change and rising global food insecurity. The work of Hanson et al. (2022) is notable for mapping the structural drivers of FLW in Latin America, including rigid aesthetic standards, overproduction, and infrastructure deficits.

The role of public policy and international cooperation is likewise stressed in reports by FAO (2020, 2023) and the Inter-American Development Bank (IDB, 2022), which advocate for multisectoral approaches centered on food governance. Brazilian initiatives such as the Food Acquisition Program (PAA) and Mesa Brasil are frequently cited as examples of good practice, effectively linking food waste reduction with enhanced food security.

The bibliographic framework adopted in this study draws on a wide range of sources, including peer-reviewed articles, technical reports, and national and international policy documents, underscoring the topic's interdisciplinary nature and global relevance.

This study employs a qualitative approach, incorporating an interdisciplinary review of academic literature, official reports, and technical studies in the fields of agriculture, sustainability, and international relations. A systematic analysis was conducted on food loss and waste (FLW) in the agricultural sector of Latin America, with particular emphasis on the post-COVID-19 period.

Primary and secondary sources, including reports from the Food and Agriculture Organization (FAO), the United Nations Environment Programme (UNEP), and regional policy documents, were examined to assess key drivers, policy interventions, and sustainable solutions. The research also considers case studies from Brazil and other Latin American countries to highlight governance frameworks, public-private partnerships, and innovative strategies aimed at FLW reduction.

Additionally, this study analyzes global and regional FLW mitigation initiatives through a comparative lens, identifying best practices that can be adapted to the Latin American context. By integrating perspectives from international technical cooperation, the study evaluates the role of multi-stakeholder engagement in addressing food insecurity and fostering resilient food systems.

Although no primary interviews were conducted for this study, the analysis draws from secondary data, including policy documents, case studies, and official reports developed in collaboration with stakeholders such as government agencies (e.g., FAO, ABC), NGOs (e.g., Mesa Brasil), and private sector actors engaged in food redistribution and governance initiatives. These sources reflect stakeholder engagement and informed the proposed strategies.

### **3. General Considerations on Food Losses and Waste in the Agricultural Sector**

Food is fundamental to human survival, yet the prevailing global patterns of pro-

duction and consumption have resulted in alarming levels of food waste. This issue is substantiated by the latest report from the Food and Agriculture Organization (FAO), which indicates that approximately 19% of the food available to consumers worldwide is wasted across the retail, food service, and household sectors. Furthermore, an estimated 13% of food is lost along the supply chain—from post-harvest through to the point of sale—representing a substantial global food loss (UNEP, 2024).

This study adopts the definitions of “food waste” and “food loss” as delineated in the Food Waste Index Report 2024 by the United Nations Environment Programme (UNEP). Food waste refers to the removal of food and its inedible parts from the supply chain designated for human consumption. According to FAO, food loss encompasses all quantities of edible agricultural and livestock products intended for human consumption that, directly or indirectly, exit the supply chain post-harvest or post-slaughter. These losses occur throughout storage, transportation, and processing stages—including imported products—up to the retail level, impacting both edible and inedible components (UNEP, 2024).

The phenomenon of food loss and waste constitutes a critical global challenge with profound implications for food security, economic stability, and environmental sustainability. These losses transpire at multiple junctures within the food supply chain, from initial production to final consumption. Addressing this issue requires an integrated value chain perspective, recognizing each stage as a crucial component of agri-food systems.

Against this backdrop, the present study examines food loss and waste in Latin America’s agricultural sector in the post-COVID-19 era, considering its associated social, economic, and environmental ramifications. By analyzing the interrelations between food waste, food loss, and the role of consumerism in exacerbating these issues, this research aims to inform and refine policy interventions and awareness initiatives. Such measures are instrumental in fostering sustainable practices and enhancing the resilience of food systems in the region.

### **3.1. Food Losses and Waste along the Agricultural Production Chain**

At the agricultural production stage, management practices—including soil quality, pest control strategies, and the application of agricultural inputs—are pivotal in mitigating losses. Infestations of pests and weeds are among the primary contributors to both pre- and post-harvest losses. Additionally, extreme weather conditions, such as prolonged droughts, excessive heat, and soil salinity, adversely impact crop yields. Climate variability also influences the proliferation of pathogens like aflatoxins, which pose a significant risk to crop contamination. A critical challenge in reducing food loss at these stages is the lack of technical training among farmers, which creates a bottleneck in implementing effective mitigation strategies (UN News, 2024; UN Department of Economic and Social Affairs, 2023). While previous analyses by the United Nations and other scholars have

considered pre-harvest losses, this study focuses exclusively on post-harvest losses, aligning with recent research trends.

Losses during processing and packaging stem from inefficiencies such as improper handling techniques, mechanical failures, and the absence of suitable preservation technologies. Contemporary research indicates that up to 20% of agricultural products are lost during processing due to inefficient methodologies and inadequate infrastructure (UN News, 2024; UNEP, 2024).

Insufficient infrastructure for storage and transportation is a significant driver of post-harvest food loss. In high—and middle-income countries, these losses are mitigated through advanced logistics, effective supply chain management, and well-developed agricultural frameworks. Conversely, in low-income nations, food loss is more prevalent in the early and mid-stages of the supply chain, often due to premature harvesting, suboptimal storage conditions, and a lack of essential processing facilities (UNEP, 2024; UN Department of Economic & Social Affairs, 2023).

At the retail level, aesthetic criteria frequently dictate food disposal, leading to the rejection of products that remain nutritionally viable. Inadequate demand forecasting and inefficient inventory management further contribute to food waste. Recent studies reveal that approximately 5% of food is wasted at the retail stage in Europe. Given the high volume of food transactions, even marginal reductions in retail waste could yield substantial positive impacts (UN News, 2024; UN Department of Economic and Social Affairs, 2023).

The increasing focus on sustainability has elevated food waste as a critical issue, not only for environmental conservation but also for global food security. Estimates suggest that nearly one-third of all food produced for human consumption is wasted along the supply chain (UNEP, 2024; UN News, 2024). This issue is especially pronounced in developed economies, where over 40% of total waste occurs at the retail and consumer levels (UNEP, 2024).

Although retail accounts for a relatively small portion of overall food waste—approximately 5%, according to a European study—its role in shaping consumer behavior is substantial (UN News, 2024). The sector has significant leverage in influencing purchasing patterns, making it crucial to explore how retail practices can promote a more sustainable food system (UN Department of Economic and Social Affairs, 2023).

The consumption stage presents one of the most challenging aspects of food waste reduction. Poor storage practices, improper handling, excessive purchasing, and a general lack of awareness regarding food shelf life are major contributors to household-level waste. According to Goodwin (2023), reducing food waste at the consumer level is imperative, and achieving a 50% reduction by 2030 is a key objective within the UN Sustainable Development Goals (SDGs).

Consumerism—characterized by the pursuit of desires over fundamental needs—is a driving force behind food waste. Theoretical frameworks developed by Bauman and further substantiated by Gimiliani et al. (2024) highlight how excessive consumption, fueled by the availability of diverse choices and the princi-

ples of planned obsolescence, exacerbates food waste, often leading to the disposal of items before spoilage occurs (Leonard, 2007).

The COVID-19 pandemic disrupted food supply chains across Latin America. According to FAO (2020), border closures, market restrictions, and labor shortages led to increased post-harvest losses, particularly in perishable produce. In Brazil, a study by Santos et al. (2020) noted that logistical bottlenecks during lockdowns resulted in food losses estimated at 15% higher than pre-pandemic levels.

Effectively addressing food loss and waste across the value chain requires a unified understanding of the issue among all stakeholders. Policymakers at the federal, state, and municipal levels must translate scientific insights into actionable policies, emphasizing the importance of reliable data collection and targeted investments to foster sustainable food systems and reduce wastage.

### 3.2. Environmental, Economic, and Social Impacts of Food Waste

Food waste is a major contributor to climate change, water scarcity, escalating food prices, and the degradation of environmental services (FAO, 2017). The environmental impact of food waste is particularly pronounced, with data indicating that its associated greenhouse gas emissions are substantial (UN News, 2024). In 2022 alone, global food waste production accounted for 9.3 billion tons of CO<sub>2</sub> emissions, a volume comparable to the combined emissions of the United States and the European Union in the same year (Dwyer, 2023).

Latin America faces a critical food waste problem, with approximately 220 million tons of food discarded annually, exacerbating greenhouse gas emissions and depleting vital water resources. In Brazil, an estimated 40,000 tons of food are wasted each day—an amount sufficient to feed 19 million people (UNEP, 2024).

Moreover, the disposal of edible food is a pressing global issue that transcends cultural boundaries. In 2022, approximately 1.05 billion tons of food were wasted, even as 783 million people suffered from hunger (UN News, 2024). Addressing this paradox requires a comprehensive understanding of food waste dynamics to develop targeted interventions and governance mechanisms.

Despite a growing body of research on food waste, significant gaps remain in the accuracy and consistency of existing data (Garske et al., 2020). Discrepancies in definitions and methodological approaches hinder precise quantification, complicating efforts to tackle the issue effectively.

Geographic disparities in food waste patterns further highlight the need for context-specific strategies. In high-income regions such as North America and Europe, waste predominantly occurs at the consumer and retail levels. In contrast, in developing economies, losses are concentrated in the early stages of production and distribution (Garske et al., 2020). Recent studies confirm that food waste is pervasive across all income levels, emphasizing the necessity of tailored approaches for different socioeconomic contexts (Goodwin, 2023).

Given these challenges, governments must adopt coordinated policies to mitigate food waste, with a particular focus on diverting food from landfills toward

productive and circular applications (UNEP, 2024).

The economic ramifications of food waste are equally substantial, with global losses estimated at approximately \$1 trillion annually (UNEP, 2024). This figure excludes indirect costs, such as reduced productivity and adverse health outcomes linked to malnutrition (Shankar, 2023). Addressing food waste could yield significant financial savings; for instance, eliminating avoidable household food waste would save approximately £700 per year per household in the UK and \$1,800 per household in the US (Goodwin, 2023).

In Brazil, nearly 30% of the national food supply—equivalent to 41 million tons—is lost or wasted annually. A substantial portion of this waste results from inefficiencies in handling and logistics, with nearly 50% attributed to inadequate infrastructure (Longo et al., 2023). Implementing robust food donation policies and enhancing public awareness of food security could facilitate the redistribution of surplus food, reducing waste while addressing hunger (Global Food Banking Network, 2024).

Food waste is intrinsically linked to food insecurity and malnutrition. In 2021, over 800 million people experienced hunger, even as one-third of globally produced food remained unconsumed (UN News, 2024). Mitigating food waste could significantly enhance global food security by ensuring broader access to nutritious diets. Perishable items, mainly fruits and vegetables, are disproportionately affected, with over 40% being lost or wasted annually (Goodwin, 2023).

In Latin America, food waste exacerbates the region's food insecurity crisis. In Brazil alone, approximately 61.3 million individuals experience food insecurity, yet much of the discarded food could be repurposed to alleviate hunger (Global Food Banking Network, 2024). Programs such as SESC Mesa Brasil have played a crucial role in redistributing food and fostering greater awareness about food waste, thereby contributing to hunger mitigation and improved nutrition (Global Food Banking Network, 2024).

Beyond its implications for food security, reducing food waste is a vital strategy for both mitigating and adapting to climate change. Climate-related disruptions, including extreme heat waves and flooding, intensify food losses, underscoring the urgency of advancing climate-resilient agricultural practices and innovative packaging solutions (Shankar, 2023).

### 3.3. Food Loss and Waste Quantification

Food waste is a matter of great global concern, not only due to its socioeconomic impact but also due to its environmental effects. To address this challenge, it is essential to adopt efficient performance measurement systems.

The results point to a lack of articles emphasizing performance measurement systems aimed at the entire supply chain and focusing on sustainability, improvement, and learning. A trend observed in the literature is the application of digital technologies in performance measurement systems (Santos & Martins, 2021). This trend presents a window of opportunity for the development of research aimed at better

quantifying food waste, thus contributing to the reduction of food insecurity.

The Inter-American Development Bank emphasizes the need for more research to understand the impact of reduction interventions on various elements and actors of the agri-food system. The recommendation is that future investigations focus on quantifying and reducing uncertainties, conducting systemic research to identify critical intervention points, and evaluating how specific local measures affect socioeconomic, environmental, and food security objectives (IDB, 2022).

Recent studies have demonstrated that multi-stakeholder engagement in digital traceability systems can significantly reduce food losses by enhancing transparency, improving inventory management, optimizing redistribution efforts, and minimizing inefficiencies. For instance, Subramanian et al. (2023) propose a blockchain-based system that provides a transparent and traceable digital ledger for all supply chain actors. This leads to improved quality assessment and advanced fraud detection capabilities. Similarly, Marin et al. (2021) highlight that blockchain technology enables real-time tracking of products from their origin to the consumer, facilitating rapid identification of contamination sources and thereby reducing food waste. These collaborative approaches not only enhance transparency but also enable targeted interventions that align with sustainability and food security goals.

#### 4. Strategies and Measures to Fight against Food Loss and Waste

The urgency to implement effective measures to combat food waste and loss has never been greater. Addressing this global challenge requires the formulation and execution of well-structured public policies aimed at enhancing food systems and governance, ensuring a more sustainable and resilient approach to food security (FAO, 2017).

Education and public awareness play a fundamental role in this endeavor. However, fostering behavioral change requires more than raising awareness—it demands concrete actions that actively engage individuals and institutions. Public-private partnerships are mainly instrumental in this regard, as they drive sustainable practices, establish regulatory standards, and create incentives for meaningful change. By integrating efforts across multiple sectors, these initiatives foster a collaborative ecosystem that promotes long-term solutions to food waste.

Nevertheless, research suggests that awareness alone is insufficient. The real challenge lies in motivating individuals to take proactive steps to reduce food waste. Successful interventions must not only disseminate information but also create an environment that facilitates and encourages waste-reducing behaviors. Providing practical guidelines, modifying consumer environments, and leveraging behavioral insights can significantly enhance the effectiveness of these strategies (Van Geffen et al., 2020).

A particularly intriguing phenomenon emerges when examining shifts in food management behaviors during the COVID-19 pandemic. Contrary to the increasing global food waste trends, studies have identified a significant decline in house-

hold waste during lockdown periods. [Principato et al. \(2020\)](#) found that movement restrictions and logistical challenges in grocery shopping prompted consumers—significantly younger individuals and those who adopted structured food management practices—to handle their food supply more cautiously. This shift underscores the potential for behavioral adaptations in response to external constraints, offering valuable insights for future strategies aimed at minimizing waste through improved consumption habits and policy-driven interventions.

The finding regarding reduced household waste during lockdowns is based on [Principato et al. \(2020\)](#), who conducted surveys across Europe and Latin America showing increased food planning and reduced impulsive purchases. This temporary behavioral shift suggests potential pathways for long-term waste reduction through structured food management strategies.

#### **4.1. The Fight against Food Loss and Waste in the World**

Several nations have emerged as frontrunners in the global fight against food waste, implementing strategic policies and innovative measures to address this pressing issue. The FAO underscores that food waste is a universal challenge that necessitates concrete action ([FAO, 2019](#)). While determining the most advanced countries in this domain remains complex, certain nations have demonstrated remarkable progress.

The Waste and Resources Action Program (WARP) identifies exemplary government-led initiatives worldwide, many of which are being incorporated into Nationally Determined Contributions (NDCs) to reinforce commitments under the Paris Agreement ([WARP, 2022](#)). These best practices provide valuable insights into how targeted interventions can lead to tangible reductions in food waste.

A diverse range of approaches has been adopted globally, including public awareness campaigns, enhancements in selective waste collection, and the widespread implementation of composting systems. For instance, Dominica has prioritized education and awareness programs alongside improvements in organic waste collection, ensuring that waste management is both efficient and environmentally sustainable. Meanwhile, Iceland has taken a bold step by integrating food waste reduction into its 2020 Climate Action Plan, which includes a legislative ban on sending organic waste to landfills ([WARP, 2022](#)).

Several other countries have also established ambitious goals within their NDCs to mitigate food waste. Cabo Verde is focused on enhancing waste management systems, while China has launched a nationwide campaign aimed at reducing food waste at all levels of society. Namibia and Sierra Leone have adopted policy-driven approaches to strengthen food security while minimizing waste. The United Arab Emirates, in particular, has set an ambitious target to halve food waste by 2030, actively engaging both public and private sector stakeholders in a concerted effort to implement food waste reduction and treatment initiatives ([WARP, 2022](#)). These varied yet strategic actions highlight the potential for tailored national policies to drive meaningful change on a global scale.

## 4.2. The Fight against Food Loss and Waste in Latin America

The issue of food waste has garnered increasing global attention, and Latin America is no exception, given its integral role in the international food system. Addressing this challenge requires targeted strategies that incorporate diverse actors and leverage cross-sector collaboration.

The latest report from the United Nations Environment Programme (UNEP, 2024) underscores the importance of public-private partnerships (PPPs) in mitigating food loss and waste, highlighting existing initiatives between Brazil and Colombia. According to UNEP, fostering an international network of PPPs is critical to achieving SDG 12.3 by strengthening collaboration among food system stakeholders. In Brazil, where annual food waste estimates range from 23 to 82.1 million tons, the ongoing revision of the Intersectoral Strategy on Food Loss and Waste in 2024/2025, along with the implementation of the new Organic Waste Strategy, presents a pivotal opportunity for policy enhancement. However, for PPPs to be effective, they must be underpinned by consistent and transparent data collection on food losses across the value chain, thereby preventing duplication of efforts, particularly in food redistribution and donation initiatives (UNEP, 2024).

Colombia faces a comparable challenge. Despite government efforts, including the enactment of Law 1990/2019 to curb food waste, progress has been limited, mainly due to insufficient contemporary research—most available data on food waste in the country dates back to 2010. Establishing a robust PPP framework in Colombia is thus a crucial step toward fostering systemic improvements within the food value chain (UNEP, 2024).

Both Brazil and Colombia present significant opportunities for large multinational and national food sector companies to engage in international coalitions and agreements aimed at food waste mitigation. A well-structured PPP model in these countries could harmonize existing efforts while amplifying their impact, ultimately contributing to the long-term sustainability of the global food system.

Research by Hanson et al. (2017, 2022) offers a comprehensive review of global food waste patterns, identifying key drivers that are particularly relevant to the Latin American context:

- Rigid aesthetic standards: The demand for visually flawless food leads to the unnecessary disposal of edible products that do not meet market expectations.
- Overproduction and demand overestimation: Driven by efforts to secure high-volume supply, food systems often generate surplus products that exceed actual consumption needs.
- Deficient infrastructure and technological gaps: Inadequate investment in refrigerated storage and transportation systems contributes to a significant portion of food loss.
- Logistical inefficiencies: Challenges in inventory management, route planning, and supply chain coordination exacerbate food loss.
- Lack of consumer awareness: Many consumers fail to recognize the intrinsic value of food, leading to increased waste at the household level.

- Socioeconomic disparities: Structural inequalities in access to food further compound the issue, resulting in waste even as food insecurity persists.

Addressing these challenges requires a comprehensive, multi-stakeholder approach involving all stages of the supply chain (FAO, 2020). Three key areas of intervention stand out:

1) Private Sector Initiatives: Companies in Latin America have taken proactive steps to mitigate food waste. Studies by Bustos & Moors (2018) and David-Benz et al. (2022) highlight strategies such as fostering partnerships with producers, optimizing supply chain management, and advancing packaging innovation to enhance food preservation.

2) Third-Sector Contributions: Non-governmental organizations (NGOs) play a crucial role in raising awareness, redistributing surplus food, and delivering capacity-building programs aimed at reducing waste at various points along the supply chain.

3) Public Policy and Legislative Advancements: Governments across Latin America have demonstrated a commitment to combating food waste through policy innovations. Efforts include the introduction of tax incentives, the establishment of supportive public-private partnerships, and ongoing legislative reforms to create a more sustainable regulatory environment (ECLAC, 2022).

While Latin America has made measurable progress in fighting food waste, persistent challenges necessitate enhanced collaboration between the private sector, civil society, and policymakers. Strengthening this coordination will be instrumental in fostering a more resilient and sustainable food system across the region.

### 4.3. The Fight against Food Loss and Waste in Brazil

In Brazil, a range of initiatives has emerged as pivotal in mitigating food waste, demonstrating the power of collaborative efforts in addressing this pressing challenge. Save Food Brasil, an initiative linked to FAO, fosters coordinated work between organizations and corporations to minimize food losses, building a network of specialists dedicated to raising awareness and promoting effective interventions. Similarly, the #SemDesperdício campaign, spearheaded by WWF-Brazil, EMBRAPA, and FAO, seeks to shift consumer behaviors by associating food practices with avoidable waste, thus fostering a culture of responsible consumption (Santos et al., 2020).

Among the standout programs, Mesa Brasil, developed by SESC, plays a crucial role in enhancing social responsibility by redistributing quality food, directly combating both waste and food insecurity. Meanwhile, Imperfect Fruit has successfully encouraged more conscious consumption by purchasing and selling produce that would otherwise be discarded, rescuing approximately 300 tons of food within just two years. The Food Bank, a nonprofit organization, has developed an effective model for redistributing surplus food from producers, benefiting over 22,000 individuals each month through food assistance, environmental education, and public awareness lectures. According to its 2022 activity report, the organiza-

tion positively impacted approximately 370,000 people by providing food and essential food baskets (Banco de Alimentos, 2022).

In addition to these civil society-led efforts, the Brazilian government has reinforced its commitment to reducing food waste through strategic policy interventions. The Interministerial Chamber of Food and Nutrition Security launched the Intersectoral Strategy for the Reduction of Food Loss and Waste in Brazil in 2017, emphasizing the necessity of a coordinated, cross-sectoral approach to tackling food waste (Brasil, 2018). This policy framework underscores the importance of integrating government actions with private and nonprofit sector initiatives to ensure a holistic and effective response.

Following **Table 1** systematically compiles key initiatives related to combating food loss and waste in Brazil, providing a structured overview that facilitates their identification and potential replication.

**Table 1.** Table of initiatives related to combating food losses and waste in Brazil.

<i>Initiative Name</i>	<i>Year of Establishment</i>	<i>Objective</i>	<i>Description of Activities</i>
Mesa Brasil SESC	1994	Tackling hunger and food waste	National network of food banks that collects surplus food and redistributes it to social institutions
FOOD PROCUREMENT PROGRAM (PAA, as per the acronym in Portuguese)	2003	Support family farming and promote food security	Purchase of food from family farming for redistribution in social assistance and food networks
Comida Invisível (Invisible Food)	2016	Reducing food waste in the private sector	A platform that connects companies that want to donate surplus food with institutions that need food
Movimento Arroz com Feijão			
Rice and Beans Movement	2020	Tackling hunger and waste through food redistribution	Redistribution of food to vulnerable families, in partnership with supermarket chains and producers
Interministerial Chamber for Food and Nutrition Security (CAISAN, as per the acronym in Portuguese)	2006	Articulate actions to promote food security and reduce waste	Development of strategies to reduce losses and waste in production chains and promotion of public policies
Gastromotiva	2006	Promoting social inclusion and reducing food waste	Youth education in gastronomy and food recovery for restaurants that serve underprivileged communities
Food Bank Brasil	2007	Tackling waste and redistributing food	Partnership between companies and social organizations for food collection and distribution
Save food Brasil	2014	Reduce food losses and waste and increase food security	Initiative that aims to sensitize society and promote solutions to reduce waste throughout the production chain

Source: Mesa Brasil SESC (2024). Food Procurement Program (PAA) (2024). Retrieved from <https://seccmesabrasil.seccsp.org.br/>. Comida Invisível (2024). <https://app.comidainvisivel.com.br/>. Movimento Arroz com Feijão (2024). Retrieved from <https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1134359/arroz-e-feijao-tradicao-e-seguranca-alimenta>. Interministerial Chamber for Food and Nutrition Security (CAISAN) (2024), as per the acronym in Portuguese). Retrieved from <https://www.gov.br/mds/pt-br/caisan#:~:text=A%20C%C3%A2mara%20Interministerial%20de%20Seguran%C3%A7a,de%20Seguran%C3%A7a%20Alimentar%20e%20Nutricional>. Gastromotiva (2024). Retrieved from <https://gastromotiva.org/>. Food Bank Brasil (Banco de Alimentos) (2023). <https://www.bancodealimentos.org.br/>. Save Food Brasil (2024). <https://www.foodtosave.com.br/>.

Various public, private, or third-sector initiatives can significantly contribute to national efforts to combat food losses and waste. They should be considered in the revision process of the Intersectoral Strategy for Reducing Food Loss and Waste in Brazil. From this effort, Brazil can serve as a reference for other countries regarding an integrative and multisectoral approach to the subject.

## 5. Trends for the Future of Food Loss and Waste

In an era marked by escalating environmental and social challenges, fostering awareness of responsible consumption has become more imperative than ever. Addressing food waste transcends mere concerns about food availability; it embodies a complex interplay of environmental sustainability, social equity, and economic efficiency.

A striking projection by the United Nations warns that, should current consumption patterns persist, the world population—expected to reach 9.6 billion by 2050—would require resources equivalent to those of three Earths. Within this context, Brazil's commitment to the UN goal of halving food waste by 2030 underscores the urgency of this issue and aligns with the Sustainable Development Goals (SDGs). Specifically, SDG 12 emphasizes the transition toward sustainable production and consumption practices, advocating for more efficient resource management and shifts in consumer behavior (Tambosi, 2020).

A promising and underutilized solution in this realm is the cultivation and consumption of Unconventional Food Plants (UFPs). These plants, characterized by their nutritional and medicinal potential, thrive in both urban and natural environments, offering an accessible and resilient food source. However, their widespread adoption remains hindered by limited public awareness and knowledge, restricting their integration into mainstream diets and food security strategies.

Raising awareness about responsible consumption and curbing food waste is an imperative for contemporary societies, with academic research and public engagement serving as vital instruments in this endeavor. One innovative approach to reducing food waste involves embedding detailed usage instructions directly onto product labels, supplemented by QR codes that provide accessible and dynamic guidance. Such an initiative could significantly decrease improper food disposal by equipping consumers with crucial information on storage, preparation, and repurposing strategies. Empirical studies have demonstrated that heightened consumer awareness and easy access to practical information play a pivotal role in minimizing food waste (Hebrok & Boks, 2017; Richter & Bokelmann, 2021).

Beyond optimizing food utilization, these labels could also serve as tools for sustainable waste management by offering guidance on proper disposal practices for packaging and residual food materials. This integration aligns with contemporary sustainability priorities, reinforcing selective collection and recycling efforts. Incorporating such information into labeling strategies fosters more conscious consumer behavior, ultimately contributing to a circular economy (Schanes et al., 2018).

For perishable and organic food items, accessible storage and usage guidelines could be displayed in retail settings through physical media such as pamphlets, posters, or digital screens. Additionally, ensuring that such resources are available in formats inclusive to individuals with disabilities would enhance accessibility and adoption. This approach not only facilitates informed consumer choices but also minimizes waste at various stages of the food consumption chain (Delgado et al., 2021; IDB, 2022).

A successful example in Brazil is the incorporation of ora-pro-nóbis (*Pereskia aculeata*), which is considered an Unconventional Food Plant (UFP), into community gardens and institutional meals. Rich in protein, iron, and dietary fiber, this plant has been promoted for food security in regions affected by food deserts and has proven adaptable to both urban and rural agroecological systems. According to Kinupp & Lorenzi (2014), its use in school gardens and low-cost recipes contributes to reducing food waste by diversifying the diet with locally available and resilient plant species.

To complement these initiatives, targeted educational campaigns can further drive consumer engagement with sustainable consumption practices. Moreover, supportive public policies that mandate informative labeling and consumer education could amplify the impact of these strategies, resulting in a measurable reduction in food waste and its environmental footprint (Stöckli et al., 2018).

Recent studies, such as those by Van Geffen et al. (2020) and Richter & Bokelmann (2021), have documented how normative prompts, food literacy, and more explicit labeling directly influence consumer behavior, leading to measurable reductions in household food waste.

### 5.1. Reverse Logistics in the Food Industry

Reverse logistics refers to the process by which products return from the final consumer back to the supply chain. In the food industry, this practice has proved vital in recovering foods that, for various reasons, have not been sold but are still suitable for consumption. According to research conducted in Norway, this approach has demonstrated significant benefits in reducing food waste and optimizing supply chain management (Hansen, 2020).

In the European scenario, measures to combat food waste at retail and consumption levels have been evaluated. For example, in Germany, a practice known as “dumpster diving,” which consists of taking food from waste containers of supermarkets or factories, was considered illegal, counterproductive waste reduction efforts. France, on the other hand, took a more proactive approach. Since 2016, French supermarkets have been required to sign agreements with charities, donating food that would otherwise be discarded. Similar initiatives are also being considered in other EU countries. However, there are still challenges related to taxation and donations, mainly due to the variable interpretation of tax guidelines related to food donation (Garske et al., 2020).

Relevant studies on food waste worldwide and its prospects for the future are

available on academic platforms. An article published in SciELO focuses on the challenges and opportunities in sustainable operations related to food waste. It highlights the need for multidisciplinary efforts to achieve SDG 12.3, which aims to halve food waste. The impact of the COVID-19 pandemic is also discussed, emphasizing the urgency of combating food waste, especially regarding food redistribution to vulnerable people affected by the pandemic (Vieira et al., 2021).

Despite its potential, reverse logistics in Latin America faces regulatory and logistical hurdles. Tax disincentives for donations, lack of cold chain infrastructure, and ambiguous liability rules often discourage companies from returning surplus food to the supply chain (Garske et al., 2020; Global Food Banking Network, 2024). Addressing these barriers requires coordinated policy efforts and clearer legal frameworks.

## **5.2. Reduction of Food Loss and Waste through Partnerships**

In addition to reverse logistics, establishing partnerships between different entities, whether companies, retailers, or NGOs, is also a promising strategy. Through these collaborations, more efficient processes to redistribute foods close to the end of their shelf life or in excess can be created. These foods can be directed to community feeding programs and school meals or transformed into by-products, such as animal feed or composting.

A collaborative approach to food governance is gaining momentum with the emergence of Food Policy Councils (FPCs). These boards, composed of various stakeholders, address food-related issues in their respective communities. The strength of FPCs lies not only in their direct efforts but in the way they can connect and coordinate different organizations in their communities, whether they are directly linked to the food industry, such as farms and food banks, or external entities, such as government agencies and schools (Nadeau & Koebele, 2023). The inter-organizational collaboration provided by FPCs demonstrates that, by joining forces, it is possible to achieve goals that would be unattainable individually.

## **5.3. Food Redistribution through Social Innovation**

Social innovation (SI) can offer valuable models to reduce food waste, establishing new relationships between participants in the food supply chain and involving actors that generally do not actively participate. An analysis of an Italian case study called “Avanzi Popolo 2.0”, an IS project managed by a non-profit organization, highlights the importance of creating a sense of community and social capital in local food redistribution networks (Lombardi & Costantino, 2020).

## **6. International Technical Cooperation and the Perspectives for Governance in Combating Food Loss and Waste**

Within the realm of technical implementation, Brazil has demonstrated significant leadership through various programs and initiatives spearheaded by the Brazilian Cooperation Agency (ABC). These efforts have fostered sustainable devel-

opment, social protection, and food security across Africa and Latin America while also contributing to humanitarian and multilateral cooperation with developed nations and international organizations (ABC, 2021).

ABC has played a pivotal role in advancing food security through strategic initiatives such as the Food Acquisition Program (PAA, as per the acronym in Portuguese), an exemplary model shared with other developing countries as a practical approach to combating hunger and promoting local agricultural development. In collaboration with the Food and Agriculture Organization of the United Nations (FAO), Brazil has also supported projects aimed at improving nutrition and strengthening food security worldwide (FAO, 2023).

The Sustainable School Feeding Network (RAES, as per the acronym in Portuguese), established in 2018 through a partnership between the Brazilian government and FAO, has reinforced efforts to mitigate food waste. This initiative fosters the exchange of best practices among Latin American countries, particularly regarding the reduction of food waste in school environments (FAO, 2018). By facilitating knowledge sharing, RAES contributes to the development of more resilient and sustainable food systems within the region.

Globally, numerous initiatives have been launched to combat food waste and enhance food governance. A prominent example is The State of Food Security and Nutrition in the World series, published annually, which provides valuable insights and recommendations for reducing food losses and waste on an international scale (FAO, 2023). Additionally, the Paris Declaration, signed during the first Global School Meals Coalition Meeting, underscores the international commitment to strengthening food security through sustainable school meal programs. Co-chaired by Brazil alongside Finland and France, this coalition emphasizes the importance of public policies that integrate family farming into school nutrition programs, thereby promoting food sustainability and minimizing waste. The initiative also highlights the urgency of coordinated actions to achieve the Sustainable Development Goals (SDGs), particularly those related to hunger eradication and equitable food systems (Paris Declaration, 2023).

The United Nations General Assembly has reinforced these efforts through key resolutions advocating for enhanced food security and waste reduction. Resolution 70/259, known as the Decade of Action on Nutrition (2016-2025), underscores the necessity of a globally coordinated strategy to combat hunger and improve nutrition (Cotton Farming). Similarly, Resolution 74/238 prioritizes food loss and waste reduction as fundamental to achieving the SDGs, reaffirming the global commitment to sustainable food governance (FAO, 2023). These resolutions exemplify the collective will to address food waste through policy-driven interventions and strategic international collaboration.

Consequently, global partnerships have emerged as crucial mechanisms for combating food loss and waste. Collaboration between nations that have achieved significant progress—such as those highlighted in this study—and countries seeking to strengthen their food policies foster mutual benefits. By sharing technolog-

ical advancements and best practices, recipient countries can tailor these initiatives to their specific contexts, improving policy frameworks and enhancing measures to combat food losses and waste. This cooperative approach reinforces the broader objective of sustainable food systems and equitable access to nutrition worldwide.

## 7. Conclusion

Given the pressing need to mitigate food waste, the food industry must adopt strategic measures such as reverse logistics and food recovery. These approaches enable the redirection of unsold or near-expired food toward alternative uses, including redistribution and donation programs. However, the effectiveness of these strategies relies on well-defined regulatory frameworks and heightened public awareness, ensuring responsible and sustainable food management throughout the supply chain.

Addressing food waste requires a multidimensional approach that integrates global strategies, public policies, sustainable business practices, and educational initiatives. Tackling the ingrained culture of consumerism and fostering a deeper appreciation for the intrinsic value of food is critical to building a more sustainable and equitable food system.

Within the context of family farming, the expansion of commercial channels for UFPs presents a valuable opportunity, aligning with Brazil's ongoing strategy revision. These plants, often rich in nutrients and possessing medicinal properties, remain underutilized primarily due to a lack of public knowledge. This challenge is compounded by the broader global trend of underutilizing food diversity, which limits sustainable food alternatives and contributes to unnecessary waste.

Effectively reducing food loss and waste demands a comprehensive and integrated approach involving coordinated efforts within the United Nations to unify studies and reports that can inform global governance mechanisms. In the Brazilian context, the engagement of agricultural statistics institutions is essential to ensure evidence-based policymaking. By identifying the key factors driving food loss and waste, targeted interventions can be designed, ranging from legislative measures on food labeling and consumer education to structured public-private partnerships that facilitate waste reduction and promote more efficient food distribution.

Considering the discussions presented in this article, it is evident that leveraging international governance bodies focused on food security is essential. Additionally, Brazil's revision of its \*Intersectoral Strategy for the Reduction of Food Loss and Waste\* provides a timely opportunity to establish a dedicated working group on this critical issue. Such an initiative would bring together researchers, civil society, public sector representatives, international organizations, and private sector stakeholders to develop collaborative solutions for reducing food losses.

Furthermore, international cooperation remains a cornerstone in addressing food waste. The exchange of best practices and policies among nations is instru-

mental in fostering effective interventions. In 2024, given Brazil's presidency of the G20, the country was uniquely positioned to drive global discussions on sustainable food systems, reinforcing its commitment to achieving the United Nations' Sustainable Development Goals and advancing meaningful progress in food security and waste reduction worldwide.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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