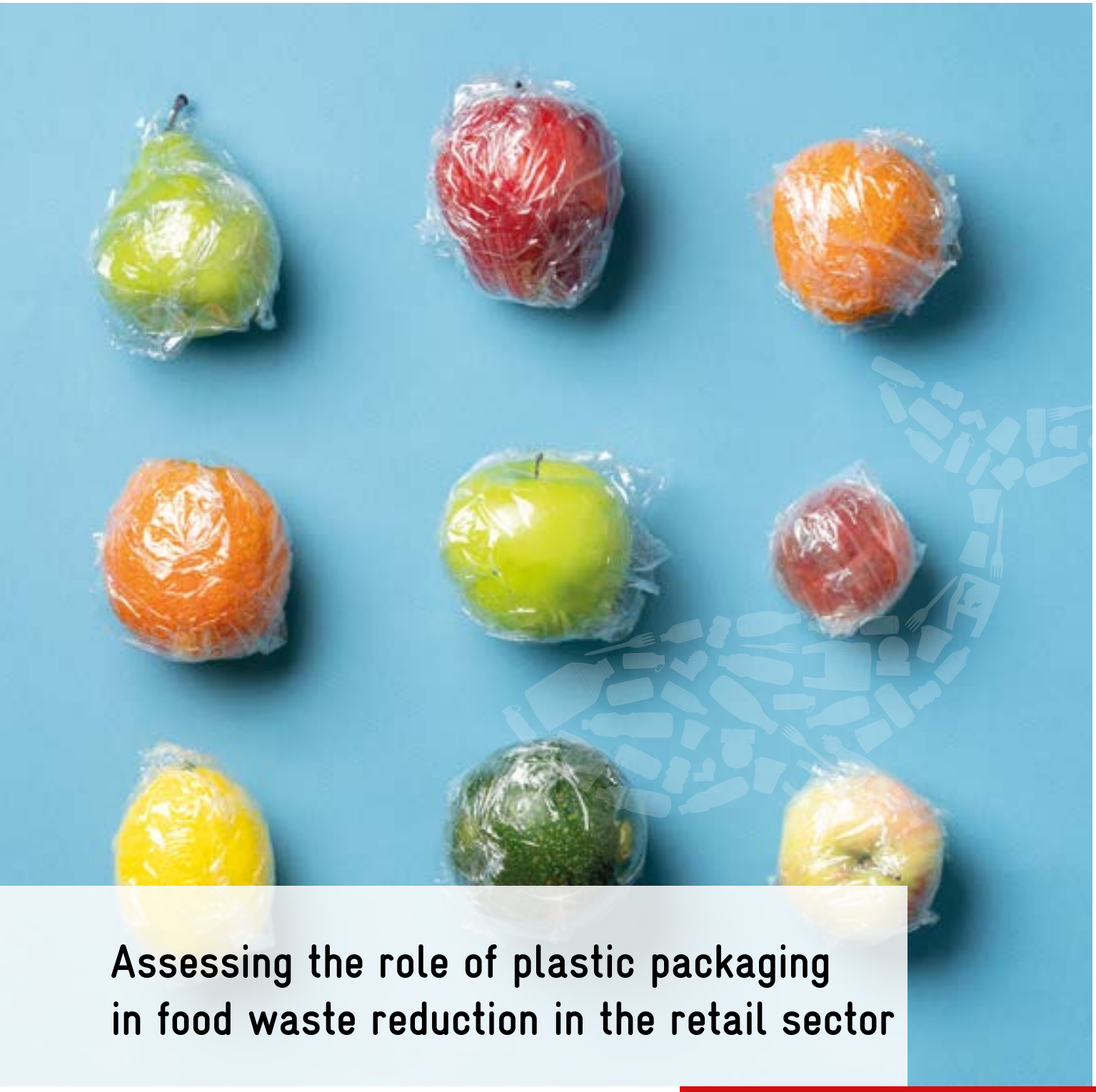


Assessing the role of plastic packaging in food waste reduction in the retail sector

Exploring sustainable alternatives to plastic packaging in the context of Brazil, Colombia and Mexico

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

E info@giz.de
I www.giz.de/en/worldwide/138385.html

Programme:
Global sector project to support the BMUKN in implementing the Marine Debris Framework – Regional hubs around the globe

Authors:
Tarun Shesh, Rafaela Craizer, Mohamed Kotaish, Federica del Llano (BlackForest Solutions)

Reviewers and editors:
Filiz Jätzold, Maryvonne Kälberer, Phong Giang, Florian Mestl (GIZ)

Responsible:
Elisabeth Duerr
E elisabeth.duerr@giz.de

Design/layout:
Ira Olaleye, Eschborn

On behalf of:
German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN)

Photo credits:
Cover, front and back, Pg. 5, 6, 7, 10, 16, 28, 25, 27, 62, 71: © istock/Михаил Руденко;
all other photos of fruit: AI generated.

Disclaimer:
This study was commissioned by and completed exclusively for the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The opinions expressed in this study are those of the authors and reviewers and do not necessarily represent the opinions or positions of the GIZ. GIZ does not, however, guarantee the accuracy or completeness of information in this document, and cannot be held responsible for any errors, omissions or losses which result from its use. Responsibility for the content of external websites linked in this publication always lies with their respective publishers.

Map disclaimer:
Country borders or names do not necessarily reflect the GIZ official position. The maps in this publication are for illustrative purposes and do not imply any opinion on the part of GIZ, concerning the legal status of any country or territory or concerning the delimitation of frontiers or boundaries.

Bonn 2025

Executive summary

This publication addresses the intersection of two pressing challenges in Latin America: food waste and plastic packaging. In Brazil, Colombia, and Mexico, supermarkets and retail chains are expanding rapidly, reshaping how food is packaged, sold, and discarded. Packaging reduces spoilage and supports food safety, yet it also creates large volumes of plastic waste that existing collection and recycling systems cannot manage. The central question guiding this report is: how can packaging be rethought so that it prevents food loss without generating new environmental burdens?

How can packaging be rethought so that it prevents food loss without generating new environmental burdens?

To answer this question, the report is organised in three interconnected parts:

Part I builds the analytical foundation by examining how packaging practices, food loss dynamics, and retail systems interact, particularly across Brazil, Colombia, and Mexico.

Part II explores practical and scalable solutions that can reduce both food and packaging waste.

Part III looks ahead, outlining the policy frameworks, behavioural enablers, and strategic recommendations needed to scale these solutions and guide the region's transition toward circular, low-waste food systems.

Drawing on regional analysis and international best practice, the report presents solutions in three domains:

- **Material innovations** ▸ Improvements to packaging materials such as compostables, bio-based plastics, fibre alternatives, and edible coatings. These solutions can reduce the footprint of packaging when aligned with waste infrastructure but are not sufficient on their own.
- **System and business-model redesign** ▸ Interventions that go beyond material substitution, including reuse and refill models, returnable bottles, loose produce sales, and short food supply chains. Case studies from Latin America show how retailers and brands are already piloting such models, with measurable benefits for both packaging and food waste reduction.
- **Policy and consumer enablers** ▸ The regulatory and behavioural frameworks that make innovation viable. Extended Producer Responsibility (EPR), eco-design standards, targeted bans, and recycling and composting targets provide the 'rules of the game,' while consumer-facing measures such as clear date labels, awareness campaigns, and in-store guidance translate them into practice.

Case study

Case studies from the region and beyond illustrate the opportunities and challenges of implementing circular packaging systems in real markets.

The report concludes that reducing food and packaging waste in Latin America requires more than material substitution. Significant losses occur before packaging is relevant, e.g. during harvest, storage, and transport. Also, at the consumer level waste arises from over-purchasing, large portions, and expired food. In some cases, packaging has no effect on shelf life. Where packaging adds value, e.g. by extending shelf life and protecting produce, it must be embedded in a wider systemic shift. Material innovation, system redesign, and policy must be pursued together. Only through coordinated action can packaging shift from being a driver of waste to a lever for food-loss prevention, delivering climate, social, and economic benefits for Latin America's retail sector. The challenge is complex, but the way forward is clear: redesign the system, not just the package.

The challenge is complex, but the way forward is clear: redesign the system, not just the package.

Figure 1 Overall structure of the publication: from evidence to action

Part I
Facts and figures – the theoretical base

Part II
From theory to practice – low-plastic solutions

Including case studies

Part III
Recommendations and conclusion

Source: adapted from BFS 2025.

Contents

Tables

Figures

Case studies

Case study

List of abbreviations

APR	Association of Plastic Recyclers
B2B	Business to Business
B2C	Business to Consumer
CSA	Community-Supported Agriculture
EoL	End of Life
EPR	Extended Producer Responsibility
EU	European Union
FDA	Food and Drug Administration
FLW	Food Loss and Waste
FMCG	Fast Moving Consumer Goods
GHG	Greenhouse Gas
LCA	Life Cycle Assessments
LMIC	Low- and Middle-Income Country
MERCOSUR	Mercado Común del Sur
PE	Polyethylene
PET	Polyethylene terephthalate
PNRS	National Solid Waste Policy (Brazil)
PP	Polypropylene
PRE	Plastics Recyclers Europe
PRO	Producer Responsibility Organisation
PS	Polystyrene
PVC	Polyvinyl Chloride
SFSC	Short Food Supply Chains
SKU	Stock-Keeping Unit
SUP	Single-Use Plastic

Part I

Facts and figures – the theoretical base

1 Introduction

1.1 Objectives, scope, and target audience

Plastic is ubiquitous in the retail sector, commonly used to package a wide range of produce available on supermarket shelves. In parallel, roughly 13 per cent of food is lost or wasted as a result of retail sector practices (UNEP 2024). This makes plastic packaging and food loss and waste (FLW) two deeply interconnected global challenges of urgent concern. The far-reaching implications of FLW and the plastic waste created in the intent to prevent it are evident not only in plastic pollution, but also in their contribution to food security, climate change, and inefficient resource use, challenges that are disproportionately felt in low- and middle-income countries (LMICs). Despite global momentum to address each problem individually, relatively little attention has been given to their joint dynamics, especially within the retail and supermarket sector. The retail sector, particularly supermarkets, sits at the nexus of these issues, where decisions on how food is packaged, distributed, and sold have significant implications for sustainability.

This publication examines how plastic packaging practices in retail settings influence FLW and explores scalable packaging and systemic solutions to mitigate the negative externalities of both waste types simultaneously. The core objective of this publication is to attempt to answer the following question: How can scalable sustainable solutions be implemented to reduce plastic packaging in the retail sector without generating more food waste? While the publication targets policymakers and retailers in LMICs globally, offering analysis and guidance grounded in global and regional trends, stakeholder insights, and best applicable practices, the focus is on Latin America, specifically Brazil, Colombia, and Mexico, as exemplary emerging economies grappling with rapid retail growth, rising plastic pollution, and persistent food loss. Rather than offering broad global recommendations, this publication concentrates on Brazil, Colombia, and Mexico to respond to the lack of tailored regional solutions that account for local retail structures, food systems, and waste management realities. However, the publication also provides a high-level guideline on leveraging each focal country's learning opportunities for similar LMIC settings globally, especially in Asia and Africa, where modern retail practices may follow similar trajectories to a certain extent.

How can scalable sustainable solutions be implemented to reduce plastic packaging in the retail sector without generating more food waste?

The retail sector plays a pivotal but often overlooked role in shaping food and packaging outcomes. Essentially, nearly a third of the approximately 5.53 billion tonnes of food produced is either lost or wasted. At the same time, nearly a third of the global population grapples with food insecurity (UNEP 2024, FAO 2023). An estimated 1.05 billion tonnes of food was wasted globally in 2022 in the retail, food service, and household sectors combined, amounting to roughly 132 kg/capita/year as shown in Table 1. This represents 19 per cent of total food produced. Additionally, 13 per cent of food is lost in the supply chain after harvesting prior to reaching the retail sector for distribution (UNEP 2024).

While households generate the largest share of food waste globally, retailers significantly influence upstream and downstream waste through procurement standards, inventory practices, and packaging design. In Latin America, the supermarket sector has expanded aggressively in recent years, reshaping food systems and increasing the volume and visibility of food packaged in plastics. Retailers also act as intermediaries between food producers and consumers, determining how food is presented, portioned, and preserved. Despite accounting for only 13 per cent of food waste globally (Table 1), the retail sector holds outsized leverage to implement solutions that can reduce losses across the supply chain. For example, changes in how perishable products such as fresh fruits and vegetables are packaged (or not) can influence both shelf life and consumer-level waste. Yet most interventions tend to focus either on households or the food service sector, leaving the retail sector unexamined.

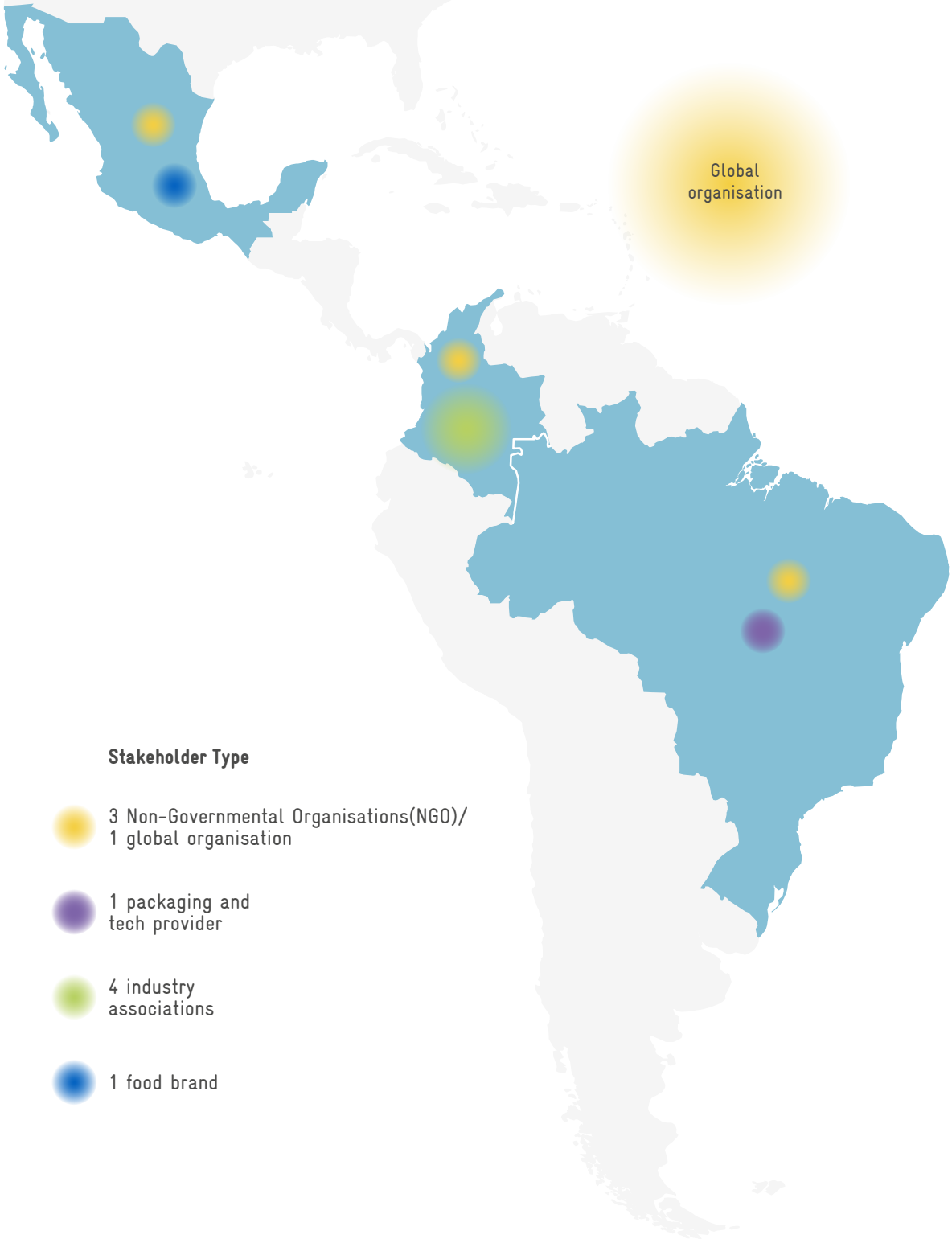
Table 1 Estimates of global food waste in 2022

Sector	Global average (kg/capita/year)	2022 total (million tonnes)	Contribution by sector
Household	79	631	60%
Food service	36	290	27%
Retail	17	131	13%
Total	132	1,052	100%

Source: adapted from UNEP 2024.

To investigate these dynamics, the publication draws from two sources. First, it is based on a comprehensive literature review of academic publications, international reports, and policy documents on FLW and packaging systems. Second, it incorporates insights from ten semi-structured interviews with stakeholders across Brazil, Colombia, and Mexico. Interviewees included packaging manufacturers, retail representatives, food industry associations, plastics industry associations, and civil society actors or non-governmental organisations (NGOs). These consultations were useful in identifying context-specific challenges, behavioural drivers, and implementation barriers often overlooked in technical assessments.

Figure 2 Overview of stakeholder consultations conducted

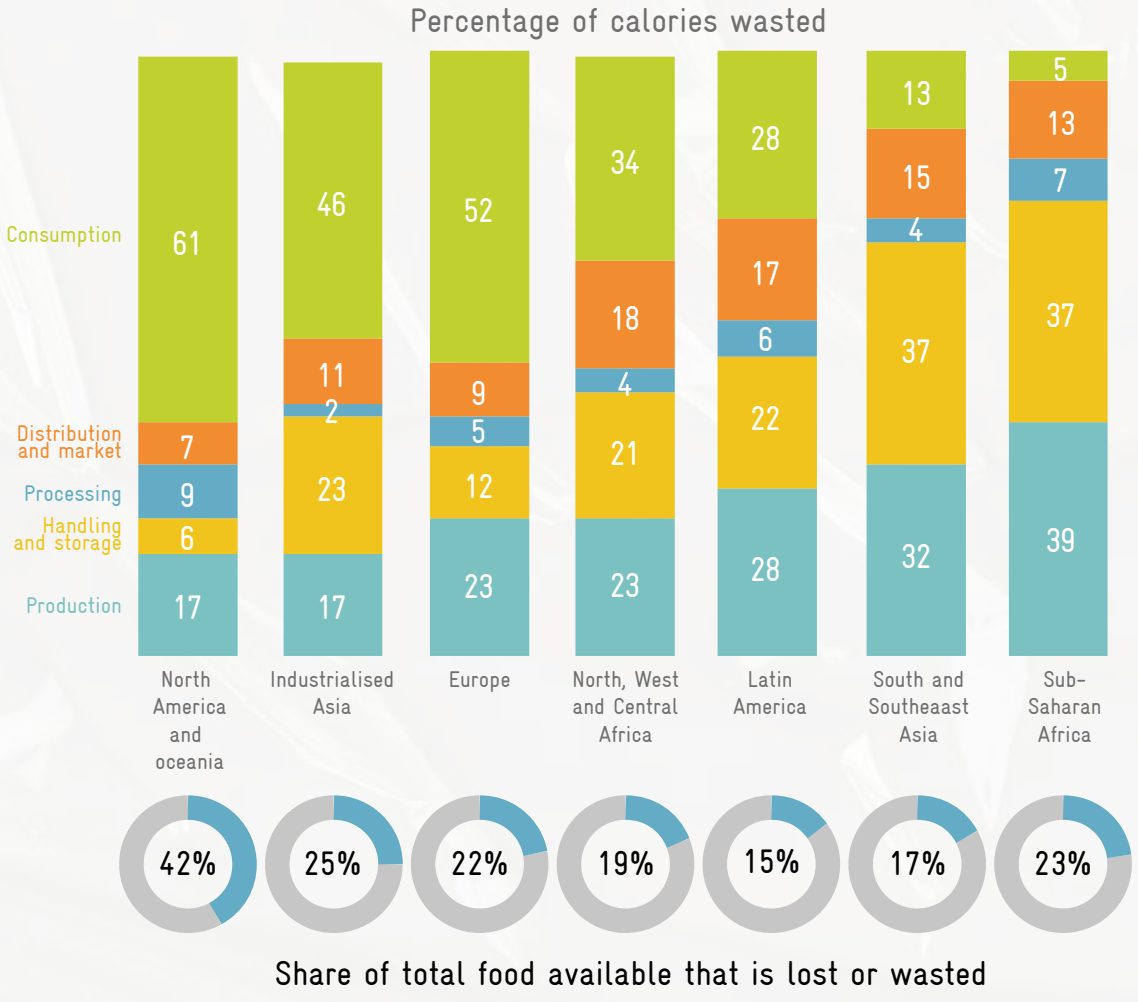


Source: adapted from BFS, 2025.

1.2 Focus region: Latin America with Brazil, Colombia and Mexico

The selection of Brazil, Colombia, and Mexico as focus countries for this study is related not only to their significant roles in plastic waste generation, their proactive policy initiatives, and their potential to influence broader regional practices, but also due to similarities with other regions in terms of retail structures and regulatory frameworks. These three countries are characterised by expanding supermarket sectors, evolving regulatory frameworks on packaging and waste, and increasing consumer awareness, features that are also shared across many LMICs. While the publication is targeted to the Latin American context, Figure 3 illustrates that food loss along the distribution and market portion of the value chain is similar in Latin America, South and Southeast Asia, and Africa, ranging from 13 to 18 per cent.

Figure 3 **Food loss along the value chain, by region, and life cycle stage**



Source: adapted from UNEP 2022.

Brazil is among the top contributors to food waste in Latin America, with substantial volumes lost annually. This wastage not only represents a loss of resources but also contributes to environmental degradation through increased greenhouse gas emissions. Additionally, Brazil is the largest contributor to ocean plastic pollution in Latin America and ranks eighth globally, with a significant portion of its annual plastic waste entering marine environments and harming ecosystems (Fonseca, 2024). These intertwined issues of food wastage and plastic pollution highlight the need for integrated strategies addressing both challenges.

In **Mexico**, over 35 per cent of all food produced is lost or wasted each year, amounting to approximately USD 25 billion. This loss is particularly concerning given that much of the wasted food is nutritious and could alleviate hunger among the 28 per cent of the population experiencing food insecurity (Harvard Law School 2024). Concurrently, Mexico faces challenges with plastic waste, especially from food packaging. The country has implemented various bans and restrictions on single-use plastics (SUPs), including disposable plastic bags and straws, to combat environmental pollution (UNEP 2023). Addressing food wastage and plastic packaging pollution is crucial for Mexico's environmental sustainability and food security.

Colombia has taken legislative measures to reduce plastic waste, particularly targeting SUPs. The country has implemented laws to phase out certain plastic products and promote biodegradable alternatives. These efforts align with Colombia's commitment to a circular economy and environmental sustainability (Dabo 2024). While specific data on food wastage in Colombia is limited, the country's proactive stance on plastic reduction positions it as a relevant focus for studying the intersection of food packaging and waste management (ADBioplastics 2024).

Apart from the relevance of the food waste and plastic waste problems prevalent in the three countries, Brazil, Mexico, and Colombia are also characterised by the following factors justifying their selection as the focal countries for this study:

- **Significant supermarket and retail sectors** ▸ The three countries have rapidly expanding supermarket and retail sectors, which have transformed food distribution and packaging trends. Brazil's supermarket sector generated USD 107 billion in 2020, accounting for about 7.5 per cent of GDP (Santander Trade 2025). Similarly, Mexico's retail grocery sector was valued at USD 100 billion in 2023 (Statista 2024). Colombia, though smaller, has a growing supermarket industry with major retail chains expanding nationwide. These large markets influence packaging trends, with a strong presence of multinational retailers like Walmart and Carrefour, shaping global packaging standards.

- **Policy and regulatory momentum** ▸ All three countries have implemented significant policies targeting plastic waste reduction, especially in food packaging. Colombia's Law 2232 of 2022 mandates the phasing out of SUPs, requiring all plastic products to be reusable, recyclable, or compostable by 2030 (ADBioplastics 2024). Mexico has taken substantial steps, with over 20 states banning SUPs, while the National Agreement for a New Plastic Economy commits businesses to ambitious sustainability targets (Michail 2020). Brazil, despite slower national regulation, is preparing laws that require companies to recycle 50 per cent of their plastic packaging (Nemitz 2024). These policies create a strong regulatory environment for studying the impact of

plastic reduction on food waste. Brazil, Mexico, and Colombia together cover a broad spectrum of policy tools (taxes, bans, voluntary accords, and comprehensive laws) in large markets, offering a rich comparative perspective.

- **Private-sector sustainability initiatives** ▸ Leading corporations in these countries are innovating to reduce plastic reliance. Grupo Bimbo, a Mexican multinational food company, has pledged to use 100 per cent recyclable or compostable packaging by 2025 (Bimbo Bakeries 2024). Brazilian firms like Videplast are developing recyclable food pouches, while Colombian companies are investing in bio-based packaging and refillable bottle programs. These business-driven initiatives complement national policies and provide valuable case studies for sustainable packaging solutions.

- **Representative conditions and market similarities** ▸ By focusing on Brazil, Mexico, and Colombia, we capture a spectrum from an upper-middle-income, industrialised economy with a huge internal market (Brazil), to a middle-income country closely integrated with North American trade and standards (Mexico), to a slightly smaller but reform-minded economy (Colombia). Despite these differences, Brazil, Mexico, and Colombia share common challenges, including food waste, plastic pollution, and growing consumer demand for sustainability. As major agricultural producers, all three countries have similarly extensive supply chains from farm to market with potential loss points and packaging needs. Additionally, similar consumer preferences for fresh food in the three countries makes findings about packaging and waste in these countries relevant to other nations with similar diets and market conditions. Their combined market size, proactive policies, and strong retail presence make them ideal test cases for solutions that can be scaled across Latin America and beyond.

This study aims to identify and support solutions to reduce food waste and plastic packaging pollution.

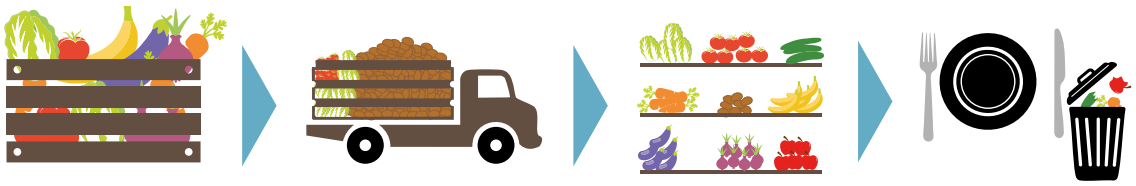
This study aims to identify and support scalable solutions emerging from Brazil, Mexico, and Colombia and globally that can be adapted across Latin America to promote a collaborative approach to reducing food waste and plastic packaging pollution.

2 Critical assessment of plastic packaging in food retail

2.1 Causes of food waste in the retail sector in Latin America

FLW remains a serious challenge in Latin American supermarkets and grocery retailers. In developing countries, food waste is largely driven by supply chain inefficiencies, limited infrastructure, and gaps in food storage awareness. Post-harvest losses, inadequate storage, and transport-related challenges are key contributors. Hot and humid climates further accelerate the spoilage of perishable goods. In contrast, food waste in developed countries is primarily linked to overproduction, retail practices, and consumer behaviour. Identifying when and where losses occur along the supply chain helps pinpoint both the hotspots of food loss and their likely causes. This is an essential step in assessing which losses are avoidable and which interventions are best suited to address them. Figure 4 below provides a high-level overview of the primary driving forces behind FLW in Latin America.

Figure 4 **Overview of primary factors driving FLW along the supply chain in Latin America**



Production
Fresh produce is often lost due to spoilage, damage, poor handling, and inadequate market infrastructure.

Handling & Storage
Long transportation distances, limited cold storage, and high ambient temperatures cause high rates of spoilage.

Retail
Retail practices such as overstocking and improper stock rotation lead to losses, especially in fresh foods.

Consumption
Bundled promotions and multi-pack formats drive consumption beyond what is necessary leading to food waste.

Across Latin America, an estimated **12 %** of **food is lost or wasted** at the retail and consumption stages

Source : adapted from BFS, 2025.

Fresh fruits and vegetables account for the largest share of FLW, with studies indicating that close to 30 per cent of produce never reaches the consumer due to spoilage, damage, or over-restrictive quality standards (UNEP 2022). This is particularly evident in urban centres, where most retail food waste is concentrated. In Brazil and Mexico, high ambient temperatures, long transportation distances, and limited refrigeration accelerate spoilage between harvest and shelf. In Colombia, where fresh produce is still largely sold through informal markets, food loss often occurs in the early stages of the supply chain (e.g., production, processing, or storage) due to poor handling, inadequate market infrastructure, and the absence of cold storage (Romagnoli, Molina and Parrado 2018, UNEP 2022, UNIDO 2025).

In retail settings, supermarkets and large distributors influence waste both directly and indirectly. Overstocking, improper stock rotation, and the early removal of items based on expiry dates all contribute to losses within stores. Upstream, retailers drive food loss through procurement policies that favour uniform appearance, impose strict delivery specifications, or cancel orders unpredictably. These practices can lead to edible food being discarded before it even enters the retail system.

Retail-level FLW is often most visible in fresh fruits and vegetables, followed by bakery products, dairy, and meat (FAO 2014). These products are highly perishable and require specific storage and handling conditions. In many cases, retail stores are not equipped with the infrastructure needed to maintain these conditions, particularly in smaller or informal outlets. In addition, bundled promotions and multi-pack formats commonly used in supermarkets can lead to over-purchasing and consumer-level waste, especially for perishable items (Reynolds, et al. 2024).

Due to these challenges, the retail sector holds significant potential to reduce FLW, which requires solutions beyond (plastic) packaging alone. Improvements in cold storage, better inventory and stock rotation practices, and the implementation of dynamic pricing or food donation systems can help recover surplus food. Packaging also has a role to play, particularly when it is designed to extend shelf life and reduce physical damage without creating additional environmental burdens. However, the effectiveness of packaging depends on how it is integrated with broader retail practices, including merchandising, procurement, and waste management systems.

As the demand for fresh food continues to rise in Brazil, Mexico, and Colombia, it is essential to strengthen the resilience and efficiency of retail food systems. Reducing FLW at this stage can contribute to improved food security, lower greenhouse gas emissions, and reduced economic losses. The next sections explore how packaging strategies, when paired with supportive retail interventions, can help achieve these outcomes.

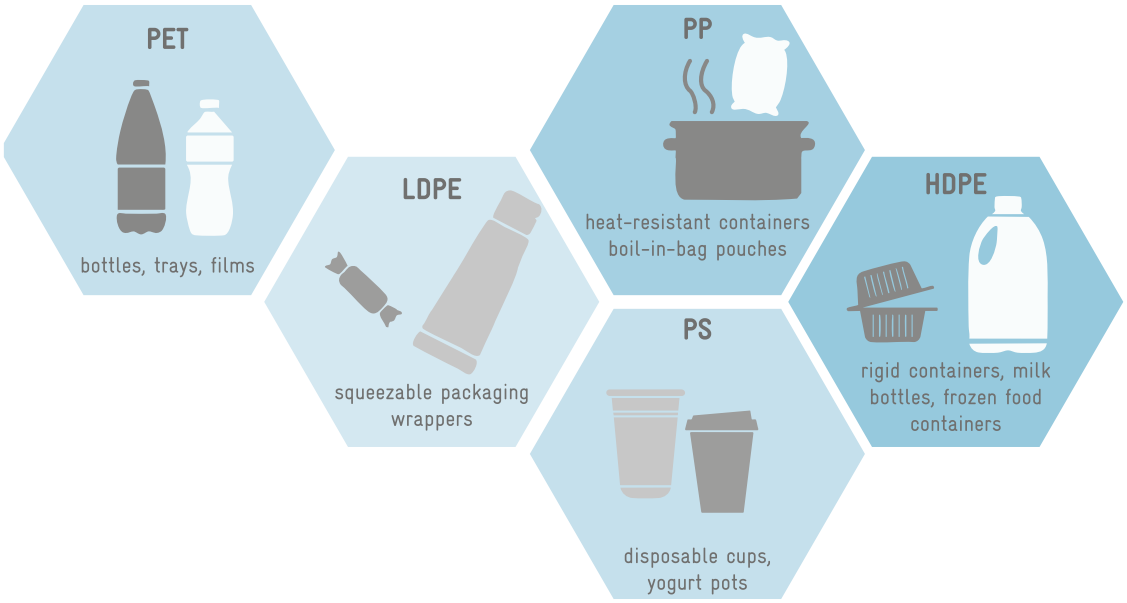
The retail sector holds significant potential to reduce food loss and waste, beyond (plastic) packaging alone.

2.2 Role of plastic packaging in the food supply chain

2.2.1 General functional requirements from plastic packaging for food

Plastic has become the default material for food packaging in modern retail due to its versatility, light weight, and low cost. With produce quality beginning to deteriorate at the moment of harvest, plastic packaging has proven effective at slowing spoilage and extending shelf life, particularly for perishable products. The most commonly used polymers in packaging solutions are polyethylene (PE), polypropylene (PP), polystyrene (PS), and polyethylene terephthalate (PET) (Figure 5).

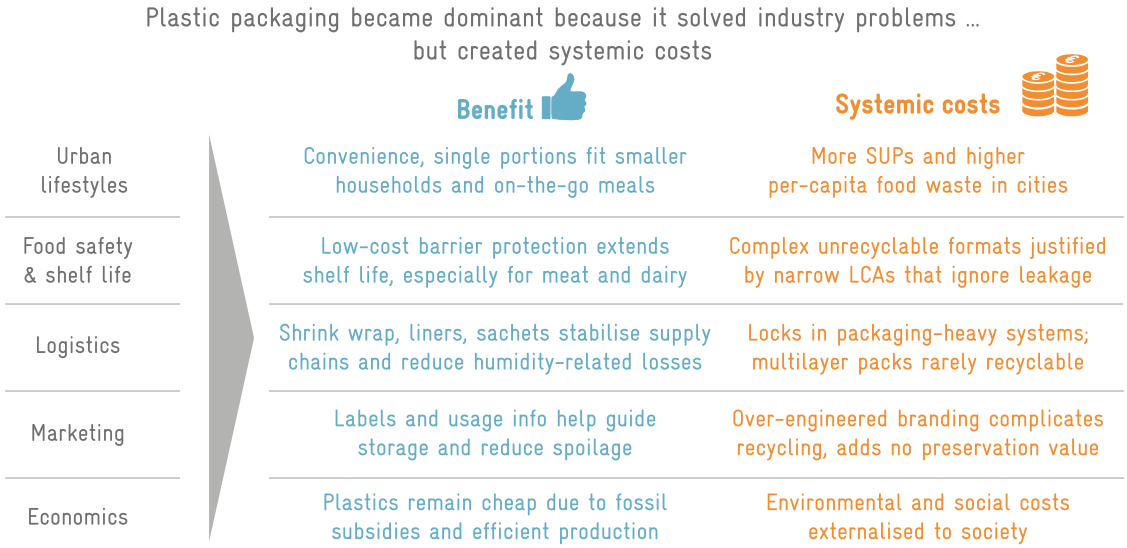
Figure 5 Plastic materials commonly used in food packaging



Source: adapted from Vuorinen, et al. 2024.

Globally, packaging is the single largest use of plastic, accounting for about 40 per cent of plastic produced (Greenpeace 2024, Plastics Europe 2022, Vuorinen, et al. 2024). The expansion of supermarkets and processed food markets, especially since the mid-20th century, coupled with increasing urbanisation has led to an explosion of single-use wrappers, bags, trays, and containers. The growth in usage of plastic packaging has been fuelled by several factors as shown in Figure 6.

Figure 6 How plastic packaging became the default choice



Source: adapted from BFS 2025.

- **Urbanisation and changing lifestyles** ▸ Urban growth and rising incomes drive demand for pre-packaged and ready-to-eat foods. SUPs support convenience and fast-moving consumer goods (FMCGs) (Ellen MacArthur Foundation 2017). Smaller households and busier lives increase portioned packs and takeaway meals, each typically wrapped in plastic. While convenient, this raises packaging waste and, in cities, higher per-capita food waste (Reynolds, et al. 2024). SUP convenience must be weighed against packaging's downstream impacts and opportunities for reduction.

- **Food safety and shelf life** ▸ Plastics extend the shelf life of perishables and reduce spoilage, making them a cost-effective tool for items where losses have high environmental costs, such as meat (Verghese, et al. 2013). Yet industry-led life cycle assessments (LCAs) often overstate benefits with a primary focus on greenhouse gas (GHG) emissions, omitting EoL impacts and leakage (MacKerron 2015). Effectiveness varies by product: sometimes plastics help, sometimes they add complexity without reducing waste. Marine litter and informal disposal in Latin America remain undercounted (Schweitzer, et al. 2018). Despite this, plastics are still strongly associated with hygiene by consumers and retailers.

- **Logistics and supply chain** ▸ Retail supply chains depend on plastics for stabilising pallets, lining bulk commodities, and protecting items over long distances. In humid climates common in Latin America and South and Southeast Asia, multilayer sachets keep products like coffee and spices safe from moisture and pests. These benefits come with trade-offs: multilayer packaging is rarely recyclable and entrenches waste-intensive distribution systems (Schweitzer, et al. 2018). Overall, globalised supply chains have locked retailers and manufacturers into packaging-heavy distribution models, often developed in high-income contexts, which are now being adopted into LMIC markets such as the Latin American region. Latin American stakeholders see plastics as critical to reducing food loss, which slows the uptake of alternatives.

- **Marketing and communication of product information** ▸ A product's packaging serves as the initial channel for consumers to be exposed and informed about the product. The plastic packaging design, functionality, and presentation can assist the user in making sound decisions about the product catering to their needs. The package also includes information on safe and proper product handling and preparation, thereby preventing the possible spoilage and wastage of food. Even basic information such as expiry dates presented in terms of 'Best Before' and 'Use By' labels can inform the consumer on the time frame for safe consumption of the product. The push to standardise and brand products for mass retail also leads to packaging that favours aesthetic and marketing considerations (glossy plastics, full-colour printing, pigmentation, etc.), which can complicate recycling. This suggests that packaging also serves a strong marketing function to appeal to consumers. While visually appealing packaging design may influence consumer preferences or branding strategies, it may have little to no functional value in terms of food preservation. Such cases present an opportunity to eliminate superfluous plastic packaging altogether.

- **Economics of scale and cost externalisation** ▸ Plastics remain cheap due to fossil subsidies and decades of industrial efficiency (Vuorinen, et al. 2024). Their environmental and social costs fall on municipalities and informal workers. Alternatives are typically more expensive due to limited supply chains. Retailers benefit from extended shelf life but do not pay disposal costs. Policies such as Extended Producer Responsibility (EPR) and virgin plastic taxes, now advancing in Brazil, Mexico, and Colombia, aim to rebalance incentives (ADBioplastics 2024, Abril Ortiz 2020, Bioleader 2025, Nielsen 2019, Nemitz 2024, McKenzie 2023).

In summary, plastic packaging became dominant because it solved many immediate problems for the food industry due to the properties it offered. The supply chain and hygiene qualities offered by plastic packaging led to undeniable short-term benefits in terms of convenience and lower per-unit costs but also encouraged over-packaging and disposable or linear consumption patterns. The following section examines the drawbacks of plastic packaging, delving into environmental and health impacts of plastic, the mixed evidence on packaging's role in reducing food waste, and the socio-economic implications including equity and gender issues.

2.2.2 Drawbacks of plastic packaging

While plastic food packaging may only serve its purpose for days or weeks, its environmental footprint lasts for decades or centuries. Most food packaging is used once and discarded, with 95 per cent of its material value lost after a single use (Ellen MacArthur Foundation 2020). The current linear model of 'take-make-dispose' has led to several interrelated crises:

- **Waste management and pollution** ▸ The majority of post-consumer plastic packaging is not effectively recycled or converted into new packaging. Regions characterised by informal waste services, including Brazil, Colombia, and Mexico, particularly use open dumping and burning as a plastic waste disposal practice. The result is widespread environmental leakage with an estimated 19–23 million tonnes of plastic entering aquatic ecosystems each year (Systemiq 2020). Studies show that most of the litter found on beaches originates from the food, beverage, and tobacco sectors. Around 85 per cent of beach litter globally is plastic, 61 per cent of which are SUPs such as sachets, wrappers, and pouches (Ocean Conservancy 2017). Such plastic can fragment and de-

grade into microplastics when exposed to environmental conditions – at least 14 million tonnes of microplastics settle on the bottom of the world's oceans (Barrett, et al. 2020).

- **Climate change and resource use** ▸ Plastics are fossil fuel-derived products, and their life cycle is carbon intensive. From oil and gas extraction, through energy used in production, to EoL incineration, packaging plastics contribute significantly to GHG emissions. Plastic packaging is expected to account for 20 per cent of global oil use by 2050, representing an increase from the current level of 7 per cent (Vuorinen, et al. 2024). Moreover, disposable packaging represents a waste of entrenched resources since plastic packaging production consumes energy and water which are wasted when packaging is quickly discarded.

- **Health risks** ▸ There is growing evidence that plastic packaging can pose risks to human health, both through chemical exposure and microplastic ingestion. Many plastics contain additives, such as phthalates for flexibility, Bisphenol-A for clarity or dyes, that can migrate into food especially when heated or used for fatty or acidic foods. Additionally non-intentionally added substances (NIAS) contained in plastic packaging which include impurities present in authorised substances are known endocrine disruptors and carcinogens (European Commission n.d.). Recycled plastics may also carry legacy contaminants from their previous life that were not designed for recycling processes and unregulated additives can appear particularly in informal markets (Vuorinen, et al. 2024). Recycled and reused plastic packaging can also accumulate and release hundreds of hazardous substances (Perkins 2023). The presence of harmful chemicals in recycled plastics raises concerns that, unless tightly controlled, promoting recycled content in food packaging could inadvertently expose consumers to more chemicals (European Commission n.d.). Regulators like the European Union (EU) and Food and Drug Administration (FDA) are examining these issues with some jurisdictions restricting recycled plastic use in direct food contact unless from approved sources. Brazil, Colombia, and Mexico permit the use of recycled plastic in food-contact applications but under certain conditions covering factors such as source location of recycled plastics, treatment processes, and component of packaging formed by recycled plastics (ADBioplastics 2024, Abril Ortiz 2020, Bioleader 2025, Nielsen 2019, Nemitz 2024, McKenzie 2023).

- **Ecosystem and food system impacts** ▸ Plastic waste can also indirectly affect food security and safety. In coastal communities, pollution of fisheries by plastic (e.g. fish ingesting microplastics) threatens livelihoods and food sources. In agricultural areas, the use of plastic packaging and mulch films can lead to soil contamination when plastics break down in fields. Open burning of plastic waste, common in some regions including the focus region, releases toxic pollutants (dioxins, furans) that can settle on crops or enter water supplies. Thus, improper disposal of packaging waste can cycle back into the food system in harmful ways.

- **Unequal impacts** ▸ In many Latin American cities, the burden of SUP packaging falls disproportionately on low-income communities and informal waste workers. Limited access to waste collection and recycling infrastructure often results in greater exposure to open dumping, burning, and pollution. Informal waste pickers, many of whom are women and children, often work without protective gear, sorting through dirty plastics or inhaling toxic fumes at burning sites. They typically earn less, handle lower-value waste streams, and face daily health risks with little support (GIZ 2025).

The hidden costs of plastic packaging far outweigh its convenience, and markets alone won't account for those costs. This provides a strong rationale for policymakers to intervene through policy measures (regulations, incentives, standards) that are needed to drive a shift toward sustainable packaging systems.

2.2.3 Myths versus facts on plastic packaging to prevent food waste

The packaging industry often argues that more packaging is justified by the gains in food preservation. The evidence presents a nuanced picture, and several myths can be debunked.

Myth 1

'More packaging = less food waste'

Latest research shows plastic packaging waste as another contributor to the inefficiency in the food system. Even though the excessive use of plastic packaging, specifically SUPs, is often justified by convenience, food preservation capacity, and shelf-life extension provided, food waste has grown concurrently with packaging waste, contesting the latter's contribution to food waste reduction (FAO 2014, Denkstatt 2017). Regions with the highest plastic packaging use (e.g., North America, Europe) also have the highest per capita food waste at the consumer level which suggests that underlying drivers such as consumer behaviour (e.g., over-consumption, improper storage, poor meal planning) and supply chain inefficiencies are significant factors in FLW rather than packaging alone (Schweitzer, et al. 2018). LMICs even exhibit the opposite trend wherein lower rates of household food waste have been witnessed despite lower plastic packaging consumption (Schweitzer, et al. 2018). A common assumption in food packaging research is that extending shelf life inherently reduces food waste. While longer shelf life increases the window for consumption, this does not necessarily translate into reduced waste particularly in households where overstocked refrigerators lead to food being overlooked until well past its expiry. In such cases, packaging delays spoilage, but not disposal (Canali, et al. 2014). Well-designed packaging can help for specific issues but an overreliance on packaging can mask inefficiencies in the food system that need addressing such as lack of cold storage or coordination failures between farmers and retailers.

Myth 2

'Without plastic packaging, fresh produce will spoil before sale'

This is only partially true and highly context dependent. In many LMIC contexts, fresh produce has traditionally been sold loose in open-air markets daily, relying on rapid farm-to-market cycles rather than long shelf life. Among the focal countries, Brazil is characterised by supermarkets supplying a substantial portion of produce with diminished informal channels compared to Colombia and Mexico. As mentioned earlier, countries with lower plastic packaging penetration tend to have lower levels of household food waste because consumers shop more frequently and value whole foods (Schweitzer, et al. 2018). Retail practices of pre-packaging produce in fixed quantities can lead to over-purchase and waste since a consumer may only need a small amount of produce but has to buy a larger pre-packaged portion, some of which must be discarded due to spoilage (Reynolds, et al. 2024). Larger portion sizes can reduce packaging waste per unit of food, but they often lead to higher levels of food waste, as well as multipacks and bulk packaging in supermarkets which often drive consumers to purchase more than can be consumed. On the other hand, smaller pre-packaged portions tend to generate more packaging waste but can help minimise food waste, as they encourage more frequent and intentional purchasing (Reynolds, et al. 2024, FAO 2011). Therefore, one must be cautious in claiming that packaging always reduces food waste. It can reduce individual item spoilage via protection, but it may encourage systemic practices that generate waste elsewhere in the supply chain.

Myth 3

'Plastic packaging is the only way to ensure food safety and shelf life for processed foods'

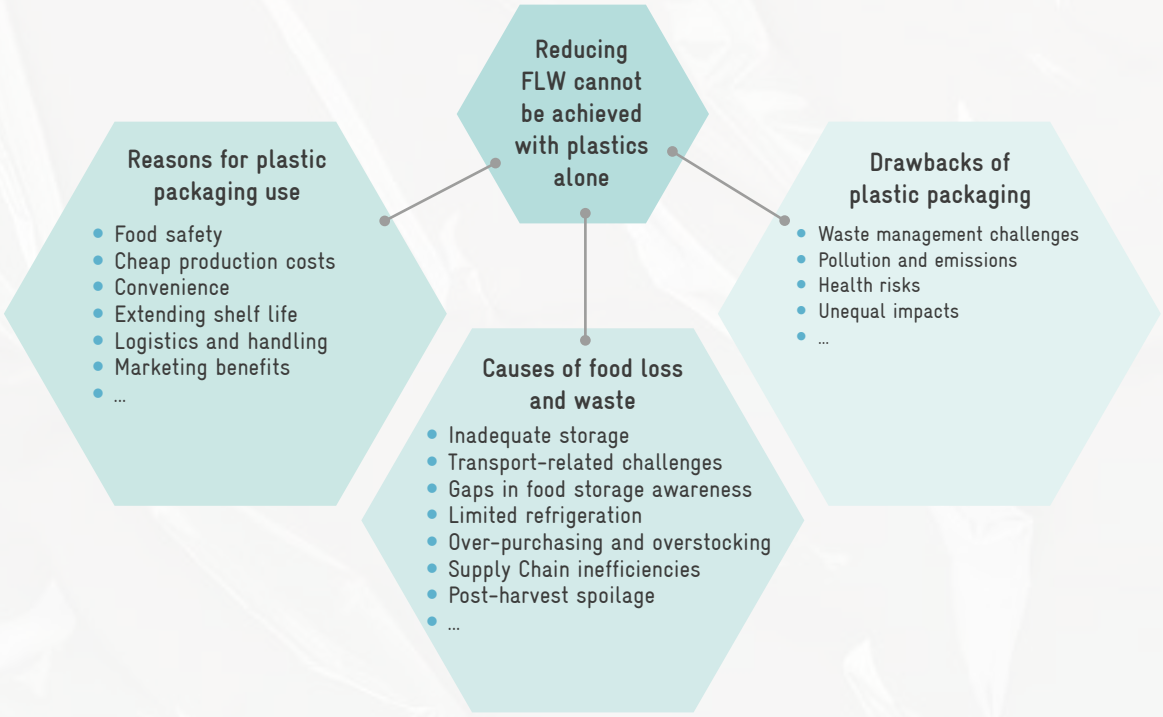
Many processed or packaged foods do require some form of packaging to survive the supply chain and be distributed. However, the type and quantity of packaging is often more than necessary from a waste-prevention standpoint.

For example, individually wrapped portions and multi-layer snack packs are done for marketing convenience and portion control, not because larger packs would result in waste. Another example are single-use sachets and small packs which companies in LMICs often chose to target low-income consumers. A family-sized bag of rice or a bulk refillable container of cleaning product can deliver the same product with less packaging per unit (Denkstatt 2017, Ellen MacArthur Foundation 2017). These plastic sachets, ubiquitous for everything from shampoo to ketchup, are cited as helping the poor access products in affordable amounts; yet, they have created a waste crisis in many countries, particularly in South and Southeast Asia (Geddie and Brock 2022). The big challenge from a waste perspective is that sachets are virtually impossible to recycle and frequently become litter that clogs waterways and urban drainage. In food systems, alternatives like bulk dispensing or refill stations can maintain safety, with proper hygiene protocols, while drastically reducing plastic consumption. For instance, dispensers for grains, spices, or liquids allow consumers to bring reusable containers. Thus, plastic is not the only solution to ensure food preservation and distribution. It is the default solution due to inertia, lack of investment in alternatives, and a potential sunk cost fallacy.

2.3 Key takeaways

In evaluating plastic packaging's relationship with food waste, a key insight is that systemic approaches yield better outcomes than standalone solutions. Packaging alone cannot compensate for fundamental inefficiencies like overproduction or misaligned consumer behaviour. For example, misleading date labelling has the potential to cause consumers to discard food more readily and unjustifiably. Adding more packaging or vacuum sealing may not change such consumer behaviour, but clearer information on labels could. Similarly, vast amounts of food waste occur upstream, prior to the retail sector, in LMIC contexts due to inadequate infrastructure. In Latin America, roughly 56 per cent of food is lost in the value chain leading up to the retail sector (Figure 3). A combination of better storage technology, market linkages, and moderate packaging could be more impactful rather than additional plastic packaging. Shortening supply chains by connecting local producers to consumers can reduce both packaging and associated waste.

Figure 7 **The complexity of the interrelation between FLW and plastic packaging in the region**



Source: adapted from BFS 2025.

Packaging plays a dual role in food systems. On the one hand, it preserves freshness, extends shelf life, and reduces losses of perishable products. On the other, it generates large volumes of waste and contributes to plastic pollution when poorly designed or used for foods that do not require protection. As the analysis of drivers in this chapter shows, the balance between packaging's protective function and its environmental burden varies by product category, value-chain stage, and retail format. Effective solutions must therefore reduce packaging's footprint while safeguarding food, recognising that the climate and resource costs of wasted food often exceed those of its packaging.

Part II of this publication explores how this balance can be achieved. Chapter 3 examines innovations in packaging materials, Chapter 4 considers systemic and business-model solutions that reduce or replace packaging altogether, and Chapter 5 reviews the policy frameworks and consumer-oriented measures that enable change. Together, these approaches demonstrate how packaging can evolve from a source of waste into a lever for prevention and circularity.

Case study

Table 2 Mapping of case studies presented in this publication to the relevant solution type

No.	Case study	Country/Region	Solution type	Page
I	Driscoll's paper containers for berries	EU/Global	Material innovation – paper/fibre	32
II	Apeel's edible coating for fresh produce	Global	Material innovation – edible coatings	33
III	Danone's elimination of a printed label	Indonesia	Design innovation – elimination	35
IV	Nestlé's elimination of plastic sleeves	Egypt	Design innovation – elimination	37
V	Algramo refill systems	Chile	Reuse/refill model (B2C)	40
VI	Coca-Cola universal returnable PET bottle	Brazil/Mexico	Reuse/refill model (B2C/B2B hybrid)	43
VII	Kecipir's harvest-to-order model	Indonesia	Alternative business model – digital platform	46
VIII	Rwanda SUP bans and France produce packaging restriction	Africa/EU	Policy – targeted bans	50
IX	Examples of materials bans from the focal region	Colombia/Mexico	Policy – EPR and eco-design	50
X	Sprite's switch from green to transparent PET bottles	Europe and Southeast Asia	Policy – eco design	52
XI	Walmart Mexico's campaign for cosmetically imperfect produce	Mexico	Retail practice reform – reduce FLW	59

Part II

From theory to practice – low-plastic solutions

3 Material-based and design innovations

Reducing food loss across the value chain requires a systems approach in which packaging serves both a protective and enabling function. While appropriate packaging can mitigate spoilage and handling losses at multiple stages, its environmental impacts must be carefully assessed. One strategy is to improve packaging materials using less plastic, increasing recyclability, incorporating compostable or bio-based inputs, and thereby reducing lifecycle emissions. Material innovations can help shift away from fossil fuel-based inputs and address EoL challenges. However, packaging sustainability cannot be achieved through materials innovation alone. Interventions explored in Chapters 4 and 5 such as reuse systems, refill models, and packaging minimisation, often enabled through business model innovation or retail sector intervention, can significantly reduce the need for packaging.

This chapter examines material-based solutions that lower environmental impact and packaging design innovations that can reduce demand for single-use formats while maintaining food safety and shelf life.

3.1 Material-based solutions: innovations in packaging materials

Material-based innovations are often viewed as the first line of response in addressing the environmental impacts of food packaging. Although they are frequently framed as more sustainable alternatives to conventional plastics, these solutions must be carefully evaluated within their specific application contexts. Food waste prevention remains the primary functional objective of food packaging, and any material innovation must preserve this function while ensuring a reduced environmental footprint across the packaging's life cycle.

Food loss in the value chain is highly product-specific and temporally concentrated. Fresh fruits and vegetables, which account for the highest share of food losses globally, are particularly vulnerable to spoilage due to their sensitivity to temperature, humidity, and physical damage (FAO 2014). These characteristics underline the critical role of protective packaging in extending shelf life and preserving nutritional quality during transport and storage. According to the FAO, the category of fresh fruits and vegetables is followed by perishables like bakery goods, dairy, meat, and fish in their susceptibility to spoilage (FAO 2014). Thus, packaging solutions for these categories must meet stringent performance criteria. This is particularly important in LMIC contexts such as Brazil, Colombia, and Mexico, where ambient temperatures are higher and cold-chain infrastructure is often limited.

Material innovations must balance these functional needs with circular economy principles. This means moving away from fossil-based SUPs toward materials that are renewable, compostable, recyclable, or otherwise lower the environmental impact associated with material production and disposal. However, the transition is not always straightforward; several alternatives present their own ecological and operational trade-offs, especially in the absence of adequate waste management infrastructure.

3.1.1 Compostable packaging

Compostable packaging refers to materials that can break down into carbon dioxide, water, and biomass within specific time frames and under defined conditions. The term is distinct from 'biodegradable', which lacks standardised parameters and is often used misleadingly. Certified compostable materials fall into two main categories: industrially compostable (requiring controlled conditions in centralised facilities) and home compostable (able to degrade under ambient conditions in household composting systems) (Ellen MacArthur Foundation 2020, World Economic Forum 2019).

In principle, compostable packaging can support circularity by returning biological nutrients to the soil, especially when co-disposed with food waste. However, in practice, the value of compostable plastics is contingent upon several systemic factors. First, the widespread absence of industrial composting infrastructure in many cities particularly in the Global South limits the feasibility of processing such materials at scale. Without appropriate collection and treatment systems, compostable packaging risks ending up in landfills, where it does not decompose efficiently and may even produce methane under anaerobic conditions. Alternatively, it may contaminate plastic recycling streams, compromising the quality of recyclate output. Second, compostable packaging is not inherently circular from a materials perspective. The process of composting, while beneficial for nutrient cycling, involves breaking the material down into basic organic matter, leading to the extraction of virgin materials for the next packaging generation. This contrasts with reuse or mechanical recycling models, where more of the original material's embodied energy and value is retained.

To be effective, compostable packaging must be clearly labelled and designed to fit existing organic waste systems.

Nonetheless, compostable materials can be suitable in niche applications. These include situations where packaging is likely to be contaminated with food (e.g., food scrap collection liners), in closed systems such as events or stadiums where separation and composting logistics can be tightly managed, or for small-format items that frequently end up in organic waste streams, like produce stickers and tea bags. To be effective, compostable packaging must be clearly labelled and designed to fit existing organic waste systems. International standards such as EN13432, ASTM D6400, and ISO 18606 provide technical criteria for compostability, but must be complemented with robust communication, colour coding, and harmonised design practices to ensure correct disposal by consumers.

3.1.2 Bio-based and biodegradable plastics

Bio-based plastics are derived wholly or partially from renewable biological feedstocks, such as corn starch, sugarcane, or cellulose. Biodegradable plastics refer to materials that can be broken down by microbial action, regardless of feedstock origin. The commonly used umbrella term 'bioplastics' often conflates the two concepts and should be avoided due to its ambiguity (Ellen MacArthur Foundation 2020, World Economic Forum 2019).

While bio-based and biodegradable plastics are often promoted as environmentally friendly, their actual performance varies widely depending on factors such as feedstock source, production process, and EoL pathway. LCAs have shown that some bio-based plastics, especially those derived from

food crops, can have higher overall environmental impacts than conventional plastics, due to land use change, fertiliser application, and water consumption (UNEP 2023). If these plastics are landfilled instead of composted or digested aerobically, they may also emit methane, a potent greenhouse gas (UNEP 2023). Further, the claim that biodegradable plastics will reduce food waste by enabling co-disposal with food in composting systems remains largely theoretical in regions lacking the infrastructure to support this process. Without proper collection and treatment, biodegradable plastics simply become another form of pollution or contamination.

Thus, while bio-based and biodegradable plastics have a role in specific, well-managed applications, they should not be considered a blanket solution. Their use should be strategically targeted to applications where their unique properties offer a clear advantage, such as in packaging formats that are consistently contaminated with food and cannot be easily recycled (Ellen MacArthur Foundation 2020, Bioplastics Feedstock Alliance 2015).

3.1.3 Alternative materials

Innovative materials that do not rely on plastics at all have emerged as a promising frontier. These include cellulose films, wax-coated papers, edible coatings, and agricultural waste-derived materials like bagasse or rice straw-based trays. Many of these alternatives are already being deployed in niche markets, and new developments continue to emerge. For instance, paper-based films laminated with polymer coatings that are compatible with the recycling stream are being developed as alternatives to hard-to-recycle plastic films. Likewise, companies such as Driscoll's have adopted paper-based clamshells for berries in European markets (Case study I) while Malaysian researchers have created biodegradable films from tropical fruit waste that offer comparable tensile strength to petroleum-based plastics at a lower cost (Severson 2024).

Edible coatings, such as those developed by Apeel (Case study II) derived from natural substances such as egg whites and plant-based fatty acids have been successfully applied to produce like cucumbers and avocados (EXAME, 2021, Packaging Europe, 2022, Severson, 2024). These coatings serve the same purpose as plastic films by extending freshness and reducing water loss but do so without generating waste.

Case study

Case study I Driscoll's paper containers for berries

Region	Sector	Scale
Europe	Fresh produce	Scaled

Solution description

Driscoll's, a leading berry producer, has transitioned from plastic clamshells to paper-based containers in multiple European markets, while increasing the use of recycled plastic in other regions (Driscoll's, n.d.). The goal is to replace hard-to-recycle plastic packaging with more sustainable alternatives. This solution offers a 94 per cent reduction in plastic usage per unit with only the lid still composed of plastic.

Environmental benefits

- Reduced plastic waste entering recycling streams, improved recyclability.

Innovation status

- Commercial deployment in Europe; continued R&D in North America with recycled plastic integration.

Figure 8 Paper containers designed by Driscoll

Source: Severson, 2024.

Case study II Apeel's edible coating for fresh produce

Case study

Country	Sector	Scale
USA	Fresh food	Scale-up

Solution description

Apeel is an edible coating derived from plant-based materials, designed to extend the shelf life of fresh produce by forming a protective barrier that slows water loss and oxidation. Approved by the FDA, the coating mimics the protective function of plastic film without generating packaging waste. It is supplied as a dry powder, which is mixed with water and applied at packaging centres using spray, dip, or brush-on methods. Apeel not only provides the coating itself but also integrates its application system into client supply chains, offering technical support and monitoring. Its global sourcing and retail network spans producers in the USA, Mexico, Peru, Spain, and the Netherlands, and retail partners such as Kroger in the USA and Edeka in Germany. Recent investments are being used to expand operations in Africa, Central America, and South America (EXAME, 2021, Ellen MacArthur Foundation, 2020).

Economic benefits

- Extends product freshness by two to three times, reducing shrinkage and spoilage.
- Leads to significant cost savings by lowering food wastage and boosting sales volumes.
- Offers a high return on investment, with no price increase necessary for Apeel-coated produce, ensuring competitive consumer pricing.

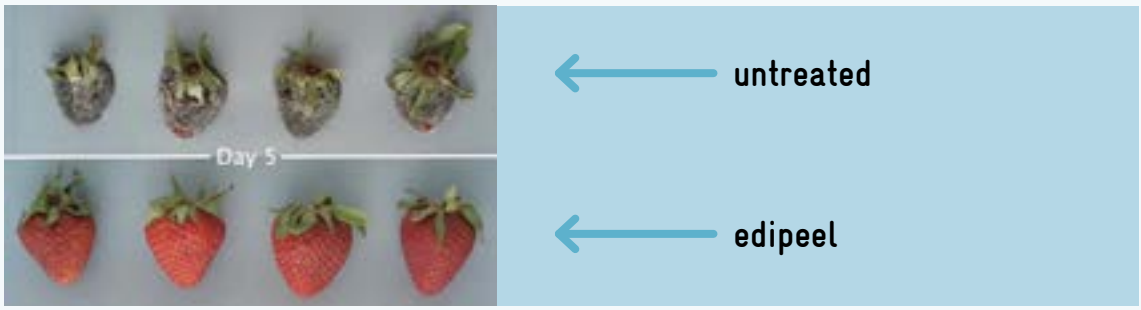
Environmental benefits

- Eliminates the need for plastic wrapping, reducing plastic use without compromising shelf life. A cucumber supplier, for example, anticipates avoiding over 30 tonnes of shrink wrap annually.
- LCA studies show carbon footprint reductions of 18% to 80%, depending on the product.
- Fully compostable and integrates seamlessly with food waste streams.

Innovation status

- Raised USD 70 million in Series C funding in 2018 and secured an additional USD 250 million in 2020 to support expansion.
- Commercial partnerships include Kroger (avocados, limes, apples) and Edeka (avocados, oranges, mandarins), with further scaling underway in new global markets.

Figure 9 Effects of Apeel's edible coating



Source: Garfield, 2017.

Still, these alternatives are not without constraints. Paper-based or cellulose-based substitutes may have reduced barrier properties or structural limitations under certain moisture and temperature conditions. In addition, questions of material sourcing, recyclability, and compostability at scale remain. Materials must also be designed for clear consumer understanding to prevent contamination of existing recycling or composting streams. For example, cellulose films can appear visually similar to conventional plastics, creating confusion at disposal unless they are clearly distinguishable through labelling or colour differentiation.

Crucially, whether a packaging material is circular depends less on its intrinsic characteristics than on the systemic context in which it is used. Transport distances, local waste infrastructure, and existing regulatory frameworks all influence the environmental performance of alternative materials. Therefore, substitution decisions must be based on full-system assessments rather than simplistic material comparisons.

3.2 Packaging design innovation

Beyond material substitution, packaging design plays a central role in both reducing packaging volumes and minimising food waste. Packaging can be eliminated, reconfigured, or redesigned to better align with product needs, logistics, and EoL treatment options. There are two main approaches to eliminating unnecessary packaging (Ellen MacArthur Foundation 2020):

- **Direct elimination** refers to removing packaging that serves no essential function. Examples include secondary plastic wrap on multi-buy packs, tear-off seals on bottled beverages, and unnecessary film on produce. Major retailers such as Tesco and Waitrose have removed secondary wrapping from canned goods, while Walmart has eliminated plastic film from fresh produce (Ellen MacArthur Foundation 2020, Tesco News 2025, Waitrose & Partners n.d.). Nestlé (Case study IV) and SonaeMC have discontinued tear-offs on several product lines (Ellen MacArthur Foundation 2020). These interventions reduce material use and can simplify consumer interaction with the product.

- **Innovative elimination** addresses situations where packaging serves an essential function but can be replaced through a different mechanism. This includes edible coatings on produce (e.g., Apeel – Case study II), multifunctional packaging units (e.g., Danone's Aqua Life label-free bottles – Case study III), and digital product delivery or localised manufacturing that removes the need for extensive packaging (EXAME 2021, Severson 2024). For example, the use of dehydrated soups or sauces sold in reusable containers eliminates the need for SUP packaging altogether.

Case study

Case study III Danone's elimination of a printed label

Country	Sector	Scale
Indonesia	Beverages	Pilot

Figure 10 Label-free bottle from Danone

Source: Aqua n.d.

Solution description

Danone's Aqua Life launched an embossed PET water bottle that eliminates the need for a printed label. Instead, product branding is moulded into the bottle surface, and the barcode is integrated into the cap. This design significantly reduces material use and streamlines the packaging format without compromising product identification or consumer trust (Ellen MacArthur Foundation 2020, Aqua n.d.).

Economic benefits

- Reduces the number of packaging components, simplifying production and lowering potential contamination in recycling streams.
- Supports a closed-loop packaging model by sourcing 100% of the PET from local recyclables, boosting domestic collection markets.

Environmental benefits

- Eliminated 1.6 million adhesive labels in the launch year alone (2019).
- Promotes circularity by using 100% locally sourced recycled PET.
- The entire bottle remains fully recyclable under existing systems.

Innovation status

- Piloted in Bali (Indonesia) in early 2019; now extended to Jakarta and Surabaya.
- The concept has also been applied to Evian bottles in France since mid-2020, indicating cross-brand scalability.

Packaging that is retained should be designed to maximise material circularity. This involves rethinking the packaging structure (e.g., using mono- instead of multi-layer materials), format (e.g., compact or collapsible designs), and additives to ensure compatibility with recycling streams. Packaging design guidelines from associations such as Association of Plastic Recyclers (APR) and Plastics Recyclers Europe (PRE) recommend eliminating problematic materials like polyvinyl chloride (PVC) and PS, minimising use of dyes and inks, and simplifying package formats to improve recycling outcomes (Association of Plastic Recyclers n.d.).

Other design innovations include enabling product resealing to preserve freshness after opening, downsizing packages to better match consumer needs, and offering 'portion on demand' services in retail environments. These strategies reduce food spoilage, especially in single-person households, where large pack sizes are a major driver of food waste.

The Household Simulation Model (HHSM), developed to simulate the environmental and economic impact of packaging interventions, highlights key trade-offs. For example, aligning pack sizes with household needs can reduce food waste by up to 70 per cent, but may increase packaging waste due to higher purchase frequency (Reynolds, et al. 2024). Extending shelf life through packaging innovation can reduce food waste and packaging waste simultaneously, but consumer education on optimal storage is necessary to realise these benefits. The HHSM stresses that multiple coordinated interventions, rather than singular changes, yield the most effective outcomes.

Case study

Case study IV Nestlé's elimination of plastic sleeves

Country	Sector	Scale
Egypt	Beverages	Scaled

Solution description

Nestlé removed the plastic tear-off sleeves that previously sealed the cap and neck of its Pure Life water bottles. To ensure consumer confidence in product safety, a simple audible indicator was introduced, a 'click' sound when the cap is twisted, signifying the bottle is unopened and tamper-proof. This modification retains product integrity while eliminating a non-essential plastic component (Ellen MacArthur Foundation 2020, Mamdouh 2024).

Economic benefits

- Maintains tamper-evidence functionality through an intuitive and low-cost mechanism.
- Improves operational efficiency by simplifying packaging assembly and reducing material complexity.

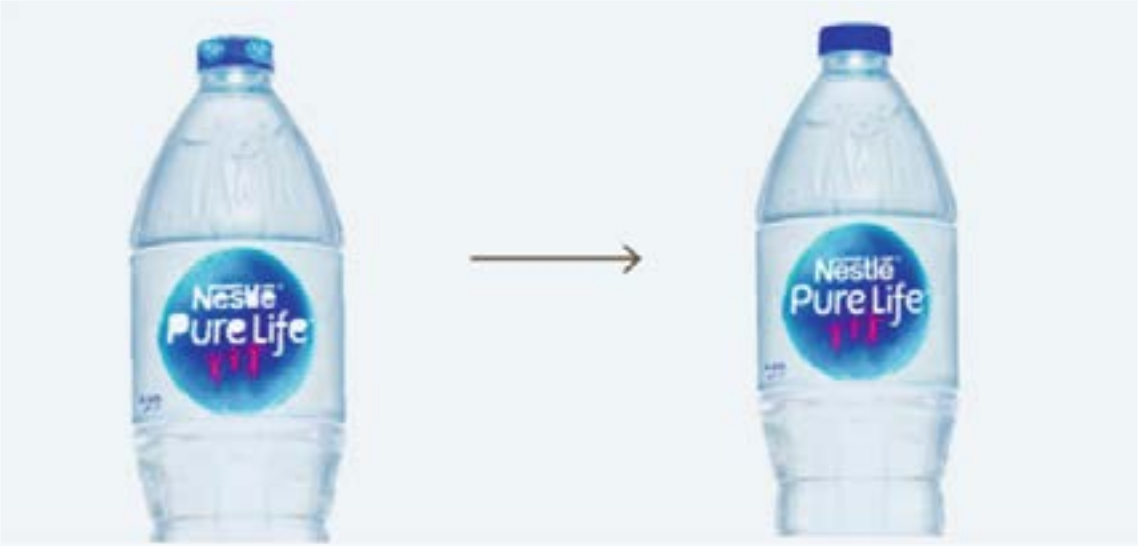
Environmental benefits

- Eliminated nearly 240 tonnes of plastic cap sleeves within the first 18 months of implementation (from January 2019 onward).

Innovation status

- Fully adopted across the Nestlé Pure Life Water product line in Egypt.

Figure 11 Eliminating bottle cap tear offs



Source: Mamdouh 2024.

Packaging systems design should also consider reverse logistics and EoL implications. Innovations that improve food shelf life without requiring complex recycling or composting processes are especially valuable. Removing and collecting packaging before it reaches the consumer ensures higher recovery rates and cleaner recycling streams. In the focus region, and LMIC contexts typically, reuse or recycling infrastructure is often limited. Packaging design innovation must therefore align with local collection, sorting, and processing realities. A strong emphasis should be placed on packaging formats that can be separated and sorted using simple technologies.

3.3 Key takeaways

Material and design innovations can reduce reliance on fossil-based plastics and improve packaging circularity while maintaining food preservation. However, they are not sufficient on their own. Compostables and bio-based plastics face major infrastructure and performance challenges, while alternative materials like paper or cellulose films require careful system integration. Design changes such as elimination of unnecessary formats, mono-material use, and resealable packaging can yield clear benefits but depend on consumer acceptance and collection systems.

Ultimately, packaging innovation should be evaluated within a systems perspective. Substituting materials without considering local waste infrastructure or consumer behaviour risks shifting, rather than solving, environmental burdens. The next chapter therefore turns to systemic and business model solutions, such as reuse and refill systems, that aim to reduce the need for single-use packaging altogether.

Packaging innovation needs to be evaluated within a systems perspective.

4 Systemic and operational solutions: beyond materials innovation

Reducing the environmental impact of food packaging requires more than switching from one material to another. The scale of plastic pollution and food waste calls for a rethinking of not only packaging but also products and business models. This section outlines solutions that do not rely on material innovation alone but instead address structural inefficiencies in packaging design, retail formats, supply chain logistics, and consumption models. These approaches prioritise prevention, reduction, and reuse over substitution, aiming to eliminate unnecessary packaging, extend product shelf life through intelligent design, and integrate packaging into broader food system innovations.

4.1 Reuse systems: models, trade-offs, and design considerations

4.1.1 Business-to-Consumer (B2C) models

Reusable packaging is designed for multiple use cycles within a system that enables cleaning, redistribution, and continued functionality of the packaging material. There are four dominant business-to-consumer (B2C) reuse models, each defined by who owns the packaging and where refilling or return takes place (Ellen MacArthur Foundation 2020, Vuorinen, et al. 2024).

Table 3 Summary of the four B2C reuse models

Refill at home Consumers refill their containers at home using concentrates or dry goods received through delivery or subscription services. Products with high water content, such as juices, sauces, or cleaning liquids, can be supplied in concentrated or dehydrated form and diluted at home. Packaging for the refill units must be circular: reusable, recyclable, or compostable. Removing water from the product reduces packaging volume and transport costs. This model is ideal for predictable, high frequency purchases and works best when integrated into a delivery system that also retrieves empties, enabling packaging rotation.	**Refill on the go** Consumers refill containers at retail locations, or alternatively public spaces or mobile units. Dried goods such as beans, grains, nuts, and pasta are suitable candidates due to low hygiene risk and ease of dispensing. Refill stations must offer guidance on container hygiene and may include on-site washing ports. This model reduces unnecessary packaging and enables precise quantity purchase, helping reduce food waste. Flexibility in container size also accommodates consumer needs without over-portioning.
Return from home Consumers return empty packaging to delivery personnel. This model works well in e-commerce or subscription systems, particularly in urban areas where delivery frequencies are high. Operators are responsible for cleaning and redistributing packaging. Packaging must be designed for durability, traceability, and stacking efficiency. Shared logistics and cleaning infrastructure across multiple brands or sectors improve cost-effectiveness. Digital tracking using barcodes, RFID, or QR codes ensures accountability and operational control. The model requires fewer changes to consumer behaviour and offers higher return rates in dense markets.	**Return on the go** Consumers drop off used packaging at stores, collection points, or return kiosks. Packaging may include unique IDs for tracking, deposit refunds, and usage analytics. Reuse-as-a-service providers manage logistics, enabling SMEs and retailers to participate without owning the infrastructure. Shared infrastructure (cleaning, return points, tracking systems) reduces system costs and encourages uptake. Return-on-the-go is most viable for high-turnover, standardised formats such as beverage containers. Harmonisation of packaging formats and logistics (e.g. Universal Bottle systems) increases reuse efficiency and economic viability.

Source: Ellen MacArthur Foundation 2020, Vuorinen, et al. 2024.

Case study

Case study V Algramo's refill systems

Country	Sector	Scale
Chile	Household and food products	Pilot

Solution description

Single-use household-product packaging adds cost for low-income shoppers who buy in small formats ('poverty premium') and creates persistent plastic waste where collection/recycling are limited (Ellen MacArthur Foundation 2021, UNEP 2023). The Chilean company Algramo's platform combines smart dispensers at stores with RFID-enabled reusable containers so customers 'pay for the product, not the packaging.' Refill dispensers and durable containers cut single-use packs, and precise metering lets shoppers buy exact quantities reducing over-purchase and leftover product spoilage at home. Retailers integrate compact dispensers in high-velocity aisles (home care, some dry foods/pet). Walmart Chile, Unilever, and Algramo publicly communicated the shopper saving potential and plastic reduction logic when announcing in-store machines (Walmart Chile n.d.).

The system also supports 'refill-on-the-go' tricycles in some deployments (Walmart Chile n.d.).

Economic benefits

- Refill-reuse at retail can lower unit costs and maintain product quality via closed-loop dispensing and smart containers. Up to 20% consumer savings reported versus standard packaged stock-keeping units (SKUs).
- Reduced packaging material handling, potential shelf-space efficiency (bulk replenished less often than many small packs), and a differentiated value proposition for price-sensitive shoppers.
- Resilience/uptake: +356% sales growth for Algramo's refill model during April–June 2020 in Santiago during COVID-19 lockdowns, indicating resilience of the model and sustained consumer uptake when mobility and supply were constrained (Ellen MacArthur Foundation 2021).
- Brand partnerships: Active collaborations with Unilever (Chile) and others (e.g., Purina) to scale categories compatible with dispensing (Ellen MacArthur Foundation 2021, Fuenzalida 2022, Mohan 2020).

Environmental benefits

- Reduction of packaging waste

Innovation status

- The company piloted and then scaled with FMCGs (e.g., Unilever OMO/CIF/Quix; Nestlé Purina) and partnered with Walmart Chile (Líder) to deploy in supermarkets.

Case study

Figure 12 Algramo system for cleaning and food products

Source: Walmart Chile n.d.

BONUS: enabling conditions and applicability in Brazil, Mexico, Colombia

- Chile's EPR framework (Law 20.920) and Decree 12 (2020) set collection/valorisation targets for packaging; the Single-Use Plastics Law (21.368) further restricts disposables and encourages reuse, creating a favourable policy signal for retail refill systems.
- What helps: (i) retailer space and power/data for dispensers; (ii) closed-loop cleaning logistics for returned/damaged containers; (iii) SKU selection with stable flowability (liquids/dry flowables); (iv) predictable pricing that rewards reuse; (v) consumer communications on hygiene and accuracy (Ellen MacArthur Foundation 2021, Fuenzalida 2022, Mohan 2020, Walmart Chile n.d.).
- Brazil: EPR and reverse-logistics expectations under PNRS (national solid-waste policy) support reuse pilots; large modern retail footprints simplify multi-store trials. Policy inference aligned with EPR direction in the region.
- Mexico: City/state plastic-restriction trends and strong modern trade penetration create opportunities; pilot in urban supermarkets first, with refills linked to loyalty apps. Market inference based on Algramo's stated interest in Mexico and regional retailer presence (Ellen MacArthur Foundation 2021).
- Colombia: Single-use plastics law (2232/2022) pressures packaging change; retail pilots can align with donation/markdown programs to reduce both packaging and product waste.

4.1.2 Business-to-Business (B2B) models

Beyond consumer packaging, a wide array of business-to-business (B2B) reuse models are operational. These include reusable crates, totes, and pallets in logistics and distribution. Industry-wide reuse systems can be developed around shared packaging pools managed by third-party operators. Standardisation of packaging sizes and materials allows for scalable reverse logistics and improved transport efficiency. To identify opportunities for B2B reuse, companies should assess where single-use transport packaging is used internally or with external partners and evaluate logistics patterns for feasibility of closed-loop or managed open-loop systems (Ellen MacArthur Foundation 2020).

The cost structure of B2B reuse includes higher upfront investment in durable packaging and handling infrastructure, but lower per-use cost over the packaging lifecycle. For example, reusable plastic crates used in short food supply chains (SFSCs) are cost-effective when return logistics are efficient and transport distances are short. Reusable plastic crates have proven to reduce environmental impact compared to single-use containers, but they must be well maintained to ensure food safety (Lopez-Galvez, et al. 2021). One assessment comparing Peruvian air-freighted asparagus with seasonal domestic produce in Germany found nearly tenfold differences in environmental impact resulting from reduced transport emissions, less demanding packaging requirements, and shortening the supply chain between harvest and consumer. In shorter supply chains, reusable transport packaging can reduce emissions and costs and environmental burdens (Burfield 2022, Schweitzer, et al. 2018). When supply chains are shorter and more local, the flexibility and durability of reusable transport packaging (like crates) become not only practical but also impactful supporting streamlined logistics and potentially reducing both emissions and waste.

In shorter supply chains, reusable transport packaging can reduce emissions and costs and environmental burdens.

Case study VI Coca-Cola's universal returnable PET bottle

Country	Sector	Scale
Brazil and Mexico	Beverages	Large-scale deployment

Case study

Solution description

Coca-Cola introduced a standardised 'Universal Bottle' made of refillable PET, designed to be shared across multiple brands (e.g., Coca-Cola, Sprite, Fanta). The common colour and shape allow bottles to switch brands after each wash cycle, increasing utilisation rates and simplifying operations. In Mexico, the paga solo por el contenido ('pay only for the content') model lets consumers pay solely for the beverage when returning empties, reinforcing reuse at neighbourhood stores and online. Bottlers invested heavily in production, washing, and retail take-back infrastructure to enable scaling (EMF 2021, Packaging Europe 2020).

Figure 13 Product options provided by Coca Cola as part of the Universal Returnable Bottle Scheme

Source: Coca Cola n.d.

Economic benefits

- Standardised design lowers SKU complexity and simplifies sorting and washing across brands.
- Shared pools reduce handling time and logistics costs for retailers.
- Consumers are incentivised by lower refill prices, driving repeat participation.

Environmental benefits

- Enables up to approx. 25 reuse cycles per bottle, cutting plastic demand by about 90% compared to single-use PET.
- Reduces upstream extraction and end-of-life burdens.
- PET refillables are lighter and less breakable than glass, reducing product losses in retail handling.

Innovation status

- Deployed at scale across several Latin American markets, with Brazil and Mexico as key examples.
- Pre-pandemic, refillables were the fastest-growing Coca-Cola pack type in the region (2018–2019).
- Supported by regional circular-economy and reverse-logistics frameworks, even without formal deposit laws.

Figure 14 Implementation process of the Universal Bottle scheme

Source: The Coca Cola Company n.d.

4.1.3 Limitations of reuse systems for food packaging

Reuse models, whether B2B systems or B2C schemes like take-back systems, face technical, economic, and systemic constraints that determine whether they deliver net environmental benefits.

At the micro level, packaging must remain durable and safe across multiple lifecycles under various conditions. Technical requirements include abrasion resistance, taste neutrality, structural integrity, and compliance with food safety regulations. Traceability tools (QR codes, RFID) must be durable, secure, and interoperable across platforms.

At the meso level, the economics and operations of reuse are challenging. High initial investment, increased labour and logistics costs, and packaging loss or damage can undermine feasibility. Cleaning and drying must be resource-efficient and scalable. Operators must maximise rotation cycles to recoup costs and reduce environmental impact. Third-party logistics and standardised systems improve coordination, while collaboration across brands can help distribute infrastructure costs. Shared depots, cleaning hubs, and return points are examples of such cooperative arrangements.

At the macro level, systemic assessment is essential as reuse only offers net environmental benefits if sufficient reuse cycles are achieved. Added impacts from transport, cleaning, and sorting must be offset by avoided production and disposal of single-use items. Policy coherence, consumer incentives, and data transparency support scaling. If reuse systems are not adequately supported, they may become additive rather than substitutive, leading to greater overall packaging use. Uncertainty also exists regarding the EoL of reusable packaging: it must be clear when an item should be retired from circulation for hygiene and safety reasons, and how it is to be disposed of.

A system-wide analysis is needed to evaluate the suitability of reuse models.

Packaging-free solutions such as in-store dispensing reflect similar constraints. If bulk packaging used for refill is less efficient than retail packaging it replaces, environmental outcomes may worsen. Similarly, returnable packaging systems can become counterproductive if reverse logistics are inefficient or if packaging is lost before achieving minimum reuse cycles. Therefore, a system-wide analysis is needed to evaluate the suitability of reuse models in each context.

4.2 Alternative business models and retail practice reform

Packaging performance is conditioned by the underlying business model. Cooperative frameworks, shorter chains, and retailer practice reforms can simultaneously reduce plastic use and food loss.

Public-private cooperation can align actors on quantified targets. The Courtauld Commitment 2 in the UK, coordinated by WRAP with 53 stakeholders, reported a 10 per cent reduction in the carbon impact of grocery packaging, about 3.7 per cent less household food waste, and around 7.4 per cent less supply-chain waste against its baselines, delivered through redesign and lightweighting, clearer labels, portion optimisation, storage guidance, and improved logistics and forecasting (Reynolds, et al., 2024, WRAP, 2020, WRAP, 2023). Structured working groups with confidential data sharing supported benchmarking and rapid diffusion of effective measures.

SFSCs, including community-supported agriculture (CSA) subscriptions, can eliminate long-life packaging for fresh produce, avoid cosmetic grading losses, and reduce storage time. Additionally, direct producer–consumer links provide channels for storage and meal-planning guidance that lower household waste (Schweitzer, et al. 2018).

Retail practice is a high-leverage point. Selling produce loose rather than in fixed packs lets customers buy exact quantities, a documented driver of waste reduction for perishables. In-store guidance on storage, simplified date labels, and reforms to promotions that encourage over-buying further reduce flexible plastic packaging waste (WRAP 2023). Contracting and staff training need to align with loose sales and markdown strategies.

The role of waste pickers in the informal sector must also be recognised in business model design. Engaging waste pickers in design workshops improves packaging collection rates and supports income generation. Their insights ensure that packaging is designed for real-world recovery, not just theoretical recyclability.

Case study

Case study VII Kecipir's harvest-to-order model

Country	Sector	Scale
Indonesia	Fresh food	Start-up

Solution description

Kecipir is a digital platform that facilitates the direct sale of fresh fruits and vegetables from peri-urban farmers to consumers in Jakarta, Indonesia. It operates through a fully circular, reusable delivery system that avoids single-use plastic packaging and supports hyperlocal distribution. The model capitalises on harvest-to-order logistics, minimising waste at every point in the supply chain (Ellen MacArthur Foundation 2020).

Economic benefits

- Product quality: Harvesting only upon order ensures optimal freshness, enhancing consumer satisfaction and minimising spoilage.
- Consumer convenience: The app-based interface allows urban consumers to order directly from farmers, streamlining the grocery process and reducing reliance on supermarkets.
- Cost efficiency: Fewer intermediaries and shorter supply chains reduce distribution costs, benefiting both producers and buyers.

Environmental benefits

- Plastic waste reduction: Since inception, Kecipir has eliminated over 6 tonnes of single-use plastic and polystyrene packaging materials.
- Food waste reduction: The harvest-on-demand model results in 132 tonnes of avoided food waste annually by preventing overproduction and ensuring immediate delivery post-harvest.
- Lower carbon emissions: With a delivery radius capped at 60 km, the model significantly cuts down on fuel use and eliminates the need for energy-intensive cold storage.

Innovation status

- Scale: Operating since 2016, the platform now handles over 1,600 deliveries per month in the Greater Jakarta area and is assessing expansion into nearby cities.
- Secured EUR 30,000 in seed funding from the Enviu Foundation and a USD 45,000 grant from National Geographic in 2019 to support scaling and platform optimisation.

4.3 Key takeaways

Systemic solutions reconfigure how packaging is used and when it is needed. Consumer-facing reuse, B2B transport reuse, short supply chains, and retail practice reforms all reduce dependence on single-use formats while protecting product quality. Their performance hinges on design for durability and hygiene, dense and reliable return networks, efficient washing and transport, alignment of incentives at point of sale, and policy signals that reward higher-value loops. Where these conditions hold, the evidence shows large reductions in packaging material use and measurable reductions in FLW. Where they do not, reuse can be additive, bulk systems can underperform, and well-meaning cosmetic-standard reforms can stall without merchandising and supplier alignment.

The chapter's cases demonstrate that Latin American retailers and brands are already operating at scale with both reuse and waste-prevention models. The next chapter turns to the enabling environment: policy frameworks and governance measures that shape market signals, standardise design expectations, and align accountability across producers, retailers, municipalities, and consumers.

Latin American retailers and brands are already operating at scale with both reuse and waste-prevention models.

5 Enabling measures: policy framework and consumer engagement

Government policy sets the rules that determine how packaging is designed, used and managed at end of life. In food retail, this regulatory scaffolding can either accelerate circularity and reduce loss or create perverse incentives and fragmentation. Voluntary commitments help, but only statutory measures can establish minimum performance, correct price signals, and ensure accountability across the value chain. The need for coherent policy is particularly acute in Latin America and other LMIC contexts where infrastructure gaps, informality, and split mandates across ministries often undermine implementation. In Brazil, Colombia, and Mexico, the direction is clear, even if instruments differ. Brazil is strengthening reverse-logistics obligations under the PNRS and related decrees, which creates a platform for retail take-back and recovery at scale (Marcilio and Fidalgo 2024, Nemitz 2024). Colombia's Resolution 1407/2018 couples material-specific recovery targets with explicit integration of waste picker cooperatives, linking packaging placed on shelves to legally enforceable take-back with social inclusion benefits (ADBioplastics 2024, Ministerio de Ambiente y Desarrollo Sostenible 2018). Mexico demonstrates sub-national leadership through measures in Mexico City and Oaxaca that restrict single-use items in food service and retail, forcing format shifts and pilots for reuse where federal policy remains limited (Michail 2020). Read together, these approaches translate a generic policy mix into concrete market signals for retail: Brazil emphasises system performance for reverse logistics, Colombia ties design choices to recovery via EPR, and Mexico leverages targeted product restrictions that change what appears on shelves.

Policy design needs to consider trade-offs between environmental goals and preservation outcomes. Poorly sequenced bans or design rules can threaten shelf life, increase damage in transport, or swap visible plastics for materials with worse life-cycle burdens. The remedy is coherence and regional alignment. Coordination between environment, agriculture, health, and trade authorities helps to avoid siloed measures that shift burdens upstream or downstream. Regional platforms such as the Pacific Alliance and MERCOSUR, as well as UNEP's Circular Economy Coalition for Latin America and the Caribbean, provide avenues to harmonise definitions, recyclability standards, labelling norms, and food-contact safety rules so that scalable solutions can move across borders without friction (Abril Ortiz 2020, Alianza del Pacifico 2020, UNEP 2024). With alignment, retailers can replicate proven formats, aggregate demand for standardised components, and reduce compliance complexity; without it, they face fragmented rules and higher costs.

Policy design needs to consider trade-offs between environmental goals and preservation outcomes.

5.1 Extended Producer Responsibility (EPR)

EPR remains the most effective way to internalise the externalities of packaging. Properly designed systems create financial and operational obligations to collect, sort, and recycle packaging, with eco-modulated fees that reward better design. Lower fees for mono-material, label- and adhesive-compatible formats and higher fees for multilayer or pigment-contaminated items convert design guidance into price signals that brand owners and private-label retailers cannot ignore (OECD 2022, UNEP 2023). For supermarkets, this changes procurement. House brands become subject to compliance responsibilities, while distributor leverage can be used to set minimum design-for-recycling specifications. In food packaging this often means shifting away from complex laminates and black plastics used for marketing aesthetics rather than function, and toward APR, PRE, and RecyClass-aligned PP and PET solutions that maintain food safety while reducing costs under fee (Ellen MacArthur Foundation 2020).

The focus countries illustrate different stages of EPR maturation. Colombia's Resolution 1407/2018 mandates differentiated recovery targets and requires the inclusion of waste-picker cooperatives, demonstrating how EPR can build social value into retail supply chains (ADBioplastics 2024, Ministerio de Ambiente y Desarrollo Sostenible 2018). Brazil's reverse-logistics framework under the PNRS is increasingly interpreted in EPR terms, creating opportunities to align retail flows with national targets (Nemitz 2024). In Mexico, state-level bans and city programmes are creating de facto obligations for supermarkets in major urban markets (Michail 2020). The common challenges are governance of Producer Responsibility Organisations, transparency in fee use, and credible monitoring. Phased compliance, audited PROs, and investments that visibly improve collection and sorting capacity help to maintain legitimacy. When reporting is robust, EPR data become a public good for regulators and retailers, highlighting leakage points and high-loss categories where reusable or compostable formats could displace single-use items.

For readers seeking further resources, the Global Action Partnership for EPR provides practical guidance, case studies, and tools to support the design of effective EPR systems worldwide.

5.2 Material bans and restrictions

Targeted bans and restrictions are powerful tools to eliminate the most environmentally damaging packaging formats, especially those that are ubiquitous in retail food systems but lack recycling pathways. These often include plastics that are difficult to recycle, easily littered, or toxic in production and use such as multilayer sachets, PS trays, PVC wraps, plastic cutlery, and straws commonly used for fresh produce and ready-to-eat meals. When carefully designed, bans that are applied to specific product categories or material properties, such as oxo-degradable additives, can reduce contamination in composting and recycling streams, improve food-scrap recovery, and directly impact what products are available to consumers on supermarket shelves. In practice, bans work best when accompanied by clear guidelines, phased implementation schedules, and viable alternatives. They also require a strong enforcement capacity and public support.

Case study VIII Rwanda's SUP bans and France's produce packaging restriction

Case study

Country	Sector	Scale
Rwanda, France	Single-use plastics	National

- **Rwanda** enacted one of the earliest comprehensive plastic bag bans starting with polyethylene bags in 2008, being expanded to cover additional SUP items such as straws, bottles, and food containers in 2019. Exceptions were permitted for packaging of meat to allow for easier refrigeration of the product. Furthermore, an exception was also granted for High Density Polyethylene (HDPE) products since this is an easy-to-recycle plastic (GAIA 2021, Xie and Martin 2022). The ban was successfully implemented through dedicated awareness campaigns for community engagement purposes.
- An example of material bans directly related to supermarkets can be seen in **France**, where in 2022, restrictions were placed on plastic packaging for fruits and vegetables under 1.5 kg (SafeGuardS 2023, Chrisafis 2021). While the ban was overturned by the French High Court in 2024 due to a 'procedural flaw', the underlying principle behind the ban could still serve as an inspiration for other countries (Horsman 2024).

Case study IX Examples of material bans from the focal region

Case study

Country	Sector	Scale
Mexico City, Colombia	Single-use plastics	Municipal, national

- Within the focus region, **Mexico City's** SUP ban, enacted under the 2020 Solid Residues Law, began with a ban on plastic bags in 2020, followed by bans on the commercialisation, distribution, and delivery of a defined list of SUP items in 2021. The list explicitly included plastic cutlery, straws, disposable plates, straws, cups and lids, coffee stirrers, single-use coffee capsules, and trays used to transport food. The law provided guidelines for the production, handling, and disposal of compostable plastic items which may be used as an alternative. Compostable alternatives are permitted only where they meet the city's technical standard, are properly labelled, and the producer is registered with an approved management plan. These requirements tightened retailer and food-service obligations by effectively eliminating disposable plastic trays for fresh foods and steering substitutions toward verified compostable or reusable formats. Some substitution challenges were reported, especially in low-income areas (Desai 2024, MBN 2024, UNEP 2020, Excelsior 2021, CDMX n.d.).
- Law 2232 of 2022 in **Colombia** banned a broad range of disposable plastic products like extended polystyrene (EPS) containers, straws, plastic bags, and food retail items such as trays and takeaway containers effective from 2024. By 2030, the law states that all consumer plastic packaging and food service items must be recyclable, reusable, or compostable (ADBioplastics 2024, Bioleader 2025).

Yet bans are not without risk. Where alternatives are poorly planned or more environmentally damaging, bans can backfire. For example, shifts to thicker plastic bags or materials with higher energy intensity have been observed in some jurisdictions (UNEP 2023). Policymakers must avoid simple substitutions that reproduce single-use dynamics and ensure that any replacement materials are locally recyclable or compostable.

The process of identifying which materials to ban should be evidence-based and participatory. Stakeholders such as waste pickers, recyclers, and packaging suppliers must be involved to evaluate technical feasibility, economic implications, and potential for smuggling or illicit substitution. Equity impacts must also be considered, particularly for small-scale retailers and low-income consumers who may rely on cheap single-use packaging for livelihoods or affordability (Martin 2025).

5.3 Eco-Design regulations and performance standards

Design decisions made at the packaging development stage have long-term consequences for recyclability, toxicity, and food waste outcomes. Eco-design policies set baseline requirements for packaging to meet environmental performance standards, with an emphasis on compatibility with collection and treatment systems.

The EU's Packaging and Packaging Waste Regulation (PPWR) provides an advanced example of design-based regulation. It mandates that all packaging be recyclable by 2030 and introduces requirements for reduced overpackaging, harmonised recyclability labelling, and recycled content quotas. The regulation also seeks to limit the use of hazardous additives and promotes a shift to mono-material designs (Hancock 2024, Reuters 2024).

Such regulations can be aligned with industry guidance, such as the APR Design Guide and Europe's Design-for-Recycling Frameworks by PRE and RecyClass which give actionable rules for food packaging. These guidelines encourage elimination of problematic polymers, restrictions on labels and adhesives, and use of coatings and inks compatible with mechanical recycling. In Latin America, uneven infrastructure and material flows makes tailored eco-design more effective than a wholesale replication of EU rules. This might involve a positive list of preferred materials and formats, training programmes for local manufacturers, and pilot certification schemes. For example, MERCOSUR's GMC (Groupo Mercado Común) Resolution Number 3/92, based on Regulation (EU) No. 10/2011 specifies a list of additives and starting substances that may be used in the manufacture of food-contact plastics (SGS n.d.).

Eco-design policies should also complement food safety requirements. For instance, packaging designed for reuse or recycling must still comply with chemical or additive migration limits and hygiene requirements for food contact materials. The EU's Regulation 2022/1616 on recycled plastics in food-contact materials is a good policy example covering aspects such as process approvals, decontamination performance, and traceability to keep migrants within specific limits (EU 2025, European Commission n.d.). Innovations in de-inking, adhesive removal, and thermal resistance testing are advancing the feasibility of safe, closed-loop recycling. These advances are highly relevant to Latin American retailers that want to scale recycled content without compromising safety.

Case study

Case study X Sprite's switch from green to transparent PET bottles

Region	Sector	Scale
Europe, Southeast Asia	Beverages	Roll-out

Solution description

Sprite is phasing out its signature green PET bottles in favour of clear PET to enhance recyclability and material value. The move improves compatibility with existing recycling systems and increases the economic value of post-consumer PET, facilitating circular packaging outcomes.

Economic benefits

- Aligns with industry-wide design-for-recycling standards and improves material recovery rates.
- Enables integration of higher recycled content into new bottles, reducing reliance on virgin plastics.

Environmental benefits

- Clear PET bottles are significantly more valuable in recycling markets; in Southeast Asia, they fetch an average premium of USD 84 per tonne over coloured PET (approximately 35% higher).
- Recycled content is already being used in 500ml Sprite bottles sold in the Philippines and Sweden, with bottles made from 100% recycled PET.

Innovation status

- The transition began in the Philippines in 2019 and expanded to Singapore, Malaysia, and Brunei in 2020.
- Roll-out continues across Western Europe, the broader Asia-Pacific region, and South Africa.

Figure 15 Sprite bottle redesign

Source: Pomranz 2022.

For the retail sector, eco-design regulation links directly to costs through EPR fee modulation. Where EPR is in place with eco-modulated fees (e.g., France's CITEO/Adelphe), packages that are easy to sort and recycle pay lower fees, while hard-to-recycle formats (e.g., black trays, complex multilayers) pay a financial penalty (Laubinger, et al. 2021, Eunomia 2025, Adelphe 2024). Supermarkets with white-label goods could therefore cut compliance costs by shifting yogurt cups, dairy tubs, or fresh-produce trays to mono PP or PET packaging formats and subscribe to APR/PRE-prescribed design guidelines. Even where fee modulation is not yet formalised in the focus region, this mechanism is a clear design signal for retailers negotiating specifications with suppliers.

As is evident, governments have a crucial role to play in supporting eco-design through regulations and incentives. Governments can:

i. mandate baseline eco-design requirements (e.g., recyclability criteria, restrictions on disruptive components); and

ii. incentivise adoption by tying compliance to lowered EPR fees, eligibility in public procurement, and targeted innovation grants.

Standardisation of products such as bottles, trays, and labels across brands and retail categories can improve reverse logistics, reduce consumer confusion, and improve system efficiency by enabling a simplification of collection and recycling systems. These incentives can be integrated into existing Latin American frameworks. Colombia's EPR under Resolution 1407/2018 already tasks supply-chain stakeholders with supporting eco-design and consumer information (Ministerio de Ambiente y Desarrollo Sostenible 2018, ADBioplastics 2024).

For Brazil, Colombia and Mexico, a potential roadmap could include:

i. adopt recognised Design for Recycling rules (APR/RecyClass) for retail suppliers;

ii. codify them via positive lists and simple recyclability criteria aligned to today's collection capacity;

iii. phase in ecomodulated fees under EPR so whitelabel and national brands adopt standardised, monomaterial foodpackaging formats that both reduce plastic waste and maintain product shelf life.

5.4 Targets, infrastructure, and credible EoL pathways

Governments often set national or local targets for waste reduction, recycling, and composting. For instance, aiming to recycle X per cent of packaging by year Y, or to reduce food waste by Z per cent. These targets, when coupled with action plans, drive efforts and funding. For example, in our focus region, Brazil's National Solid Waste Plan (2020) established a national goal to recycle 22 per cent of packaging waste by 2040, while São Paulo state has committed to reach 45 per cent recycling of municipal solid waste by 2035 (Ministério do Meio Ambiente e Mudança do Clima 2024). Colombia's Resolution 1407/2018 sets differentiated recovery targets for packaging by material type, requiring plastics to reach 30 per cent recovery by 2030, and explicitly involving waste-picker cooperatives in collection and sorting (ADBioplastics 2024, Ministerio de Ambiente y Desarrollo Sostenible 2018). Mexico does not have a single national recycling target, but Mexico City's Solid Waste Program 2021–2030 aims to divert 52 per cent of waste from landfills by 2030, including through composting and recycling infrastructure (Galicia, Paez, et al., 2019, Galicia, Paez, et al., 2021). These commitments provide formal drivers for action across the value chain, including retailers. For the retail sector, such targets translate directly into operational requirements. Packaging placed on supermarket shelves must increasingly align with available recycling and composting capacity.

Infrastructure development is critical to making these targets credible. Public investment, public–private partnerships, and producer responsibility fees can finance new waste sorting lines, composting plants, and material recovery facilities (MRF). Import restrictions that protect domestic recycling markets are another mechanism to incentivise infrastructure development by ensuring a steady feedstock for recyclers. Crucially, integration of the informal sector improves both system efficiency and social equity. If governments support informal sector integration (paying waste pickers for collection, upgrading sorting centres), they can dramatically increase recovery of packaging.

Achieving them requires improving infrastructure: more collection points, sorting facilities, recycling plants, and composting sites. Policy can incentivise infrastructure development through public investment, public-private partnerships, or by creating market conditions that reward recyclers (like ensuring a steady feedstock via EPR or import restrictions that boost local recycling industry). One crucial infrastructure for linking food and packaging waste solutions is organics recycling (composting/anaerobic digestion). If a city invests in a robust composting program for food scraps, suddenly compostable packaging becomes much more viable as a solution, because it has a place to go.

Policymakers also use landfill and incineration policies to push recycling/composting: e.g. higher landfill tipping fees or bans on landfilling recyclable/compostable material. In high-income contexts, this has been effective, for example Europe's landfill directive drove many countries to ramp up recycling. In Latin America however, poorly structured landfill taxes risk incentivising illegal dumping. A better approach is to pair landfill restrictions with immediate investment in alternatives, such as urban composting programs or upgraded sorting facilities. Where governments make these investments, retailers gain viable outlets for compostable packaging and recycled-content commitments, closing the loop between packaging design and EoL options.

5.5 Food waste reduction policies with packaging linkages

Date label reform is a useful policy mechanism for reducing food waste particularly in the retail sector (e.g., the EU Farm-to-Fork strategy). Using 'use-by' only for safety-critical products and 'best before' for quality coupled with clear formatting and consumer awareness may help reduce food wastage. For example, a 2025 US study found that 88 per cent of consumers discarded food near the label date due to confusion, emphasising the importance of standardisation globally (Ribakove 2025). This connects tangentially to packaging because producers might need to adjust how they present info on the pack and possibly use smart labels as mentioned.

From the stakeholder interviews, one clear message was that policy coherence is needed: environment ministries, agriculture/food agencies, and city authorities should align efforts so that, for instance, a ban on packaging doesn't inadvertently increase food losses due to lack of proper handling improvements. Another example is that a push for more fresh produce consumption as a health goal should be accompanied by strategies to achieve it without an increase in plastic use. Some participants from Brazil noted that policies are sometimes siloed and advocated for integrated approaches like a national task force to ensure synergy.

5.6 Consumer behaviour and retail environments

Policy succeeds when it meets consumers where decisions are made. Behavioural interventions in and around stores complement upstream design and end-of-life measures. Evidence from the United Kingdom shows that sustained campaigns combining media outreach with practical guidance on planning, storage, and label interpretation supported a large per-capita reduction in avoidable household waste over a decade, particularly when messages were segmented by household type (WRAP 2020). Packaging itself shapes habits in the home. Formats that trap residues, accelerate spoilage, or confuse disposal magnify waste. Retailers can mitigate this by clarifying claims such as recyclable, biodegradable, and compostable in ways that reflect local system realities and by equipping staff to reinforce guidance at the point of sale.

The retail environment is a powerful setting for influencing food and packaging choices. Supermarkets and grocery stores shape consumer expectations about packaging formats, product quantities, and shelf-life indicators. Redesigning these cues can significantly reduce both food and packaging waste. One of the most effective interventions is offering fresh produce without plastic packaging. Loose selling allows consumers to buy only the quantities they need, reducing spoilage at home. Studies from WRAP show that selling produce such as apples or potatoes without packaging, and without date labels, did not reduce shelf life under ambient conditions (Table 4).

The retail environment is a powerful setting for influencing food and packaging choices.

Table 4 Impact of packaging on shelf life, compared to selling loose produce (days to deterioration score of 0.3)

Product	Condition	Impact of Packaging on Shelf Life
Apple	Ambient	No impact detectable
	4°C Fridge	No impact detectable
Banana	Ambient	Increase of 1.8 days (+23%)
Broccoli	Ambient	No impact detectable
	9°C Fridge	No impact detectable
	4°C Fridge	Increase of 7 days (+35%)
Cucumber	9°C Fridge	No impact detectable
	4°C Fridge	No impact detectable
Potato	Ambient	No impact detectable

Source: adapted from WRAP 2020.

While these findings originate in Europe, their relevance for Latin America is high because loose selling is quite common in fresh produce retail in Brazil, Colombia, and Mexico. In traditional markets, fruit and vegetables are almost universally sold loose, while supermarkets typically use plastic packaging for convenience, portioning, or to signal 'premium' quality. This suggests that consumer acceptance of unpackaged produce in the focus region may be stronger; extending loose selling into supermarkets in Latin America would therefore align with existing cultural practices rather than disrupt them.

For this approach to work, it must be supported by additional guidance. Retailers should provide prominent in-store signage or QR codes linking to food storage tips (Figure 16). Reusable produce bags should be made available or encouraged through loyalty rewards. Pricing of loose produce must be comparable to packaged alternatives, and shelf arrangements should emphasise accessibility and hygiene.

Products that can be prioritised for loose selling are (Figure 16):

- Items where there is the greatest opportunity to prevent food waste e.g., potatoes.
- Where the barriers to removing plastic packaging are less e.g., peelable fresh produce such as bananas.
- The items that are already sold loose by major retailers such as papayas, onions, and tomatoes.

The following best practices can be adopted while selling fresh produce loose:

1. Include home storage guidance in a prominent place.
2. QR codes can be used to link to additional content to help customers understand the changes they are seeing in store.
3. Where individual items are stickered, transition to use compostable stickers.
4. When selling by net weight, include clear instructions and messaging around the use of reusable bags.
5. Loose versions should be available at a reasonable and comparable price to any packed alternatives, and price comparisons must be highlighted, prominent, and simple to understand.
6. Train in-store colleagues on key features of loose produce.
7. Agree with suppliers on any specific information or handling requirements.

Figure 16 Best practice example for selling fresh produce loose in supermarkets

Source: WRAP 2023.

Retailers can also adjust pack sizes to better match household needs. The HHSM identified that smaller pack sizes, aligned with weekly consumption patterns, can reduce food waste by up to 70 per cent (Reynolds, et al. 2024). In Latin America, this is relevant in urban middle-class households increasingly shopping in supermarkets where oversized packs lead to spoilage. However, smaller pack sizes may also increase packaging waste unless packaging formats are redesigned for recyclability or reuse. Offering consumers a choice of formats, with clear communication of environmental trade-offs, empowers better decision-making.

Training in-store staff to communicate these changes is essential. Employees can reinforce campaign messages, guide customers to new formats, and address concerns about freshness or food safety. This human touch helps bridge the gap between new practices and consumer acceptance.

Finally, retailers should also revisit promotional practices. Multibuy offers and price bundling often encourage over-purchasing, especially for perishable items. Shifting to value-based promotions (such as discounts for bringing reusable containers) or portion-based pricing can nudge more sustainable behaviours. Retail partnerships with local food banks and recovery programmes can also help redirect surplus food.

Case study

Case study XI Walmart Mexico's campaign for cosmetically imperfect produce

Country	Sector	Scale
Mexico	Retail produce	National roll-out

Solution description

Walmart de México y Centroamérica (Walmex) launched 'Imperfectas, pero buenas' ('imperfect but good') to sell cosmetically imperfect produce at discounted prices. The programme relaxes cosmetic standards, uses consistent pack/mesh for visibility, and educates consumers that quality and nutrition are unaffected (Market Screener 2022, WRAP 2023).

Economic benefits

- Converts shrink into revenue by monetising off-spec produce.
- Improves affordability for consumers through visible discounts.
- Strengthens supplier relationships by broadening acceptance criteria.

Environmental benefits

- Reduces field losses and in-store culling by broadening appearance standards.
- Prevents edible produce from being discarded, lowering upstream food loss.
- Encourages consumer acceptance of variable produce.

Innovation status

- Piloted in 11 stores in 2022; scaled to 109 stores by 2024.
- Reported 2,581,192 kg of cosmetically imperfect produce sold in 2024.
- Supports Mexico's voluntary food-waste reduction agenda and aligns with FAO/UNEP/WRAP best practice.

Figure 17 Example of Walmart's Imperfect Produce programme

Source: Soy502 2023.

5.7 Community-led initiatives and short supply chains

Community-based initiatives such as CSA, food cooperatives, and SFSCs provide bottom-up pathways to reduce food and packaging waste. By shortening distribution distances and relying on direct-to-consumer delivery, these models often bypass the use of single-use packaging formats typically used in supermarkets. Weekly produce baskets, for example, may be delivered in reusable crates or cloth bags, minimising plastic use while reducing food rejected based on appearance. SFSCs also reduce the need for cold-chain infrastructure and complex packaging. Because food is delivered quickly and directly, perishable goods can be sold in reusable containers or even unpackaged. Bread, fruits, and vegetables are often sold loose or in returnable crates, and items like yogurt may be packaged in refillable jars. These practices are well-suited to pedestrian, bike-based, or market-based distribution. Within the retail sector, supermarkets can learn from CSA and SFSC logistics by integrating bulk sales sections, returnable packaging schemes, and partnerships with local producer cooperatives. For example, mercados campesinos (farmers' markets), located inside or adjacent to supermarkets, offer unpackaged or minimally packaged produce directly to consumers (Romagnoli, Molina and Parrado 2018). This creates a hybrid model, blending community-based short chains with formal retail infrastructure.To scale such initiatives, supportive policy frameworks are needed. Municipalities can provide land access, storage infrastructure, or market stalls. Governments can also provide subsidies for reusable containers or invest in aggregation platforms that link small producers to local consumers. Training in logistics, food safety, and business planning is also essential to support new entrants.

Finally, community kitchens, zero-waste stores, and food-sharing platforms play a complementary role in extending food life and minimising waste. These initiatives build local knowledge and ownership, contributing to a culture of circularity. Incorporating packaging considerations into their operations, for example, using standardised, reusable takeaway containers, can amplify their impact.

Consumer-based solutions are a vital complement to upstream interventions. While individual actions alone cannot fix structural problems in the food system, they play an essential role in reinforcing system-level changes. Behavioural strategies rooted in practicality, inclusion, and trust are more likely to succeed and endure. When aligned with supportive policies and infrastructure, they can transform how food is valued, consumed, and preserved.

5.8 Key takeaways

Policy defines the playing field and can make circular choices the default for retailers and consumers. EPR aligns money with material outcomes and, when transparent and inclusive, channels investment into collection and sorting while recognising the role of informal workers. Targeted bans remove formats that trap systems in linear habits. Eco-design rules bring day-to-day specifications into line with what recovery systems can handle. Targets backed by credible infrastructure make end-of-life pathways real rather than aspirational. Consumer-facing measures then translate these system changes into everyday practice, from clearer date labels and better in-store guidance to loose selling, right-sized packs, and reuse. For Brazil, Colombia, and Mexico, the most durable results will come from coherent portfolios that sequence these instruments and align them across ministries, while using regional platforms to harmonise definitions and standards. With that alignment in place, retailers can scale formats that reduce plastic leakage and food loss together, rather than trading one problem for another.

Policy defines the playing field and can make circular choices the default for retailers and consumers.

Part III
Recommendations and conclusion

6 Outlook: recommendations and conclusion

Drawing from the solutions and examples discussed in previous chapters, this section provides targeted recommendations most relevant for Brazil, Colombia, and Mexico. The focus is on measures that retailers and policymakers in Latin America can realistically implement to address FLW while mitigating the negative externalities of plastic packaging. This chapter also discusses the replicability of such regional solutions to similar emerging economies globally.

6.1 Key takeaways

Plastic packaging plays a complex role in Latin America's food system, particularly in the retail sector. While it can help extend shelf life and reduce spoilage, particularly for fresh and perishable products, it is often overused and misaligned with actual preservation needs. In many cases, it displaces rather than prevents food waste, especially at the consumer level. Drawing from the preceding chapters, the following points highlight the main lessons and practical directions for retailers and policymakers in Brazil, Mexico, and Colombia:

- **Packaging effectiveness is context specific.** Plastic packaging is neither inherently beneficial nor detrimental to food waste prevention. Its effectiveness depends heavily on the product type, market context, supply chain conditions, and consumer behaviour. Blanket assumptions about its benefits often obscure more systemic inefficiencies.

- **Fresh produce remains the hotspot.** In Latin America, fresh fruit and vegetables account for the highest share of food waste in retail. Causes include weak cold chains, cosmetic standards, and procurement practices, not just packaging. In Brazil, gaps in refrigerated transport compound losses; in Mexico, strict quality standards for supermarkets drive rejection; in Colombia, fragmented supply chains limit storage time. Packaging adjustments alone cannot resolve these issues.

- **Packaging intensity does not equate to lower waste.** High packaging usage does not correlate with low food waste. In fact, regions with higher packaging intensity, such as North America and Europe, tend to have higher consumer-level food waste. By contrast, more frequent shopping and cultural valuation of food in Latin America often reduce household losses, despite less packaging.

- **Material substitution is not a silver bullet.** Substituting plastic with alternative materials is not a guaranteed sustainability win. Material innovations such as compostables, bio-based plastics, and agricultural waste-based trays must be assessed based on local waste infrastructure, lifecycle impacts, and actual use cases. Without supporting systems, these alternatives can become contaminants in existing recycling or composting streams. In Mexico, weak composting infrastructure means 'compostable' packs risk contaminating recycling streams. In Brazil, bio-based PET may align better with recycling capacity. Assessments must reflect infrastructure and actual use cases.

- **Packaging systems need to be redesigned for reuse and refill, not just repackaged.** Innovations in packaging-free retail formats are essential. These require enabling infrastructure, clear governance, and behavioural change incentives, particularly at the retail and consumer interface, as well as scale. Examples such as Coca-Cola's returnable PET in Brazil and Mexico show high potential when logistics are efficient and deposit schemes are enforced. Reusable packaging systems and SFSCs offer high potential for impact. When food moves quickly from farm to consumer, packaging needs are reduced. Investing in local infrastructure, producer-retailer partnerships, and logistics systems that enable reuse can address both food and plastic waste at once.

- **Just transition principles must be considered.** A systems approach to packaging must include equity. Informal workers, low-income consumers, and small producers interact with packaging differently. Transition strategies must be inclusive, addressing the needs and vulnerabilities of these actors, and avoiding burden-shifting across the value chain.

- **No one-size-fits-all solution.** There is no single 'best' packaging solution. What works in a high-volume supermarket chain in urban Mexico may be inappropriate for smallholder markets in rural Colombia. Policymakers and retailers must assess packaging interventions in context, balancing food preservation needs, waste infrastructure, and socio-economic factors.

- **Stronger policy coherence is needed.** Packaging and food waste policies are often developed in silos, leading to unintended consequences. For example, bans on certain packaging formats without improving cold chains can increase food spoilage. Integrated strategies must align food security, environmental protection, and economic resilience.

- **Data gaps hinder better decision-making.** Disaggregated data on FLW and packaging use in Brazil, Mexico, and Colombia is scarce, especially in informal markets. Improved transparency would allow retailers and policymakers to target hotspots more effectively.

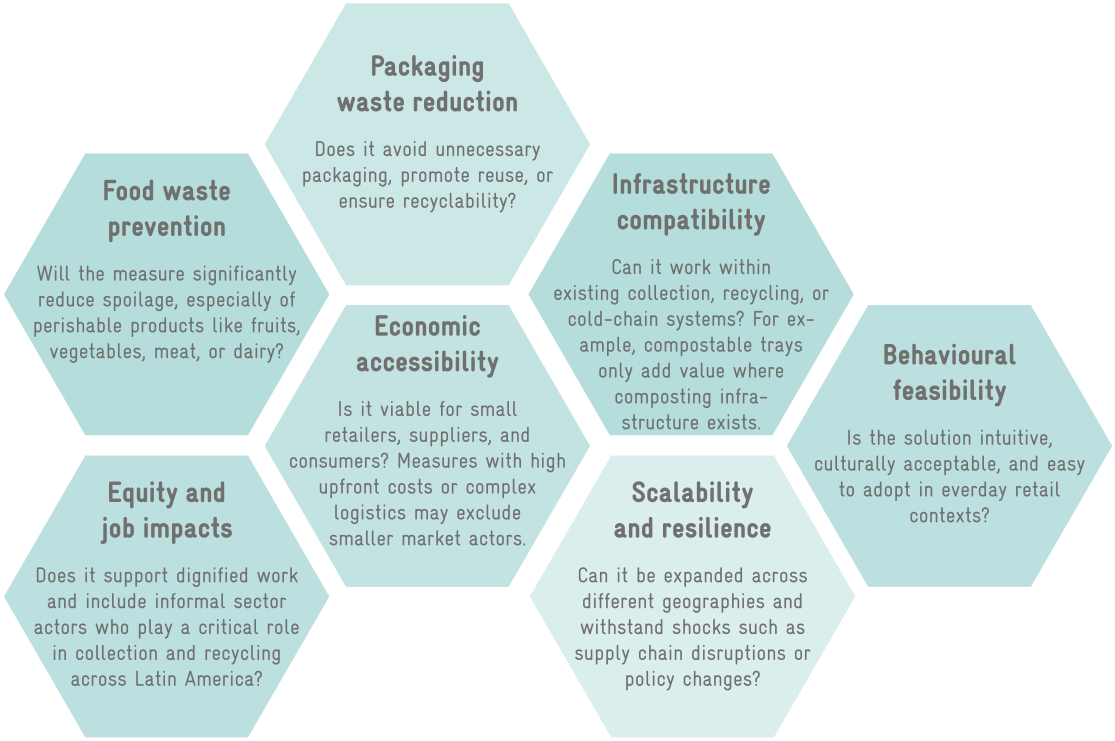
- **Consumer engagement is critical.** The success of any packaging intervention depends on how food is purchased, stored, and consumed. Behavioural change campaigns, clearer labelling, and in-store guidance can significantly reduce waste and support adoption of new packaging formats.

- **Decision tools must broaden their scope.** LCAs and other decision tools must be expanded to include environmental leakage, informal sector dynamics, environmental cost of production and EoL treatment, and the impact of packaging on food system behaviour. Current LCAs are often too narrow to guide sustainable packaging design in LMIC contexts.

Guiding principles for assessing possible solutions

When evaluating any potential intervention (e.g., bulk refill stations, changes in date-labelling, or re-distribution platforms), relevant stakeholders should consider the points in Figure 18.

Figure 18 Guiding principles for assessing possible solutions



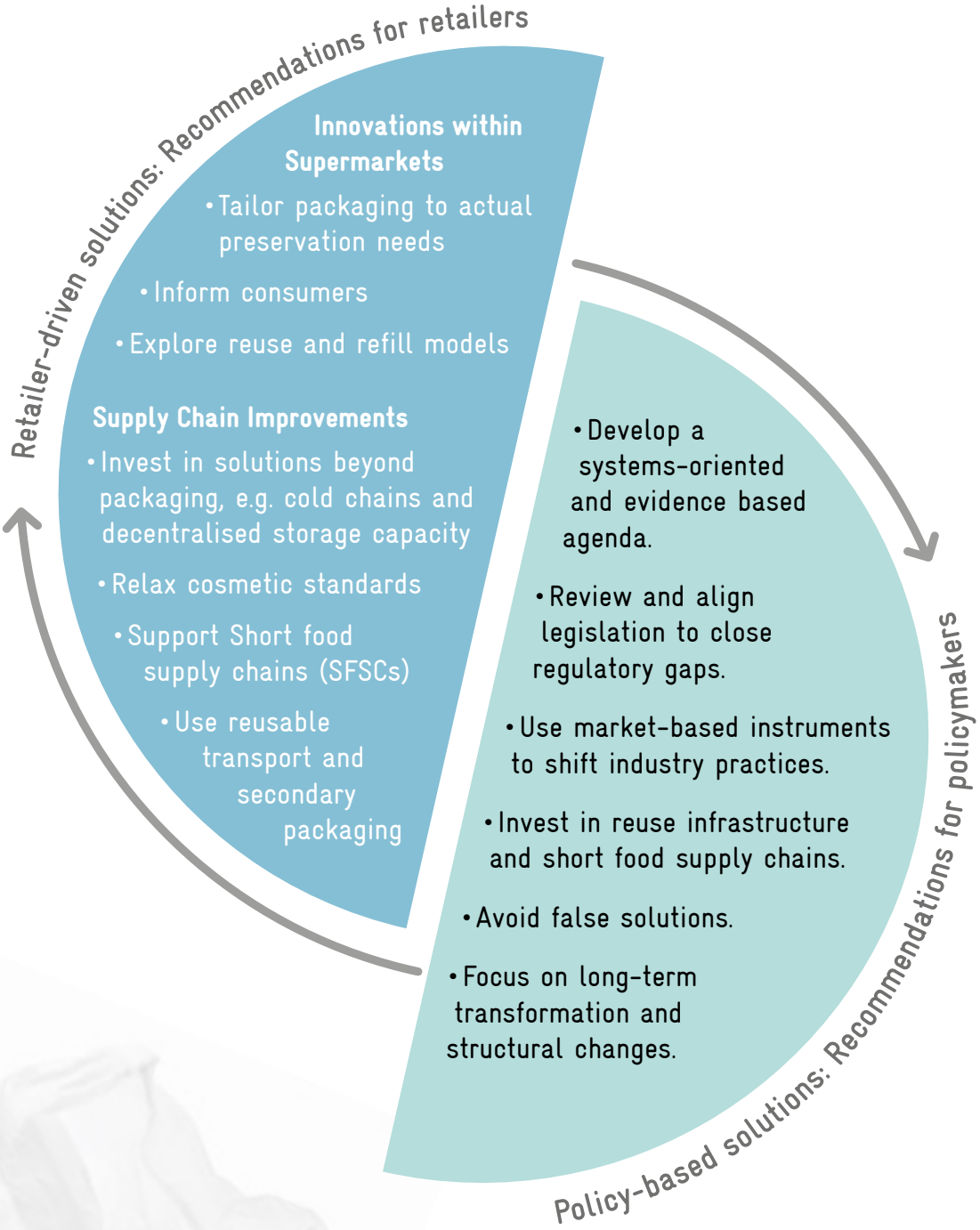
Source: adapted from BFS 2025.

Policymakers and retailers can use these questions to structure internal discussions, compare alternatives, and anticipate unintended consequences. For instance, a refill station may be very beneficial for packaging waste reduction and scalability but face challenges in consumer uptake and hygiene perception. Conversely, relaxing cosmetic standards on fresh produce may strongly prevent food waste but require retailer buy-in and consumer awareness campaigns.

The questions are not a blueprint but a decision-support tool. They highlight that packaging interventions must be judged not only on material substitution but on how they interact with food systems, infrastructure, and behaviour.

The following two sub-chapters provide recommendations for two key actors who can drive a systemic change preventing FLW and plastic pollution simultaneously: Retailers and policymakers. Figure 19 provides an overview on those two important levers for change.

Figure 19 Two levers for change: retailers and policymakers



Source: adapted from BFS 2025.

6.2 Recommendations for retailers: retailer-driven solutions

Retailers are pivotal actors in shaping both packaging practices and food waste outcomes. Their role spans multiple leverage points: procurement and supply chain design, in-store presentation, consumer engagement, and surplus redistribution. Across the case studies and regional analyses, three overarching lessons emerge:

1	2	3
The choice and design of packaging must be tailored to actual preservation needs.	**Behavioural nudges and infrastructure can often achieve better results than over-packaging.**	**Retailers can drive systemic change by shifting away from single-use logic and enabling reuse, redistribution, and waste prevention.**

Innovations within supermarkets

Supermarkets are the main interface between consumers and packaged food. Their product choices, in-store signage, discounting strategies, and packaging policies all shape consumption behaviour and waste generation.

- **Assess the trade-off between food and plastic waste.** This helps to decide when plastic packaging is really needed and essential, e.g. for meat, and when it is not, e.g. packaging fresh produce like oranges. Experiences from both Latin America and Europe show that packaging can be justified for high-risk perishables but often fails to prevent waste for robust fresh produce.

- **One-size-fits-all packaging approaches do not align with real product needs.** Fresh produce, for example, is often over-packaged to increase shelf life without strong evidence of actual waste prevention. Retailers should default to selling fresh items loose unless shelf-life studies show a clear benefit.

- **Don't overengineer packaging.** Several retailers over-engineer packaging for marketing rather than protection. Stakeholder interviews highlighted that visual appeal and branding often trump functionality, especially for shelf-stable items. This also leads to unnecessary material use without demonstrable benefits in waste reduction.

- **Label clarity matters.** Misunderstanding of date labels, especially the conflation of 'Best Before' with food safety leads to premature disposal of edible food. Supermarkets should avoid applying date labels to uncut produce unless justified by clear evidence and must avoid vague alternatives like 'display until.'

- **Storage cues influence food longevity.** Retailers are well-positioned to communicate optimal storage practices, such as the benefit of refrigerating certain fruits and vegetables, particularly in tropical LMICs where ambient temperature accelerates spoilage.

- **Explore reuse and refill models.** Supermarket pilots across Latin America reveal that reuse and refill models can work when paired with consumer incentives, deposit-refund systems, and digital tracking. These models are most viable for dry goods, cleaning products, and some beverages, and require both backend logistics and customer-facing design.

Supply chain improvements

Retailers also influence food loss and packaging waste through their sourcing standards, logistics operations, and relationships with producers. In LMICs, weak cold chains, long distances, and strict cosmetic standards amplify upstream losses.

- **Invest in solutions beyond plastic packaging.** Strengthening cold chains and decentralised storage capacity is more impactful for reducing perishables waste than switching to more plastic-intensive packaging. Targeted investments in affordable refrigeration, especially at aggregation and market nodes, can significantly reduce spoilage.

- **Procurement contracts and grading standards must be reviewed.** Excessively strict cosmetic standards lead to edible but 'imperfect' produce being discarded before reaching shelves. Retailers should work with suppliers to relax these criteria, as seen in 'ugly food' campaigns in Europe.

- **Short food supply chains bring multiple benefits.** Retailers can support short food supply chains that reduce transit time and packaging intensity. By sourcing directly from local or regional producers, especially for fresh goods, packaging needs decrease and shelf life improves. Models like Kecipir in Indonesia (Case study VII) demonstrate how app-based logistics and harvest-on-demand systems reduce both plastic and food waste.

- **Use reusable secondary packaging.** Reusable secondary packaging, such as crates and bins for transport, helps eliminate stretch wrap, foam padding, and single-use boxes. Retailers should invest in pooled or reverse logistics systems to facilitate reuse and recovery from suppliers and distribution centres.

6.3 Recommendations for policymakers: policy-based solutions

Tackling food and plastic packaging waste through regulation requires more than bans or substitution mandates. Effective policy must be holistic, evidence-based, and grounded in system-wide thinking. The most significant insights from this study underscore the importance of integrating packaging into broader food system policy frameworks, rather than treating it as a standalone environmental issue. Moreover, policy must recognise the differences in infrastructure, enforcement capacity, and market dynamics that exist across Brazil, Colombia, and Mexico.

Develop a systems-oriented and evidence-based agenda

- **Conduct comprehensive LCAs.** A recurring weakness in current policy approaches is the lack of clarity on when packaging prevents waste and when it merely adds cost and pollution. More comprehensive LCAs, adapted to Latin American contexts, are essential to evaluate trade-offs. These should cover not only carbon and material flows but also end-of-life pathways, leakage, and consumer behaviour.

- **Assess overall impact of packaging.** Packaging should be assessed not only for its material properties but for its role in driving or preventing food loss across the value chain. This requires better integration of research on food systems, waste streams, marine litter, and chemical migration.

- **Mitigate biases in analyses.** Decision-making should be informed by independent assessments that account for infrastructure gaps, leakage into the environment, and the human health risks associated with both plastics and some 'green' alternatives.

- **Enable framework to allow for comprehensive data reporting and evaluation.** Data transparency across the supply chain, especially at retail and distribution levels, is vital. Governments should require large retailers and packaging producers in Brazil, Colombia, and Mexico to disclose data on material use, waste rates, and surplus food management practices.

Review and align legislation to close regulatory gaps

- **Target high-impact areas.** Policies should directly target high-impact areas of packaging overuse, such as multipacks, neck sleeves, and cosmetic over-packaging. Regulation should be clear about which formats are unnecessary and offer no measurable benefit to food preservation.

- **Provide holistic regulatory frameworks.** Reduction targets for single-use plastics are most effective when paired with policies that promote reusable and refillable systems. Without these alternatives in place, bans can lead to material substitution without meaningful waste prevention. Food waste and packaging regulations must be harmonised to avoid misguided incentives. For example, cosmetic standards that require high uniformity of produce should be reformed to reduce pre-retail rejection rates.

- **Policies should consider entire value chain including EoL.** Packaging standards and eco-design criteria must be updated to prioritise recyclability, reusability, and the elimination of toxic additives. Legislation should also support innovation in locally recyclable or compostable materials, especially for short shelf-life applications (e.g., fibre-based trays for bakery items or banana leaf wraps).

Use market-based instruments to shift industry practices

- **Incentivise private-sector stakeholders.** EPR schemes with differentiated fees can reward producers who adopt low-impact packaging formats while penalising single-use or non-recyclable materials. These schemes should also fund local collection and sorting infrastructure.

- **Governments can lead by example through procurement contracts that specify waste reduction goals.** Green public procurement (GPP) can create demand for packaging-free or reusable systems, particularly in public food service institutions.

- **Economic instruments such as taxes on virgin plastic, incentives for reverse logistics infrastructure, and rebates for reuse adoption can be critical levers.** These must be tailored to Latin America's market structure, where informal economies and micro-enterprises are major players.

Invest in reuse infrastructure and short food supply chains

- **Mobilise public- and private-sector capital.** Many promising solutions from bulk dispensers to reusable transport packaging depend on reverse logistics and cleaning systems. Public investment and donor support should prioritise these enablers, especially in urban centres.

- **Funding should support SFSCs that reduce both transport-related spoilage and the need for shelf-life extending packaging.** Short food supply chains can reduce packaging demand and spoilage by shortening distribution distances and enabling direct retail partnerships. Supporting such initiatives in Latin America would deliver both environmental and economic benefits while advancing circular packaging goals.

- **Investment must also be directed toward collection infrastructure for both organic waste and packaging materials.** Co-treatment facilities that handle compostables, recyclables, and food waste in an integrated way are especially relevant for dense Latin American urban areas.

Avoid false solutions and focus on long-term transformation

- **Technological lock-in must be avoided.** Investments in incineration or low-value recycling can undermine the prevention hierarchy and discourage innovation in upstream waste reduction.

- **Policy should not focus narrowly on material substitution or consumer guilt.** Instead, it should enable structural changes in how food is produced, transported, sold, and consumed.

6.4 Conclusion

Addressing food and packaging waste in Latin America cannot be achieved by substituting one material for another. A large share of food loss occurs at stages where packaging plays little or no role, e.g. during harvesting, post-harvest handling, storage, and transport, mainly due to inefficient logistics, inadequate cold chains, and poor storage infrastructure. Significant waste also takes place at the consumption stage, in households and restaurants, where cultural habits, oversized portions, and limited consumer awareness are main drivers. In contexts where packaging can make a meaningful difference, e.g. by extending shelf life, protecting delicate produces during transport, or providing guidance for storage and consumption, it must be embedded in a broader systemic shift. This requires rethinking how food is packaged, marketed, and sold in retail environments, and how supply chains are structured to support these changes. The examples and solutions presented in this report demonstrate that progress is possible when interventions are adapted to the realities of Brazil, Mexico, and Colombia, backed by coherent policy and grounded in evidence.

The region has a strategic opportunity to leapfrog outdated, single-use packaging models and instead build systems that emphasise resilience, equity, and circularity. Supermarkets and retailers play a central role in this shift, e.g. by expanding loose sales, introducing reuse systems, harmonising date labels, improving cold chains. Their choices on packaging formats, promotions, and consumer guidance directly shape waste outcomes. Policymakers can accelerate change by aligning regulations with food system goals and by promoting investments in the infrastructure that enables reuse, redistribution, and efficient cold chains.

Latin America's food systems face real challenges namely, high levels of fresh produce waste, uneven logistics, and growing packaging burdens, but also hold unique strengths, from SFSCs to consumer cultures that still value fresh, unpackaged foods. By capitalising on these strengths and driving coordinated action between retailers, governments, and consumers, the region can reduce waste across the value chain while supporting food security and livelihoods. The challenge is complex, but the way forward is clear: redesign the system, not just the package.

Redesign the system, not just the package!

References

Abril Ortiz, A., Sucozhañay, D., Vanegas, P., & Martínez-Moscoso, A. 2020. 'A Regional Response to a Global Problem: Single Use Plastics Regulation in the Countries of the Pacific Alliance.' *Sustainability 12* (19). doi:https://doi.org/10.3390/su12198093.

ADBioplastics. 2024. *Legislation on single-use plastics and products in Colombia: keys, trends and opportunities.* 10 September. https://adbioplastics.com/en/legislation-on-single-use-plastics-and-products-in-colombia-keys-trends-and-opportunities.

Adelphe. 2024. *2024 rates for reducing, reusing and recycling household packaging.* Adelphe.

Alianza del Pacifico. 2020. *Pacific Alliance conducts virtual public-private dialogue on sustainable management of plastics.* 29 October. https://alianzapacifico.net/en/pacific-alliance-conducts-virtual-public-private-dialogue-on-sustainable-management-of-plastics.

Aqua. n.d. *Aqua Life.* https://aqua.co.id/en/brand/aqua-100-recycled-1.

Association of Plastic Recyclers. n.d. *APR Design® Guide Overview.* Accessed 2025. https://plasticsrecycling.org/apr-design-hub/apr-design-guide-overview.

Barrett, Justine, Zanna Chase, Jing Zhang, Mark M. Banaszak Holl, Kathryn Willis, Alan Williams, Britta D. Hardesty, and Chris Wilcox. 2020. 'Microplastic Pollution in Deep-Sea Sediments from the Great Australian Blight.' *Frontiers in Marine Science* 7. doi:https://doi.org/10.3389/fmars.2020.576170.

BBC. 2020. *Tesco to ditch plastic-wrap for multipack tins.* 24 January. https://www.bbc.com/news/business-51223214.

Bimbo Bakeries. 2024. *Grupo Bimbo Reports That 93% of Its Packaging is Made of Recyclable Materials.* 3 July. https://www.globenewswire.com/news-release/2024/07/03/2908385/0/en/Grupo-Bimbo-Reports-That-93-of-Its-Packaging-is-Made-of-Recyclable-Materials.html.

Bioleader. 2025. *Colombia's Single-Use Plastics Ban: What It Means for Food Packaging, Compliance, and Compostable Innovation.* 20 June. https://www.bioleaderpack.com/colombias-single-use-plastics-ban-what-it-means-for-food-packaging-compliance-and-compostable-innovation.

Bioplastics Feedstock Alliance. 2015. *BFA whitepaper: Responsible bioplastics.* WWF.

Brooks, Amy, Jenna Jambeck, and Eliana Mozo-Reyes. 2020. *Plastic Waste Management and Leakage in Latin America and the Caribbean.* Inter-American Development Bank. doi:https://doi.org/10.18235/0002873.

Burfield, Tom. 2022. *Peruvian asparagus importers face transportation issues.* 23 September. https://www.thepacker.com/news/produce-crops/peruvian-asparagus-importers-face-transportation-issues.

C40. 2023. *How to manage food and organic waste in Global South cities.* October. https://www.c40knowledgehub.org/s/article/How-to-manage-food-and-organic-waste-in-Global-South-cities?language=en_US.

– 2025. *How to manage food waste and organics on the path towards zero waste.* January. https://www.c40knowledgehub.org/s/article/How-to-manage-food-waste-and-organics-on-the-path-towards-zero-waste?language=en_US.

Canali, Massimo, Karin Östergren, Pegah Amani, Lusine H. Aramyan, Siet Sijtsema, Graham Moates, Keith Waldron, and Clementine O'Connor. 2014. 'Drivers of current food waste generation, threats of future increase and opportunities for reduction.'

Cater, Leonie. 2024. *EU to ban single-use plastic in deal on new green packaging rules.* 4 March. https://www.politico.eu/article/eu-ban-single-use-plastic-packaging-deal-green-rules.

CDMX. n.d. *Basura Cero – Plan de acción que consiste en implementar estrategias orientadas a prevenir y reducir la cantidad de residuos en la Ciudad de México.* https://www.sedema.cdmx.gob.mx/programas/programa/basura-cero.

Ceinture Aliment-Terre Liégeoise (CATL). n.d. *Ceinture Aliment-Terre Liégeoise (CATL).* https://www.catl.be.

Chrisafis, Angelique. 2021. *That's a wrap: French plastic packaging ban for fruit and veg begins.* 31 December. https://www.theguardian.com/world/2021/dec/31/thats-a-wrap-french-plastic-packaging-ban-for-fruit-and-veg-begins.

Coca Cola. n.d. *Descubre la forma más ecológica de disfrutar tus bebidas de la familia Coca-Cola.* https://coca-colaentucasa.com/returnables.

CompoPac. n.d. *Compostable natural fibre nettings.* https://compopac.com/en/#:~:text=CompoPac%C2%AE%20is%20a%20compostable,friendly%20and%20product%2Dappropriate%20home.

Dabo, Mohamed. 2024. *New Regulations Reshape Food Packaging in Latin America.* 26 November. https://www.packaging-gateway.com/news/new-regulations-reshape-food-packaging-in-latin-america.

Denkstatt. 2017. 'How Packaging Contributes to Food Waste Prevention.' *Summary of a study by denkstatt GmbH in cooperation with ARA AG (Austrian packaging recycling association) and further partners from the sectors retail, packaging production and science (Denkstatt 2014).*

Desai, Kareena. 2024. *My Zero-Waste Adventure: How Mexico Reduces Plastic Pollution.* 15 July. https://www.plasticpollutioncoalition.org/blog/2024/7/15/my-zero-waste-adventure-mexico-city.

Driscoll's. n.d. *94% less plastic ... and that's just the beginning ...* https://www.driscolls.eu/new-paperpack.

Ellen MacArthur Foundation. 2021. *Refill solutions to keep packaging out of the environment: Algramo.* 8 September. https://www.ellenmacarthurfoundation.org/circular-examples/refill-solutions-to-keep-packaging-out-of-the-environment-algramo.

Ellen MacArthur Foundation. 2017. 'The New Plastics Economy: Catalysing Action.'

Ellen MacArthur Foundation. 2020. 'Upstream Innovation: A guide to packaging solutions.'

EMF. 2021. *A reusable drinks bottle design for multiple brands: Universal Bottle.* 7 October. https://www.ellenmacarthurfoundation.org/circular-examples/a-reusable-drinks-bottle-design-for-multiple-brands-universal-bottle.

EU. 2025. *Commission Regulation (EU) 2022/1616 of 15 September 2022 on recycled plastic materials and articles intended to come into contact with foods, and repealing Regulation (EC) No 282/2008 (Text with EEA relevance).* 16 March. https://eur-lex.europa.eu/eli/reg/2022/1616/oj/eng.

Eunomia. 2025. 'Review and analysis of packaging EPR programs.'

European Commission. n.d. *Recycling of plastic intended for contact with food.* https://food.ec.europa.eu/food-safety/chemical-safety/food-contact-materials/plastic-recycling_en.

EXAME. 2021. *Apeel, startup da Oprah contra o desperdício de comida, vira um unicórnio.* 12 May. https://exame.com/negocios/apeel-startup-da-oprah-contra-o-desperdicio-de-comida-vira-um-unicornio.

Excelsior. 2021. *Conoce la lista de plásticos prohibidos en CDMX.* 4 January. https://www.excelsior.com.mx/comunidad/conoce-la-lista-de-plasticos-prohibidos-en-cdmx/1425275.

FAO. 2014. *Appropriate Food Packaging Solutions for Developing Countries.* Rome: Food and Agriculture Organization of the United Nations.

FAO. 2011. *Global food losses and food waste - Extent, causes and prevention.* Rome: Food and Agriculture Organization of the United Nations.

FAO, IFAD, UNICEF, WFP, WHO. 2023. *The State of Food Security and Nutrition in the World 2023.* Rome: FAO; IFAD; UNICEF; WFP; WHO, 316.

Fonseca, Iolanda. 2024. *Brazil Tops Latin America in Ocean Plastic Pollution.* 21 October. https://www.riotimesonline.com/brazil-tops-latin-america-in-ocean-plastic-pollution.

Fraunhofer IVV. n.d. *Safe use of post-consumer recyclates in food packaging.* https://www.ivv.fraunhofer.de/en/packaging/migration-tests/research-project-safecycle.html.

Fresh Plaza. n.d. *Our compostable nets made of local beech wood are the packaging of the future.* https://www.freshplaza.com/north-america/article/9236087/our-compostable-nets-made-of-local-beech-wood-are-the-packaging-of-the-future/?utm_source=chatgpt.com.

Fuenzalida, Gonzalo. 2022. *Unilever, Algramo y Walmart presentan máquinas de recarga de productos de aseo en supermercados Líder.* 26 March. https://chocale.cl/2022/03/unilever-algramo-y-walmart-presentan-maquinas-de-recarga-de-productos-de-aseo-en-supermercados-lider.

GAIA. 2021. *Rwanda: A global leader in plastic pollution.* Durban: Global Alliance for Incinerator Alternatives.

Galicia, Francisco Gutierrez, Ana Lilia Coria Paez, and Ricardo Tejeida Padilla. 2019. 'A Study and Factor Identification of Municipal Solid Waste Management in Mexico City.' *Sustainability.*

Galicia, Francisco Gutierrez, Ana Lilia Coria Paez, Ricardo Tejeida Padilla, and Emma Frida Galicia Haro. 2021. 'A System for the Inclusion of the Informal Recycling Sector (IRS) in Mexico City's Solid Waste Management.' *Sustainability.*

Garfield, Leanna. 2017. *Spray this invisible, edible coating on produce and it will last five times longer.* 17 January. https://www.businessinsider.com/apeel-sciences-food-edipeel-invisipeel-extend-life-2017-1.

Geddie, John, and Joe Brock. 2022. *Explainer: Plastic sachets: As big brands cashed in, a waste crisis spiraled.* 22 June. https://www.reuters.com/business/environment/plastic-sachets-big-brands-cashed-waste-crisis-spiraled-2022-06-22.

GIZ. 2025. 'Gender in focus: Towards inclusive solutions to plastic pollution.'

Greenpeace. 2024. *10 Eye-Opening Facts About Plastic.* 19 January. https://www.greenpeace.org.au/learn/10-facts-about-plastic.

Hancock, Alice. 2024. *EU agrees action to cut packaging waste in face of heavy lobbying.* 5 March. https://www.ft.com/content/80895792-7a44-4c22-9967-be56f894880a.

Harvard Law School. 2024. *State by State: New Toolkit Aims to Combat Food Waste in Mexico.* 16 December. https://chlpi.org/news-and-events/news-and-commentary/food-law-and-policy/state-by-state-new-toolkit-aims-to-combat-food-waste-in-mexico.

Horsman, Stephanie. 2024. *French High Court Overturns Ban on Plastic Packaging.* 15 November. https://monacolife.net/french-high-court-overturns-ban-on-plastic-packaging.

Kimeu, Caroline. 2023. *After a plastic bag ban, Kenya takes another shot at its pollution problem.* 30 May. https://www.theguardian.com/global-development/2023/may/30/kenya-wrestles-with-its-plastic-pollution-problem.

Laubinger, Frithjof, Andrew Brown, Maarten Dubois, and Peter Börkey. 2021. *Modulated fees for extended producer responsibility schemes (EPR0).* OECD.

Lopez-Galvez, Francisco, Laura Rasines, Encarnacion Conesa, Perla A. Gomez, Francisco Artes-Hernandez, and Encarna Aguayo. 2021. 'Reusable Plastic Crates (RPCs) for Fresh Produce (Case Study on Cauliflowers): Sustainable Packaging but Potential Salmonella Survival and Risk of Cross-Contamination.' *Foods* 10 (6). doi:https://doi.org/10.3390/foods10061254.

MacKerron, Conrad B. 2015. *Waste and Opportunity 2015: Environmental Progress and Challenges in Food, Beverage, and Consumer Good pAckaging.* Natural Resources Defense Council.

Mamdouh, Ola. 2024. 'Life Cycle Sustainability Assessment as a Tool for Businesses in a Circular Economy: Business Examples from Egypt.' In *Circular Economy in Sustainable Supply Chains*, by Ola Mamdouh.

Marcilio, Flavia, and Jose Davi Fidalgo. 2024. *Reverse Logistics: Regulatory Decrees and the Role of the States.* 03 10. https://klalaw.com.br/en/reverse-logistics-regulatory-decrees-role-states.

Market Screener. 2022. *Wal Mart de Mexico B de C : 'Imperfectas pero buenas', la iniciativa que busca transformar los hábitos de consumo para reducir el desperdicio de alimentos.* 15 December. https://es.marketscreener.com/cotizacion/accion/WAL-MART-DE-MEXICO-S-A-B--21021565/noticia/Wal-Mart-de-Mexico-B-de-C-Imperfectas-pero-buenas-la-iniciativa-que-busca-transformar-los-h-42568355.

Martin, Nareeta. 2025. *Navigating environmental policy change: Lessons from Kenya's plastic bag ban for a just transition of MSMEs.* ILO.

MBN. 2024. *Mexico City's Strides in Single-Use Plastics Ban.* 22 February. https://mexicobusiness.news/ecommerce/news/mexico-citys-strides-single-use-plastics-ban.

McKenzie, Baker. 2023. *Spotlight: food and cosmetic safety in Mexico.* 14 September. https://www.lexology.com/library/detail.aspx?g=deda09a9-0861-49ec-a9db-c5221b1e7775.

Meijer, Lourens J.J., Tim van Emmerik, Ruud van der Ent, Christian Schmidt, and Laurent Lebreton. 2021. 'More than 1000 Rivers Account for 80% of Global Riverine plastic Emissions into the Ocean.' *Science Advances* 7 (18). doi:https://doi.org/10.1126/sciadv.aaz5803.

Michail, Niamh. 2020. *Plastic food and drink packaging: Use it or lose it?* 6 January. https://www.foodnavigator-latam.com/Article/2020/01/05/Plastic-food-packaging-in-Latin-America-Legislation-and-consumer-concerns.

Ministerio de Ambiente y Desarrollo Sostenible. 2018. 'Resolucion 1407 de 2018.' https://cancilleria.gov.co/normograma/compilacion/docs/resolucion_minambiente_ds_1407_2018.htm.

Ministério do Meio Ambiente e Mudança do Clima. 2024. 'Plano Nacional de Resíduos Sólidos.' 5 July.

Mohan, Anne Marie. 2020. *Unilever Partners in 'Refill on the Go' Reuse Model.* 10 July. https://www.packworld.com/sustainable-packaging/article/21139789/unilever-partners-in-refill-on-the-go-reuse-model.

Nemitz, Ellen. 2024. *What will the Brazilian food industry do about plastic packaging?* 19 September. https://news.mongabay.com/2024/09/what-will-the-brazilian-food-industry-do-about-plastic-packaging.

Nestlé Professional. 2019. *New Maggi Professional food services packaging is simpler to recycle.* 15 January. https://www.nestle-professional.com/news/new-maggi-professional-food-services-packaging-simpler-recycle.

Nielsen, Catherine R. 2019. *Regulation of Food-Contact Materials in Latin America (Part 2).* 15 July. https://www.packaginglaw.com/special-focus/regulation-food-contact-materials-latin-america-part-2.

Ocean Conservancy. 2017. *Together for our Ocean – International Coastal Cleanup 2017 Report.* Washington, DC: Ocean Conservancy.

OECD. 2022. *Global Plastics Outlook: Economic Drivers, Environmental Impacts, and Policy Options.* Paris: OECD Publishing. doi:https://doi.org/10.1787/de747aef-en.

Packaging Europe. 2025. *How can we boost the circularity of post-consumer polypropylene?* 11 February. https://packagingeurope.com/comment/how-can-we-boost-the-circularity-of-post-consumer-polypropylene/12475.article.

– 2020. *Reuse: a closer look at Coca-Cola Brazil's unique returnable bottle initiative.* 11 February. https://packagingeurope.com/reuse-a-closer-look-at-coca-cola-brazils-unique-returnable-bottle-initiative/1583.article.

– 2022. *The start-up turning agricultural waste into compostable packaging.* 7 July. https://packagingeurope.com/features/the-start-up-turning-agricultural-waste-into-compostable-packaging/8433.article.

Packnatur. n.d. *Cellulose.* https://packnatur.at/en/products/cellulose-tube-netting.

Pascall, Melvin A., Kris DeAngelo, Julie Richards, and Mary Beth Arensberg. 2022. 'Role and Importance of Functional Food Packaging in Specialized Products for Vulnerable Populations: Implications for Innovation and Policy Development for Sustainability.' *Foods.* doi:https://doi.org/10.3390/foods11193043.

Perkins, Tom. 2023. *Recycled and reused food contact plastics are 'vectors' for toxins – study.* Edited by The Guardian. 27 May. https://www.theguardian.com/environment/2023/may/27/recycled-reused-food-plastic-toxins-study#:~:text=Recycled%20and%20reused%20food%20contact,and%20phthalates%2C%20new%20research%20finds.

Plastics Europe. 2022. *Plastics – the Facts 2022.* Plastics Europe.

Pomranz, Mike. 2022. *Food & Wine.* 27 July. https://www.foodandwine.com/news/sprite-bottle-color-green-clear.

Reuters. 2024. *EU provisionally agrees on law to cut packaging waste.* 5 March. https://www.reuters.com/world/europe/eu-reaches-deal-reduce-plastic-waste-packaging-2024-03-05.

Reynolds, Christian, Lenny Koh, Ramzi Fayad, Jack Pickering, Gloria Rui, Virginia Martin Terrejon, Deborah Rees, et al. 2024. 'Reducing plastic packaging and food waste through product innovation.' *Centre for Food Policy.* City University London. https://www.youtube.com/watch?v=DDle1BuJ15c.

Ribakove, Sara. 2025. *Date labels and food waste: Here's what to know.* 28 February. https://www.cspi.org/cspi-news/date-labels-and-food-waste-heres-what-know.

Romagnoli, Federica, Juan Molina, and Alvaro Parrado. 2018. 'How to improve smallholder market access: Evaluation of Mercados Campesinos in Colombia.' *Economía y desarrollo rural.*

SafeGuardS. 2023. *France: the ban on plastic packaging for fruits and vegetables is back in force.* 27 June. https://www.sgs.com/en/news/2023/06/safeguards-7823-france-the-ban-on-plastic-packaging-for-fruits-and-vegetables-is-back-in-force.

Santander Trade. 2025. *Trade Markets.* March. https://santandertrade.com/en/portal/analyse-markets/brazil/distributing-a-product.

Schweitzer, Jean-Pierre, Susanna Gionfra, Mia Pantzar, David Mottershead, Emma Watkins, Foivos Petsinaris, Patrick ten Brink, Emilia Pta, Charlotte Lacey, and Charlotte Janssens. 2018. *Unwrapped: how throwaway plastic is failing to solve Europe's food waste problem (and what we need to do instead).* Brussels: Institute for European Environmental Policy (IEEP).

Severson, Kim. 2024. *So Much Produce Comes in Plastic. Is There a Better Way?* 2 April. https://www.nytimes.com/2024/04/02/dining/plastic-food-packaging.html.

SGS. n.d. *Food Contact Material Regulations – Mercosur Region.* https://www.sgs.com/en-ch/services/food-contact-material-regulations-mercosur-region.

Sikaria, Radhika. 2023. *Tipa crafts food tray from rice waste for at-home composting and recycling.* 9 November. https://www.packaginginsights.com/news/tipa-crafts-food-tray-from-rice-waste-for-at-home-composting-and-recycling.html.

Soy502. 2023. *¡Menos desperdicio, más sabor! Walmart lanza «Imperfectas pero Buenas».* 13 September. https://www.soy502.com/articulo/walmart-lanza-nuevo-programa-imperfectas-pero-buenas-101337.

Statista. 2024. *Retail revenue of supermarkets and convenience stores in Mexico from 2014 to 2023.* December. https://www.statista.com/statistics/1056565/mexico-retail-revenue-supermarkets-and-convenience-stores.

Systemiq. 2020. 'Breaking the Plastic Wave: A comprehensive assessment of pathways towards stopping ocean plastic pollution.'

Tesco News. 2025. 'Journey to Greener Groceries – Minimising food waste and reducing our packaging footprint.' 28 January. https://www.youtube.com/watch?v=EEj14ihSikc.

The Coca Cola Company. n.d. *Sé Retornable.* https://www.coca-cola.com/mx/es/offerings/retornables.

UNEP. 2023. *Blue Awakening as Latin American and Caribbean states say no to plastic.* 5 June. https://chlpi.org/news-and-events/news-and-commentary/food-law-and-policy/state-by-state-new-toolkit-aims-to-combat-food-waste-in-mexico.

UNEP. 2023. *Compilation of information, best practices and lessons learned on measures taken by key stakeholders to prevent and reduce single use plastic waste and packaging waste.* UNEP.

UNEP. 2024. 'Food Waste Index Report 2024. Think Eat Save: Tracking Progress to Halve Global Food Waste.' Nairobi. https://wedocs.unep.org/20.500.11822/45230.

UNEP. 2024. *Latin America and the Caribbean launch first regional eco-labeling programme.* 24 July. https://www.unep.org/news-and-stories/press-release/latin-america-and-caribbean-launch-first-regional-eco-labeling.

UNEP. 2018. *Legal Limits on Single-Use Plastics and microplastics: A Global Review of National Laws and Regulations.* Nairobi: United Nations Environment Programme.

UNEP. 2018. 'Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations.'

UNEP. 2020. *Mexico City, a megalopolis' war on plastic bags.* 13 February. https://www.unep.org/news-and-stories/story/mexico-city-megalopolis-war-plastic-bags.

UNEP. 2022. *Single-use supermarket food packaging and its alternatives: Recommendations from Life Cycle Assessments.* Nairobi: UNEP.

UNEP. 2023. *The Chilean start-up changing our relationship with plastic.* 17 May. https://www.unep.org/news-and-stories/story/chilean-start-changing-our-relationship-plastic.

UNIDO. 2025. *Navigating the food loss and waste paradox.* UNIDO.

United Nations. 2014. *Plastic waste causes $13 billion in annual damage to marine ecosystems, says UN agency.* 23 June. https://news.un.org/en/story/2014/06/471492#:~:text=Concern%20is%20growing%20over%20widespread,the%20United%20Nations%20Environment%20Assembly.

Verghese, Karli, Helen Lewis, Simon Lockrey, and Helén Williams. 2013. *'Final Report: The role of packaging in minimising food waste in the supply chain of the future.'* doi:http://dx.doi.org/10.13140/2.1.4188.5443.

Vuorinen, Tiia, Erwan Mouazan, Emma Väre, and Ella Kärkkäinen. 2024. *State of the art of food packaging systems.* STOPP.

Waitrose & Partners. n.d. *Plastics and Packaging.* https://www.waitrose.com/ecom/content/sustainability/plastic-reduction/plastics-and-packaging.

Walmart Chile. n.d. *Walmart, Unilever y Algramo implementan iniciativa sustentable con envases inteligentes recargables que permitirá ahorrar y reducir el uso de plástico.* https://www.walmartchile.cl/walmart-unilever-y-algramo-implementan-iniciativa-sustentable-con-envases-inteligentes-recargables-que-permitira-ahorrar-y-reducir-el-uso-de-plastico.

Walmart de México y Centroamérica. 2024. *Sustentabilidad.* Walmart de México y Centroamérica.

Walmart. 2019. *Update: Walmart Canada prevents 1.1 million pounds of plastic from entering its supply chain.* 23 October. https://www.walmartcanada.ca/content/walmart-canada/en_ca/news/2019/10/24/update-walmart-canada-prevents-11-million-pounds-of-plastic-from-entering-its-supply-chain.html.

World Bank. 2020. *Addressing Food Loss and Waste: A Global Problem with Local Solutions.* World Bank. http://hdl.handle.net/10986/34521.

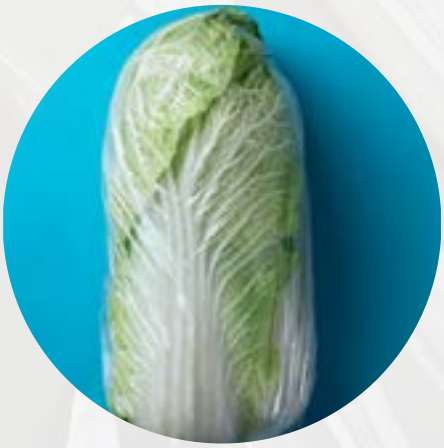
World Economic Forum. 2019. *Harnessing the Fourth Industrial Revolution for the CIrcular Economy: Consumer Electronics and Plastics Packaging.* World Economic Forum.

WRAP. 2020. *Addressing the Food Loss and Waste Challenge – a WRAP perspective.* https://www.pas.va/en/publications/scripta-varia/sv147pas/gover.html.

WRAP. n.d. *Redesigning the Plastics System: Reducing the Climate Impact of Plastic Packaging.* https://www.wrap.ngo/taking-action/plastic-packaging.

WRAP. 2023. *When to sell uncut fruit and vegetables loose; Labelling to help people waste less food.* WRAP.

Xie, Jian, and J. Martin. 2022. *Plastic Waste Management in Rwanda: An Ex-post Policy Analysis.* World Bank.



Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Friedrich-Ebert-Allee 32 + 36
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1 – 5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de