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A review of parameters and requirements for an effective consumer label on plastics and plastics alternatives

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Abbreviations

ACDN	Colombian Association of Dietitians and Nutritionists
ANDI	National Business Association of Colombia
ASTM	American Society for Testing and Materials
ARL	Australasian Recycling Label
CCPA	Central Consumer Protection Authority
CEL	China Energy Label
CEN	European Committee for Standardisation
CONAI	Consorzio Nazionale Imballaggi
ECCC	Environment & Climate Change Canada
ELIS	Environmental Labels and Information Schemes
EPR	Extended Producer Responsibility
FDA	Food and Drug Administration
FOPL	Front of Package Label
ICIPC	Plastic and Rubber Training Institute
ICPEN	International Consumer Protection and Enforcement Network
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
INC	Intergovernmental Negotiating Committee on Plastic Pollution
ISO	International Standardisation Organisation
KPI	Key Performance Indicator
NAFTA	North American Free Trade Agreement
NDC	Nationally Determined Contribution
NTB	Non-Tariff Barriers
NTM	Non-Tariff Measures
OECD	Organisation for Economic Co-operation and Development
OPRL	On-pack Recycling Label
PREP	Packaging Recyclability Evaluation Portal
RIC	Resin Identification Code
SASO	Saudi Standards, Metrology and Quality Organisation
SIRIM	Standards and Industrial Research Institute of Malaysia
TBT	Technical Barriers to Trade
TISI	Thailand Institute of Industrial Standards
UNGCP	United Nations Guidelines for Consumer Protection
UNCTAD	United Nations Trade and Development
UNEP	United Nations Environment Programme
USCMA	United States–Mexico–Canada Agreement
VSS	Voluntary Sustainability Standards
WTO	World Trade Organisation
WWF	World Wildlife Foundation
WMO	World Meteorological Organization
WTO	World Trade Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
USMCA	United States–Mexico–Canada Agreement
W3C	World Wide Web Consortium
WEF	World Economic Forum
WTO	World Trade Organization

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Chapter I

Introduction


BOXED WATER IS BETTER.

1. Background

Labelling has played a crucial role in guiding consumer choices, dating back to ancient Egyptian and Greek civilizations, where symbols denoted the origin and authenticity of goods (Smith, 2004). Although many rudimentary labelling practices existed, modern labelling can be traced back to the United States of America's Pure Food and Drug Act of 1906, which required accurate labelling to prevent misbranding and consumer harm (U.S. Food and Drug Administration, 2018). Since then, various sectors, such as nutrition, energy, and plastics, have implemented labelling practices. Plastic labelling began in 1988 with the Resin Identification Codes (RIC), introduced in the United States by the then Society of the Plastics Industry to facilitate recycling (Romer, 2021). Other schemes such as European Energy labelling was introduced in the European Union through European Union Directive 92/75/EC in 1994 (Cetik, 2011).

The United Nations Guidelines for Consumer Protection acknowledge consumers' legitimate right to adequate information, enabling them to make informed choices according to individual wishes and needs (UNGCP, Paragraph 5e). Additionally, the Guidelines recommend promoting consumer access to accurate information about the environmental impact of products and services through product profiles, industry environmental reports, consumer information centres, voluntary and transparent eco-labelling programs, and product information hotlines (UNGCP, Paragraph 29).

Labelling is key to upholding consumers' right to information, ensuring transparency,

Clear, standardized plastic labels empower people to choose sustainably, reduce pollution, and close the loop—transforming everyday consumption into a force for circularity and global environmental progress

Figure 1
Example of a Resin Identification Code (RIC) and other plastic labels

Source: Wikicommons.

and fostering informed decision-making. It is important in domestic and international trade as it ensures transparency and a level playing field amongst market actors, promotes regulatory compliance, and enhances consumer protection and economic interests. Harmonized labelling practices are essential for smooth trade and market stability, as they establish a consistent framework for businesses, reducing complexity and costs while preventing disruptions caused by labelling discrepancies (FAO, 2023). These standards streamline export and import processes by minimizing compliance checks and enhancing supply chain efficiency (Hoekman, Mavroidis, & Nelson, 2023).

Additionally, labelling can help product traceability, which is vital for managing recalls and maintaining quality, especially in the food sector (Jarzębowski & Petersen, 2021). Eco-labelling and product traceability has become increasingly relevant in international trade discussions. Between 2009 and 2021, amongst notifications submitted under the Technical Barriers to Trade (TBT) Agreement circular economy related notifications experienced the most rapid growth, including eco-labelling and information schemes policies, demonstrating the close link between trade and product label policies (OECD, 2023).

In the context of the circular economy, Environmental Labels and Information Schemes (ELIS) provide information such as a product's material content, repairability, recyclability, lifespan, production methods, and expected performance, thereby fostering better communication among value chain actors (OECD, 2023). Businesses can use these labels to showcase the environmental aspects of their products, while consumers can use them as a reference when making purchases. Governments can integrate labelling and information schemes into regulations to promote market transformation and encourage behavioural change. In turn, behavioural insights can inform and improve consumer labelling.

1.2 Study objective and methodology

Building on the INC process, WTO environmental dialogues and UNCTAD's ongoing dialogue with national environmental institutions and consumer protection agencies, this study aims to provide a comprehensive analysis that includes an overview of plastic labelling practices used across countries, drawing upon best practices and learnings from cases of mislabelling or false performance claims.

The primary objective of this study is to define the parameters and requirements for an effective consumer-facing label for plastics and non-plastic alternatives. The goal is to ensure that labels convey accurate, accessible information on key product attributes, such as composition, characteristics, recyclability, and appropriate disposal methods, thereby enabling consumers to make informed decisions and contributing to the reduction of plastic waste.

This study initially identifies and compares global best practices in plastic consumer labelling from developed and developing countries. By analysing successful systems across regions, the study aims to identify patterns and trends that have been successful across countries in a regional and local context. As a means of comparison, the study also examines international labelling best practices in the sectors of energy and nutrition to draw parallels with the insights gathered for plastics labelling thus far. Finally, the study explores the key factors needed to equip consumers with accurate label information to make informed and sustainable choices.

Recommendations are made to standardize and improve labelling practices, offering a road map for policymakers to enhance environmental protection and facilitate consumer's education and awareness of material choices. Moreover, this study also seeks to enhance international cooperation by encouraging global

alignment on labelling standards addressing plastic pollution, facilitating cross-border trade, and promoting sustainability across the life cycle of products.

This report employs a literature and policy review as the primary research method to provide a comprehensive overview of product labelling practices. It covers examples from developed countries and regions such as Australia, Canada, Japan, the Republic of Korea, United States of America, and the European Union together with examples from developing regions such as Africa, South and South-East Asia and Latin America, focusing primarily on labelling policies introduced or in force during the 2010s and 2020s. The review includes an illustration of energy and nutrition labelling (see Appendix 7.3) and offers recommendations and best practices for plastic packaging labelling. This report relies on available data from both developed and developing countries. Energy and nutrition labelling cases were selected based on reported successes in Chile, China, Colombia, Germany, and the European Union (see Appendix 7.3), highlighting common factors that contributed to the effectiveness of these labels.

Based on the information gathered, the benchmarking process evaluates and compares mandatory labelling standards (see Appendix 7.1). This process involved identifying best practices, analysing differences and commonalities, and examining the influence of local contexts on the efficacy of respective labels. The assessment qualitatively analyses the effectiveness of labels using data on consumer comprehensibility and awareness surveys, along with factors such as the simplicity and widespread acceptability of label designs and the supporting regulatory mechanisms.

A stakeholder analysis was also conducted, mapping relevant actors and assessing their influence in labelling policy development. It also contains recommendations for inclusive engagement strategies (see Appendix 7.2).

1.3 The international landscape in consumer protection and sustainability

It is crucial to consider broader international frameworks that support consumer information and protection, especially given the importance of environmental labelling in the circular economy. The United Nations Guidelines for Consumer Protection (UNGCP) are the only internationally agreed global framework for consumer protection and have been widely implemented by UNCTAD member States. One of the key principles outlined is the promotion of sustainable consumption patterns, particularly in addressing environmental degradation caused by unsustainable production and consumption, especially in industrialized countries.

Moreover, the UNGCP encourage all Member States to promote sustainable consumption actively, with developed countries leading the effort and developing countries striving to achieve sustainability while considering their unique circumstances, respecting the principle of common but differentiated responsibilities (UNGCP, Paragraph 6).

Previous analysis by UNCTAD (2024) revealed that many trade-related policy measures on non-plastic material substitutes relate directly to protecting human health and the environment. Similarly, a 2023 study by the International Institute of Sustainable Development (IISD) examined the various policy measures that countries are implementing to regulate the marketing of plastics. However, in both instances, the regulations identified did not consistently produce clear communication or labelling directed at consumers.

Labelling structural and packaging materials, such as plastics, plastic alternatives, and non-plastic substitutes, is crucial, as it facilitates proper recycling, ensures regulatory compliance, and provides vital safety information. Such labelling

supports consumers in making informed choices and promotes environmental sustainability and circularity. However, labelling for plastic and plastic-containing products–such as paper mixed with plastic resins and plastic alternatives such as bioplastics, biodegradable, including oxo-biodegradable plastics, and compostable plastics–presents an additional complexity for consumer comprehension, which may lead to confusion and mismanagement in downstream plastic disposal.

With 80 per cent of plastics ending up in landfills or leaking into the environment due to mismanagement (PlasticsEurope, 2020; Geyer et al., 2017), clear and accurate labelling is key for proper disposal. By empowering consumers with the correct information, labelling plays a key role in closing material loops and fostering a circular economy, where resources remain in use for as long as possible, waste is minimized, and materials are continuously recovered and reintegrated into production cycles.

As consumers become increasingly aware of the environmental impacts of their purchases, a report analysing consumer perceptions across nine countries revealed that 84 percent of respondents consider sustainability an important criterion when selecting products or brands (IBM, 2021). Effective labels can streamline trade processes and improve consumer perceptions, but mislabelling can mislead consumers and exacerbate plastic pollution. Despite growing concern about the environmental impact of plastics, confusion persists among consumers regarding the proper disposal of plastic items, as many still struggle to understand the differences between biobased, biodegradable, and compostable plastics.

International trade in plastic products (or those with plastic packaging) has increased interest in labelling as a crucial tool to educate market agents and help combat plastic pollution. The UNGCP state that Member States, in close collaboration with manufacturers, distributors and consumer organizations, should take measures regarding misleading environmental claims or information in advertising and other marketing activities. Additionally, the guidelines encourage the development of appropriate advertising codes and standards for regulating and verifying sustainability claims. (UNGCP, Paragraph 30).

Moreover, the Guidelines allocate shared responsibility for sustainable consumption to all members of society, including States, informed consumers, businesses, labour organizations and environmental organizations (Paragraph 50); Member States are encouraged to develop and implement comprehensive policies that integrate sustainable consumption into broader public policies. These policies should foster collaboration with businesses, consumer groups, and environmental organizations to ensure policymaking that reflects diverse stakeholder perspectives. Member States should also promote the design, development and use of products and services that are energy and resource-efficient throughout their entire life cycle. They should encourage the adoption of recycling programs, and for consumers to both recycle waste and purchase recycled products (Paragraph 52). The Guidelines encourage Member States to support developing and implementing strategies that promote sustainable consumption through regulatory measures, economic incentives, and public awareness campaigns (Paragraph 51). Moreover, the Guidelines call for Member States to promote the development and use of national and international environmental health and safety standards for products and services; such standards should not result in disguised barriers to trade (Paragraph 53). According to the UNGCP, as part of good business practices, businesses are expected to develop programmes and mechanisms to help consumers acquire the knowledge and skills necessary to understand risks, make informed decisions, and access competent, professional advice, ideally from independent third parties (UNGCP paragraph 11(d)). Likewise, Member States, in partnership with businesses and civil society organizations,

should also implement strategies to promote sustainable consumption. These strategies should raise awareness about the impacts of consumption patterns, eliminate subsidies that encourage unsustainable practices, and promote best practices in environmental management across sectors. As such, Guideline 44 further encourages Member States to incorporate product labelling into consumer education and information programs, helping consumers make informed and sustainable choices. Indeed, effective labelling, especially concerning plastic products, could be a key tool in driving consumer behaviour towards better material options and supporting global efforts to tackle plastic pollution.

However, recent findings highlight significant gaps in current labelling practices. A global assessment by Consumers International, UNEP, and the One Planet Network revealed that only 19 per cent of recycling and sustainability labels on plastic packaging offer consumers the quality information needed to make informed decisions (UNEP and Consumers International, 2020). This lack of clear, standardized, and accountable labelling contributes to consumer confusion, even as awareness and the desire to reduce plastic use continue to grow. In response, the 2020 report proposes five global recommendations to engage businesses, policymakers, and standard setters in creating better plastic labelling that makes sustainability an easier choice for consumers (UNEP and Consumers International, 2020).

Despite ongoing advancements in sustainability, there is an urgent need for a comprehensive reform of labelling practices to accurately reflect the evolving composition, complexities, and technological innovation in the market. Updating labelling practices is essential to ensure they remain relevant and effective in empowering consumers, supporting sustainable consumption, and fostering greater market transparency.

1.4 The international landscape in plastic pollution

The widespread issue of plastic pollution has gained significant global attention. However, the absence of a unified international framework for plastic labelling has complicated efforts to reduce plastic pollution (UNEP, 2020). While many regions rely on national plastic policies and the regionalization of these policies, significant international efforts and dialogues aim to establish a global standard for addressing plastic pollution.

The ongoing discussions by the Intergovernmental Negotiating Committee (INC) led by the United Nations Environment Programme (UNEP), as well as the World Trade Organization's (WTO) Dialogue on Plastic Pollution (DPP), both highlight the global recognition of the urgent need to tackle plastic pollution. The UN Plastics Treaty aims to address the entire life cycle of plastics—from production to disposal—focusing on reducing plastic pollution and its harmful effects on the environment and human health. Similarly, the WTO's DPP, launched in November 2020 with 78 co-sponsors representing over 85 per cent of global plastics trade, seeks to reduce plastic pollution and promote sustainable trade practices (WTO, 2021).

At the WTO's 13th Ministerial Conference in February 2024, members agreed to cooperate on trade-related actions to support global efforts to end plastic pollution, complementing other international initiatives (WTO, 2024).

Both processes recognize the importance of transparency and cooperation, advocating for tracking and traceability measures to promote eco-labelling practices. The primary objective is to ensure safe use of plastics, as well as recycling, and proper disposal throughout its life cycle. Emphasis is placed on standardized labelling practices, acknowledging the empowerment of consumers with reliable

information to address plastic pollution. In factual compilation I, section 2b, the WTO calls for improving the identification of targeted plastic products such as chemicals, polymers, additives, and plastic products to facilitate better monitoring, evaluation, reporting, and regulation (WTO, 2024). Standardized labels with clear definitions of typology, recycled content, and end-of-life instruction would facilitate the monitoring flow and the design of future trade policies. Additionally, in factual compilation IV, section 2a identifies the trade-related plastics measures (TrPMs) of bans/prohibitions pursuing restriction of single-use plastics, waste management and chemical, toxic and hazardous substances management. By consistently using standardized labels, it would be simpler to impose control measures on the trade of products that cause significant harm to the environment (WTO, 2024).

The INC draft (Compilation draft text on the internationally binding instrument on plastic pollution, including Marine environment) also specifies material traceability and recyclability of plastics and plastic products. Establishing governing bodies and maintaining certification procedures and labelling requirements, under Suboption 1 of negotiating text on Product Design, composition and performance. This highlights the need to make changes in the design stages and the role of labels in reflecting the product composition. The establishment of digital tracking, traceability and eco-labelling were highlighted in INC negotiating drafts as important steps in the promotion of circularity, addressing plastic pollution and aiding informed consumer decision-making.

As negotiations for a global plastics treaty progress and the WTO explores trade-related measures that can facilitate implementation of an eventual treaty, standardized and effective plastic labelling systems will likely become more prominent. These initiatives are essential to a comprehensive, life-cycle approach to plastic pollution. The increased focus on plastic labelling, particularly when coupled with improved consumer education and awareness, reflects a broader shift towards sustainable and circular economies, where accurate information about materials and their environmental impact becomes crucial for informed decision-making.

1.5 Analytical frameworks and international standards applied

To define robust parameters for an effective consumer-facing label on plastics and plastic alternatives, this section draws on internationally recognized frameworks and standards that address recyclability, composability, and biodegradability. These frameworks guide the type of information a label should convey to ensure clarity, credibility and alignment with global best practices. This analysis examines several internationally recognized frameworks and standards based on their governance, market recognition, and international acceptance. Their application has ensured that labelling practices are consistent, reliable, and internationally accepted, providing a strong benchmark for evaluating label effectiveness.

This section examines standards for labels established by the three main standard-setting bodies: the International Organization for Standardization (ISO), the American Society for Testing and Materials (ASTM), and relevant guidelines from the European Committee for Standardization (CEN).

These organizations have frameworks that mimic each other in terms of functionality. For example, ISO 14021 (which verifies recycled content and recycled materials for self-declared environmental claims (ISO, 2016)) overlaps with the CEN standard EN 15343 (for plastic recycling traceability and assessment of conformity and recycled content (CEN, 2007)). Regarding labelling, these two standards help define the information a plastic label should communicate about recycled materials and

Table 1
List of international standards

Standard	Organization	Year	Focus
EN 13432	CEN	2000	Compostability and anaerobic treatability for recovering packaging materials
ASTM D6400	ASTM International	2019	Guidelines for industrial composting for plastics
ASTM D6868	ASTM International	2021	Guidelines for Composting for items incorporating plastics and polymers
ISO 18606	ISO	2013	Packaging and environment: recyclability, compostability, hazardous substances
ISO 17088	ISO	2021	Procedure and requirements for recovery through organic recycling
NF T 51-800	French government	2015	Plastics suitable for home compostability

Source: UNCTAD.

content. One of the most widely recognized standards for recycling is the ASTM D7611 (which provides guidelines for coding plastic products (ASTM International, 2021). It specifies the Resin Identification Code (RIC) system, which helps identify and sort seven categories of plastic materials for recycling. RICs offer a model for visual communication through symbol coding on consumer-facing labels. For materials and recyclability, ISO 18604 provides guidance on which packaging can be classified as recoverable by material recycling. This standard was set to end the fragmented approach to recycling taken by jurisdictions, regulators, packaging manufacturers or certification bodies to date (ISO, 2013; UNCTAD, 2022).

There are a few comparable standards among these standard-setting bodies for biodegradability and composability of plastic and plastic alternatives. The EN 13432 by the CEN is one of the oldest standards set for composability and anaerobic treatability for recovering packaging materials (CEN, 2000). ASTM International has the ASTM D6400 and the ASTM D686, which provide guidelines for industrial composting for plastics (ASTM International, 2019) and compositing for items that incorporate plastics and polymers (ASTM International, 2021), respectively. Correspondingly, ISO 18606, which focuses on packaging and the environment, including recyclability, compostability, and hazardous substances (ISO, 2013), and ISO 17088, which provides procedures and requirements for recovery through organic recycling (ISO, 2021) offer further specifications to better regulate plastics and plastic alternatives.

Regarding home compostability, attention is given to the French national standard NF T 51-800, which specifies requirements for plastics suitable for home composting. While international standardization bodies have not yet addressed home compostability, this French standard is modelled after ISO 18606 (UNCTAD, 2022).

These standards provide a foundation for labelling frameworks, but they are not universally adopted. By reviewing these frameworks, we extract key parameters– such as traceability, material and content classification, recyclability claims, and compostability standards that inform the effective structure of consumer-facing plastic labels. In this report, various examples which show how these standards have been adopted and modified are analyzed. The following sections examine the interaction between these standards and national laws mandating labelling practices and discuss their evolution and impact on markets.

Chapter 2

Overview of labelling practices

From Resin Codes to recycling symbols and QR codes, plastic labels are transforming to meet consumer needs, improve waste sorting, and support circular economy goals across diverse national contexts.

2.1. Practices and trends in plastic labelling

The labelling of plastics was initially introduced to address environmental concerns associated with their widespread use. Early plastic labels focused on material composition to determine recyclability and end-market use. In 1988, the United States Society of the Plastics Industry (now the Plastics Industry Association) introduced the Resin Identification Codes (RIC) to facilitate manufacturing and post-consumer management of plastics (see Table 2). The United States Society of the Plastics Industry (now the Plastics Industry Association), along with the United States government and other countries, supported this initiative. However, the RIC, originally designed for waste management, provided limited information to consumers, lacking clarity on the complexity and recyclability of products. Today the use, interpretation, and understanding of RIC labelling vary significantly across countries, influenced by regional and national differences in adoption and practices, often resulting in misconceptions and confusion about the labels.

Currently administered by ASTM International, RICs remain a key component of plastic labelling worldwide. Countries across the world use them, though with significant regional variations. For example, the European Commission's system includes codes for up to 99 different materials, while China has expanded its system to account for 140 plastic resins (UNEP and CI, 2020). South Africa (SANS 1728, 2019)[1] and the Republic of Korea, have modified the RIC design to fit domestic contexts, making it a region-specific identifier (Hu, 2021).

India primarily relies on the RIC, often alongside ISO standards. In South-East Asian countries such as Indonesia and Thailand, they have implemented their own mandatory labelling systems (see Figure 2). Meanwhile, most African countries are still in the early stages of developing plastic management policies, focusing more on broader waste management issues and bans on single-use plastics rather than specific labelling requirements. In South America, countries like Brazil have adopted labelling standards like the RIC system, though practices vary across the region.

Figure 2

Indonesian Ramah Lingkungan (Environmentally Friendly) label

Source: Based on UNEP (2020).

Over time, the varying interpretations of the Resin Identification Code (RIC) have led to the common misconception that it indicates recyclability. Confusion arose due to the inclusion of the Mobius loop or chasing arrows symbol, which became synonymous with recyclability (UNEP, 2020; see Figure 3). However, in 2023, the United States Environmental Protection Agency (EPA), through the Green Guides Review, highlighted issues with the chasing arrows symbol—particularly regarding public awareness of its true meaning and transparency in its communication—and recommended that the symbol be revised to represent the recyclability of plastic products more accurately (Yoder, 2024).

A similar trend is emerging in Canada. The country's Regulatory Framework Paper on Recycled Content and Labelling Rules for Plastics proposes banning the chasing arrows symbol, except when used in compliance with labelling rules (ECCC,

[1] https://www.gov.za/sites/default/files/gcis_document/201904/42391gen229.pdf

Table 2
Resin Identification Codes (RIC)

Plastic type	Resin Identification Code (RIC) option A	Resin Identification Code (RIC) option B	Common use
Polyethylene Terephthalate PE/PETE (1)			Clear plastic bottles such as soft drink, mineral water
High-Density Polyethylene HDPE/PE-HD (2)			Milk jugs, cleaning agents, laundry detergents, bleaching agents, shampoo bottles, washing and shower soaps
Polyvinyl Chloride PVC/V (3)			Trays for sweets, fruits, plastic packing (bubble foil) and food foils
Low-Density Polyethylene LDPE/PE-LD (4)			Crushed bottles, shopping bags, highly-resistant sacks and most wrappings
Polypropylene-PP (5)			Furniture, luggage, toy as well as bumpers, lining and external borders of the cars
Polystyrene-PS (6)			Toys, hard packing, refrigerator trays, cosmetic bags, CD cases, vending cups
“Other Plastics” (7) Includes: acrylic, polycarbonate, polylactic fibres, nylon, fiberglass			Varies (Includes a variety of plastics) One example is a polycarbonate used for CD production and baby feeding bottles

Source: Adapted from Garwal et al. 2020.

2023). This prohibition extends to the RIC when it incorporates the chasing arrows.

This shift suggests that regulatory authorities in various regions are moving towards creating a more consistent and transparent labelling framework for plastics.

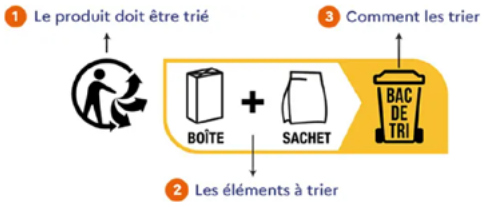
Figure 3
Universal recycling symbol (chasing arrows)

Source: Recycling.com.

A recent and significant change in label design is the inclusion of recyclability information.. This trend is consistent across different regions, particularly for plastic labels. In developed countries, it adds waste sorting information for plastic products (e.g. Italy, France and Australia). In France, the sorting information comes with an official “Triman” (or “Sort-man”) logo on labels, sometimes with detailed steps for effective sorting (see Figure 4). When the “Triman” logo appears on an aluminium can, the can is subject to sorting rules and must not be discarded with general waste (see Figure 5). The label indicates that the product or packaging should not be thrown in the household waste bin but should be sorted and placed in the yellow bin (designated recycling bin in France) or taken to a collection point or waste disposal centres (Triman, 2022).

Additionally, “BIODEGRADABLE” and “COMPOSTABLE” labels can be seen in the identification marks of plastic alternatives in countries like Australia and New Zealand. An extension of this is the inclusion of the type of compostability for plastic and plastic alternatives (for example, “Home Compostable” and “Industry Compostable” in Australia; see Figure 6). Home composting typically happens at a lower temperature and takes longer, often around a year, while industrial composting can finish in weeks. Industrial composting applies much higher heat to pre-processed packaging, further breaking it down and speeding up the decomposition process (Mancarella, 2020). Industrial composting can handle a wider variety of compostable materials and occurs in a highly regulated environment with precise temperatures and conditions, but such facilities are not available in many countries. In Canada, compostability labelling requires the additional information “Not Recyclable”, and the use of green-coloured labelling, striping, or tinting to distinguish these products from regular plastics. Third-party standards, such as ASTM D6400, ASTM D6868, and ISO 17088 are also included as acceptable labelling options. (ECCC, 2023).

Figure 4
French Triman logo for packaging



Source: Ministry of the Ecological Transition, 2024.

Here is an example of the “Triman” logo on labels in France, with detailed steps to effective sorting. The first step instructs the product must be sorted. The second step then indicates which items of the packaging to sort, pointing at the box and the bag. Lastly, the last step shows how to sort them, meaning in the recycling bin.

Figure 5
Example of French "Triman" label

Source: ConsoGlobe, 2014.

Figure 6
Australian home (left) and industrial (right) compostable products labels

Source: Renew, 2020.

Recyclability considerations for different materials in a final product are also evident in various labelling practices. For example, Japan's Containers and Packaging Recycling Law (Ministry of Economy, Trade, and Industry, Japan, 2003) mandates labelling for each layer of composite packaging material. Similarly, in countries like Canada and the United Kingdom, labelling requirements are being updated to include flexible packaging plastics (Jamison et al., 2024).

Emerging trends in circularity are reflected in labels that show compliance with Extended Producer Responsibility (EPR) schemes, which extend producers' financial and operational responsibility to the take-back and final disposal of their products. India has a dedicated EPR portal for packaging plastics, created per the Plastic Waste Management Rule in 2016 (and included in the Plastic Waste Management Rule amendment in 2024) (MoEFCC, 2024). The Regulatory Framework Paper in Canada and the Labelling Guide published in the United Kingdom in 2021 have also mapped the role of EPR. The EPR guidelines vary with the type of plastic packaging (for example, the United Kingdom does not include flexible plastics and films in their current EPR guidelines) and the technological capacity of the concerned region. EPR is also seen through take-back options on plastics tied to deposit schemes. For example, Denmark and Germany have labels for recycling financing (UNEP, 2020). Recycling financing typically involves the payment of a deposit at the time of purchase of the product, which consumers can claim back if the container is deposited, usually at a reverse vending machine. Towards this, Germany uses two labels (Pfand - Einweg for single-use containers and Pfand - Mehrweg for multiple-use containers) with varied success (UNEP, 2020). On the other hand, Denmark uses the Pant - A, B, C system, which categorizes the different containers using the letters according to the amount to be refunded (see Figure 7). Since the labels are based on the refund amount, the system is geared towards collecting and recycling single-use containers (UNEP, 2020).

Consumer survey responses regarding accessibility and understanding have also triggered broad changes in labelling. One notable example is the Republic of Korea, where the Ministry of Environment revised recyclability labels for food and beverage packaging in 2020. The updated labels include additional directions and information on materials to improve comprehensibility

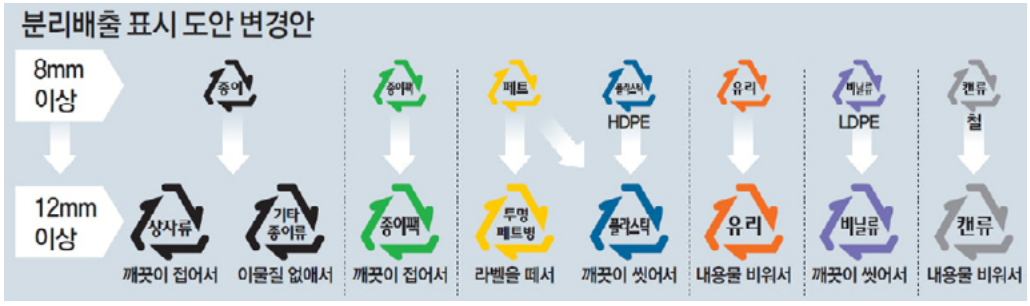
Figure 7
Danish Pant B label

Source: UNEP (2020) and Dansk Retursystem.

and sorting. A post-consumer survey prompted this change by highlighting issues with the existing labelling system. While over two-thirds of consumers found the labels useful, they also identified several shortcomings, such as inconsistencies between recycling symbols on products and collection boxes, lack of accompanying text, and insufficient policy measures to promote the use of easily recyclable materials (Neo, 2020; see Figure 8).

Before adding additional instructions to the recycling labels, the Republic of Korea only provided information on the type of material of the packaging. In the first row from left to right, the labels and their corresponding materials are as follows: the black label represents paper, the green label represents a paper bag, the yellow label indicates PET, the blue label indicates HDPE plastics, the orange label is for glass, the purple label indicates vinyl, and the grey label refers to

Figure 8
Republic of Korea label - before and after consumer survey



Source: Food Navigator Asia, 2020.

cans. After the change, the labels included specific additional directions, shown in the second row. From left to right: the first black label indicates to "Fold before recycling," the second black label says "Remove foreign material," the green label also instructs to "Fold before recycling," the yellow label states "Remove the labels before recycling," and the blue, orange, purple, and grey labels all share the instruction to "Rinse out before recycling (Li, 2020).

The evolution of labelling practices and the current trends in labelling standards reflect an increasing emphasis on consumer comprehension and label transparency. From the introduction of the RIC labels to the recognition of the new trends emphasizing consumer participation, it is evident that labelling practices are evolving to better support upstream measures at both national and global levels. While various countries implement region-specific labels, efforts toward harmonization are also underway. Building on these developments and adaptations, the next section of this study examines the baseline requirements for effective labelling practices for plastics and plastic alternatives.

2.2 Benchmark of best practices

The plastic labelling approaches adopted in various regions are compared with practices in other sectors, such as nutrition and energy, to develop globally consistent and impactful standards. By identifying key attributes of the most effective labelling schemes—focusing on design, dissemination, stakeholder engagement, and implementation. This section analysis key characteristics from labelling systems in Australia, Colombia, Japan, the Republic of Korea, South Africa and Thailand.

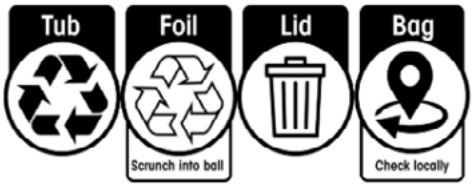
To establish a benchmarking for developing globally consistent and impactful labelling standards, some of the key attributes that emerged in literature analysis are[2]:

- **Evidence-based approach:** The Australasian Recycling Label (ARL) applied by Australia and New Zealand, and South Africa's On-Pack Recycling Label (OPRL) emphasise an evidence-based labelling approach. The ARL provides recycling information about the various parts of the material and how they will behave in the recycling facility. The ARL achieves this through the Packaging Recyclability Evaluation Portal (PREP) tool. The PREP tool considers factors such as packaging size, shape, weight, material, ink and adhesive to determine recyclability information to the consumers. The tool also measures this information against the number of people in the municipality to determine how many people can recycle in a particular collection centre. This ensures that the information provided is accurate and reflects the actual recyclability of packaging in local recycling systems. The system also promotes a "When in doubt, leave it out" principle to prevent the contamination of the recycling scheme (Planet Ark, 2024).

The ARL has been recognized in key national policies such as Australia's National Waste Policy Action Plan and the National Plastics Plan. In New Zealand, the Ministry for Environment has also endorsed the ARL as the preferred labelling option. The ARL can serve as an example of a good evaluation strategy for analysing the impact of a label before authorities implement it as a mandatory label.

[2] A supplementary table providing information such as a guiding framework, comprehensibility, consumer awareness, and dissemination strategy on the global best practices is included in the Appendix 7.1.

Figure 9
Australasian recycling label



Source: Australasian recycling label website.

- **Consumer-centric design:** The labelling system in the above-mentioned countries prioritizes clear, easy-to-understand labels that use various features such as colour coding, specific recycling instructions by material, and easy-to-understand language. Policymakers and designers can also consider Thailand's plastic label for consumer-centric design. On Thailand's label, the symbol green colour suggests that it is environmentally friendly, and the text clearly states whether a product is recyclable, compostable or biodegradable (see Figure 10). An example of an excellent design in the energy sector that puts consumer-centric design at the forefront is the European Union energy scoring system, where a categorical scale (A to G) with colour codes indicates energy efficiency. (For further details, see Annex 7.3)

Figure 10
Thailand plastic label for biodegradable and compostable plastic

Source: Thailand Plastic Institute.

- **Stakeholder collaboration:** Strong collaboration between industry players, government bodies, and environmental organizations has largely driven the success of these labelling schemes.

  A comparison with successful nutrition labelling practices highlights the importance of stakeholder engagement across sectors (Annex 7.3). In Colombia, for instance the implementation of a national nutritional label was supported by coordinated efforts from health organizations (such as the Colombian Association of Dietitians and Nutritionists and the Colombian Heart Foundation), industry groups (like the National Business Association of Colombia, ANDI), educational campaigns, and major supermarket chains (see Figure 11). These examples illustrate that broad, cross-sector collaboration is a critical factor in the effective dissemination and adoption of labelling schemes, whether for plastics or food products.

Figure 11
Colombian mandatory nutrition labels

Source: Food Navigator Latin America, 2020.

In the case of Japan, plastic packaging labels were introduced under the Containers and Packaging Recycling Law, reflecting policy support (see Figure 12).

Figure 12
Japanese identification marks following the Containers and Packaging Recycling Law, 2003

Source: Ministry of Economy, Trade and Industry, Japan, 2003.

- **Importance of consumer education campaigns:** The ARL has been supported by a comprehensive awareness campaign titled "Check It! Before You Chuck It," which utilizes various communication channels to promote recycling behaviours and sustainable packaging practices. Since its inception, ARL has been adopted by 255,000 products across Australia and New Zealand, making a 280 percent increase since 2021 (Laclette, 2022; see Figure 13). Despite these successes, challenges remain, particularly in engaging small-to-medium-sized enterprises (SMEs) due to the costs of adopting new labelling and packaging standards. There is also a continuing need for greater consumer and business education about the ARL program and sustainable packaging. To address these challenges, the Australian Packaging Covenant Organisation (APCO) launched the ARL Marketplace in 2022, an innovative online platform designed to assist SMEs in adopting the ARL for their packaging. Backed by a $5 million investment from the Australian Government, the marketplace aims to help 20,000 SMEs improve their packaging practices and implement the ARL at a lower cost.

Figure 13
Example of ARL

Source: Australasian Recycling Label.

- **Continuous improvement:** The examples from Australia, Chile and the Republic of Korea show a commitment to ongoing refinement of labelling systems based on consumer feedback and changing recycling capabilities. The system of the Republic of Korea demonstrates the value of incorporating consumer feedback to improve label design and effectiveness. Following consumer feedback, the label size was increased, and additional design updates were made. Chile took a similar approach, where feedback on nutrition labelling led to changes in the Front of Packaging Label (FOPL) design. The government replaced the initial black-and-white stop sign and hand symbols with a clearer label stating "excess of [nutrient]" (see Appendix 7.3 and Figure 14).

Figure 14
Chilean Front of Packaging (FOPL) mandatory label

Source: Panamerican Health Organization.

The insights gained from this analysis provide a foundation for future policy development and international collaboration in plastic labelling.

2.3 Commonalities and differences across plastic labelling practices

While plastics labelling practices share some similarities across regions, without standardized global rules, significant differences still exist amongst regions and countries. This section explores these practices, starting with the broad use of ASTM labels. It examines the similarities in label design and the information they convey, followed by an analysis of nationally mandated labelling policies.

In many developing countries, ASTM resin identification codes are widely used as the main plastic labelling standard, often in the absence of mandatory national labelling requirements.

Countries like Brazil, Colombia, and Mexico are navigating diverse approaches to plastic packaging regulation and sustainability in Latin America. While Brazil has initiated discussions on banning certain single-use plastics and implementing voluntary labels such as ASTM, mandatory nationwide consumer labels are still under development (Plastics News, 2022). Colombia emphasizes reducing single-use plastics through its Plastic and Rubber Training Institute (ICIPC) voluntary label, alongside policy instruments like Extended Producer Responsibility (EPR) and plastic bag regulations (Zero Waste Europe, 2023). Mexico is involved in collaborative efforts such as the Mexico Plastics Pact and the Mexico City Plastics Action Partnership, focusing on improving recycling infrastructure and reducing plastic waste (WRAP, 2022). These initiatives highlight a focus on regulatory mechanisms and downstream management of single-use plastics rather than implementing plastic labelling systems.

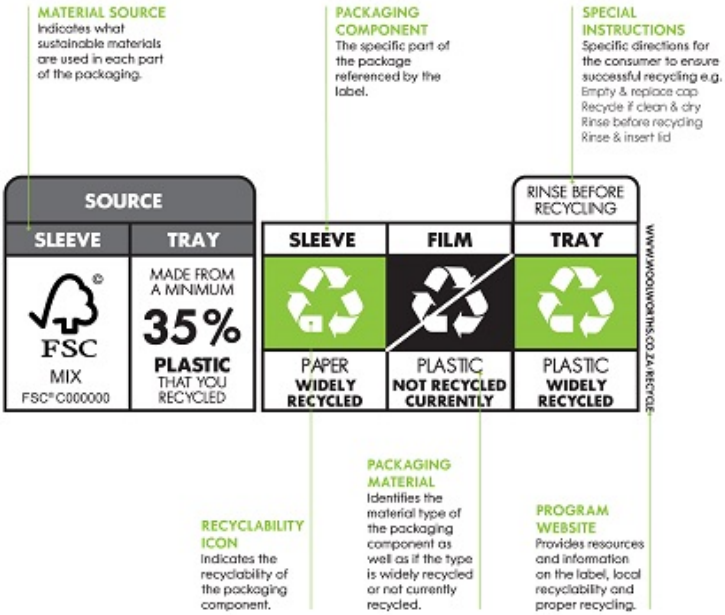
Similar trends are observed in Asia. India, for instance, uses the ASTM scale but has recently strengthened its regulatory framework through amendments to the Plastic Waste Management Rules. These mandate clear labelling requirements for recycled and biodegradable plastics (MoEFCC, 2024). Under the amended rules, all such packaging must bear a label indicating the percentage of recycled plastic and comply with ISO 17088:2021 specifications for compostable plastics. Labels must also specify the number of days required for biodegradation and whether the material is biodegradable in soil or water under controlled composting conditions. While ASTM labels serve as a basic reference, there is a growing shift towards more detailed labelling to improve consumer understanding.

By contrast, Indonesia, Malaysia and Thailand have developed national labelling systems tailored to their own environmental standards. These systems indicate compliance with criteria related to energy efficiency, sustainable resource use or reduced hazardous content, aiming to promote more environmentally responsible consumer choices.

In terms of label designs, the United Kingdom and South Africa share similarities, both requiring standardized recycling labels for plastic packaging under their respective systems: Extended Producer Responsibility (EPR) in the United Kingdom and On-Pack Recycling Labelling (OPRL) in South Africa. These systems promote consistency and clarity for consumers.

South Africa's OPRL is considered one of the most successful labelling schemes among developing countries. Originally launched by Woolworths Holdings Limited (a multinational retail chain) as a voluntary initiative, it has since achieved nationwide adoption. Its success is attributed to a clear design, easy-to-follow recycling instructions, and the use of consumer research in its development (see Figure 15). To ensure effectiveness and avoid confusion, Woolworths tested the label with consumers

Figure 15
South African Woolworths recycling labels



Source: Woolworths, 2019.

prior to its broader rollout. Consumers International has praised the OPRL for its "clarity: specific, detailed guidance" and "transparency: source material specified", giving it a positive overall assessment (UNEP, 2020). Given its demonstrated impact, South Africa's OPRL offers a valuable model for other developing countries developing national recycling labels.

Figure 16
On-pack recycling label – United Kingdom

Source: OPRL Plastics Pact Commitments Progress Report, 2021.

Beyond shared label designs, there is also convergence in the underlying vision for labelling schemes. Voluntary labels for plastics and plastic alternatives are widely used, often acting as testing grounds for policy measures that may later become mandatory. Notable examples include the Nordic Swan label, used in Finland, Norway and Sweden, and the SIRIM eco-label in Malaysia.

While both share the goal of promoting environmental responsibility, their approaches differ. The Nordic Swan operates as a licensing system encompassing the entire product supply chain and has evolved through multiple updates since its launch in 1989 (see Figure 17). In contrast, the SIRIM label functions as a certification system emphasizing environmental performance. As a relatively new initiative, it still requires further evaluation to determine its long-term effectiveness (see Figure 18).

Despite these differences, the successful evolution of certain voluntary schemes into mandatory standards demonstrates their value as precursors to formal regulatory frameworks.

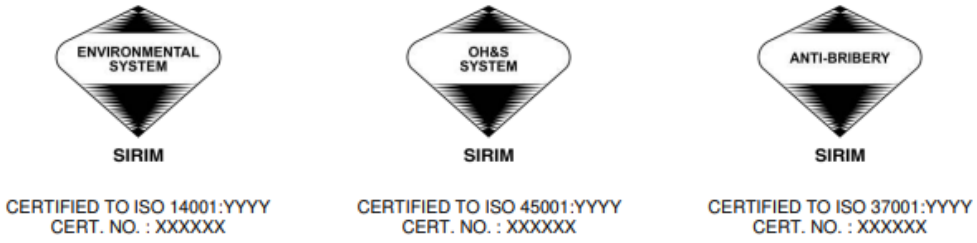
Figure 17
Nordic swan label

Source: Nordic ecolabel.

A growing trend in plastic labelling is the shift from physical to digital formats. In the Republic of Korea, a new mandate by the Ministry of Environment will require single-use plastic bottles to display only QR codes, aiming to reduce waste from traditional labels (Neo, 2024). Thailand has also adopted QR codes for bioplastic labelling, although these are currently used alongside conventional labels. Unlike Thailand, the Republic of Korea intends to eliminate physical labels entirely.

As this trend evolves, it is essential to address the needs of vulnerable and disadvantaged consumers—particularly in rural or low-income urban areas—who may lack access to smartphones or have limited digital or literacy skills. Ensuring the accessibility of digital labelling must include measures to overcome these barriers, so all consumers can understand and benefit from the information provided.

Figure 18
Malaysian Standard and Industrial Research Institute (SIRIM) label



Source: Sirim Qas International.

Chapter 3

Identification of major challenges in current labelling practices in developing countries

Developing countries face key challenges in plastic labelling, from consumer comprehension and greenwashing risks to weak infrastructure—highlighting the urgent need for clearer standards, education, and localized systems.

Environmental labelling for plastic packaging is highly dynamic. It is driven by developing market realities and ongoing shifting regulations. The growing consumer demand and market pressure for effective plastic labelling is pushing companies and regulators to improve the comprehensibility and sorting of plastic labels. Moreover, governments and international organizations frequently update environmental policies, leading to changes in plastic labelling standards to meet new sustainability targets, and meet developing consumer and market demand. In addition, new types of plastics and bio-based or compostable materials continue to emerge, requiring new and updated labelling to reflect appropriate disposal methods and environmental impact. As such, plastic labelling is driven shaped by material and design innovation and evolution. At the same time, labelling design is continuously improving to enhance user comprehension, awareness and decision-making, ensuring that the labels are not only informative but also easily understood by diverse audiences.

This dynamism presents challenges for developing countries, where current labelling practices often hinder sustainable development efforts. While many developing countries are transitioning towards mandatory labelling for plastic and plastic substitute packaging, the effectiveness of these labels varies widely. This study measures effectiveness by consumer comprehensibility, as defined in the UNEP Guidelines for Providing Product Sustainability Information (2017)—where consumer comprehensibility refers to a direct, explicit, and easy-to-understand link between the product and the claim, with clear limits stated for the claims. Label effectiveness depends on design, symbol usage, dissemination strategies, and integration into national policies.

3.1. Label comprehensibility and consumer awareness

Unsustainable production and consumption patterns, particularly in industrialized countries, significantly contribute to global environment degradation. Linear models of production and consumption, based on taking, making, and disposing of raw and manufactured materials, are among the biggest contributors to global emissions, and resource depletion.

Label comprehensibility is directly linked to the overall effectiveness of labelling systems and profoundly impacts consumer awareness and decision-making. For instance, studies on nutrition labelling in Africa have demonstrated that consumers were generally more aware of and likely to use nutrition labels than they were able to understand or interpret correctly (Prince Kwabena Osei et al., 2024). Common barriers identified include time constraints, small font sizes, complex terminology, and unfamiliar languages. Similar patterns were observed in India, where research by Kamboj et al. (2022) indicated that the adoption of labels by producers must be matched by a minimum level of literacy and comprehension among consumers to be truly effective.

These findings are equally relevant to plastic packaging labels, where comprehending symbols and language is essential for guiding purchasing decisions and encouraging proper waste sorting. Even well-intentioned consumers may be misled by unclear or confusing labels, resulting in the purchase of products that do not align with their sustainability values or improper disposal of packaging materials (Buelow et al., 2010). Dissemination challenges exacerbate this knowledge gap, highlighting the need for labels that are both easy to understand and culturally relevant. A study by De Run and Fah demonstrated that consumers are more responsive to product packaging presented in their native languages, emphasizing the importance of linguistic and cultural considerations in label design to enhance consumer engagement and promote sustainability. However, multiple languages and, therefore,

the need for translation on packaging can increase costs. As such, countries with more than one official language must weigh the benefits and costs of introducing additional languages to labels, with the addition of languages increasing the cost of production but increasing the comprehensibility of the message.

For this reason, dissemination and education campaigns are key drivers to enhance label comprehensibility and consumer awareness. Dissemination and education campaigns should respect cultural traditions and are crucial in cultivating informed consumers fully aware of their rights and responsibilities. Consumer education and information programs are fundamental rights that empower consumers to make informed and responsible choices.

Limited access to traditional information channels like TV ads or posters, language barriers, and a lack of targeted educational and awareness campaigns can contribute to consumer confusion. Developing countries often have limited resources to dedicate to public education initiatives, and competing priorities like meeting healthcare and other basic needs of their populations, which can further dampen the impact of awareness campaigns. The rapid pace of innovation in packaging materials further complicates these efforts, as maintaining up-to-date educational materials is an ongoing challenge (Ketelsen et al., 2020).

Therefore, it is essential to prioritize the needs of vulnerable and disadvantaged consumers in both rural and urban areas, particularly those with low incomes and limited or no literacy skills.

3.2 Label standardization, mislabelling and greenwashing

While environmental labelling for plastic packaging aims to empower consumers to make sustainable choices, the lack of standardization and consistency in these labels can impede this process. Inconsistent labelling makes it difficult for consumers to assess the sustainability and recyclability of plastic packaging (UNEP, 2020). Many plastic labels fail to specify whether a product is truly recyclable in a given region. Even when labels provide information, consumers often need to conduct additional research to verify its accuracy and practical relevance (Burrows et al., 2022). Labels that state “recyclable” without clarifying local recycling compatibility further obstruct informed decision-making. In many developing countries, where language barriers are common, as illiteracy rates are higher and multiple languages and dialects are spoken, such as in Nigeria, with over 500 languages (Green, 2023), both factors contribute to challenges in label comprehensibility. As such, inconsistent labelling can be particularly problematic, potentially excluding large population segments from understanding important sustainability messages. The path forward involves establishing clear and consistent labelling practices across countries and adapting them to local conditions. The goal should be to promote uniform symbols, clear definitions, and easily understandable, verifiable information.

Furthermore, greenwashing is a deceptive practice in which businesses suggest or create the impression that a product or service has a positive or minimal negative impact on the environment or is less harmful than competing products.3 This is achieved through misleading marketing, advertising, or public relations. Greenwashing capitalizes on the growing consumer demand for sustainable products, allowing companies to appear eco-conscious without making substantial changes to reduce their environmental impact.

The spread of greenwashing is facilitated by vague or unverified claims, such as “eco-

[3] For a reference definition, see European Commission, 2016, Guidance on the implementation/application of directive 2005/29/EC on unfair commercial practices, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016SC0163.

friendly," "sustainable," or "natural," often made without providing concrete evidence or third-party certification. Consequently, misleading claims lead consumers to believe they are making environmentally responsible choices, while they may support businesses that contribute to environmental harm. The perceived environmental attributes in green markets (markets for environment-friendly goods and services) create opportunities for fraud and necessitate third-party certifications, which can further fragment consumer comprehensibility (Hamilton & Zilberman, 2006).

Critics argue that businesses rely on greenwashing in their marketing efforts due to growing public awareness of environmental issues (Northen, 2011). Green marketing strategies often use eco-labels as a competitive advantage over non-green products. Both eco-label information and consumer awareness contribute to building trust in eco-labelled products, which, in turn, influences consumers' environmentally friendly purchase intentions (Sharma & Kushwaha, 2019).

However, the expanding range of eco-labels has confused consumers regarding the criteria for making informed purchasing decisions. A study conducted in India found that eco-labels alone do not significantly impact consumer awareness unless they provide comprehensive information (Sharma & Kushwaha, 2019). Labels that rely solely on visual representation or minimal written information are more likely to create doubt. Green advertising has also been criticized for increasing consumer vulnerability and potentially leading to "green fraud" (Northen, 2011).

Greenwashing is especially prevalent and problematic in the plastics sector, as plastic pollution is one of the most significant contributors to climate degradation. Plastic is one of the most widely used materials in the world, namely for packaging, its pervasive presence across industries means that it is subject to significant public scrutiny in relation to its environmental impact. Facing new market realities and pressure to make their plastic packaging more environmentally friendly, companies often resort to greenwashing. Plastic labelling often promotes misleading recycling labels and wrongful claims of biodegradability. For example, the "SASO OXO-Biodegradable Mark" in Saudi Arabia, certifies plastics as oxo-biodegradable, that may in reality contribute to microplastic pollution rather than breaking down into carbon dioxide and water as expected (UNEP, 2020; see Figure 19). Similarly, critics have pointed out that the SIRIM label in Malaysia fails to provide clear information about the product's end-of-life process. The label lacks guidance on sorting and recycling, making it potentially misleading.

Figure 19

Saudi Arabian SASO OXO-Biodegradable mark

Source: UNEP, 2020.

Additionally, the chasing arrows symbol (Figure 3), often used on plastic products, has come under scrutiny for implying the

recyclability of products that are not truly recyclable. This symbol faced backlash in Canada and the United States of America and is now under review by many other countries to ensure its proper use.

Another aspect of corporate plastic greenwashing relates to re-designing packaging, which claims to be more sustainable but is only an aesthetic modification. An example of design greenwashing is Coca-Cola's choice to change Sprite's green bottles to clear ones, claiming it improves recyclability. However, the reality is that these clear bottles are not significantly more recycled, regardless of the design change (Mutwol, 2025).

In response to these challenges, there is growing interest among consumer protection agencies in combating greenwashing and ensuring that consumers have access to reliable information for making sustainable choices. In 2021, members of the International Consumer Protection and Enforcement Network (ICPEN) analysed nearly 500 websites promoting products and services in the clothing, cosmetics, and food sectors. They found that 40 per cent of the environmental claims made by these companies were misleading. These misleading claims included vague language, the use of self-created eco logos without accreditation, and the omission of crucial information about the environmental impact of products. The lack of universal standards for labels has also led to consumer misinterpretation and contamination of recycling streams (UNEP, 2020).

A 2020 study by the European Commission revealed that over half of the examined environmental claims in the European Union, which considered plastic labelling claims, were either vague, misleading, or unfounded. For example, the European Commission found that in "100 per cent recycled plastic" washing machine detergent contained only 50 per cent recycled material. It also emphasised that companies advertised some plastic bottles as "recyclable" but the extent of that recyclability was not clear, as some municipalities lack the capacity to recycle all sorts of plastics. Moreover, in the report, 64 per cent of the environmental claims were assessed as clear and unambiguous, which typically used vague terminology, or the claim could not be linked to any specific characteristic of the product (McGuinn, J. et al., 2024). The European Commission identified at least 230 different labels, contributing to consumer confusion and distrust. The absence of consistent guidelines for companies making voluntary green claims resulted in widespread greenwashing, creating an unequal playing field in the European Union market and disadvantaged genuinely sustainable companies. To address this, the European Union now mandates that any new private labelling schemes must demonstrate greater environmental ambition than existing ones to receive pre-approval, thereby controlling the proliferation of labels (European Commission, 2023).

In parallel with the European Union efforts, other countries have developed guidelines to promote transparency and accuracy. The Green Guide, created by the United States Federal Trade Commission (FTC), aims to help businesses avoid misleading claims. First issued in 1992 and revised in 1996, 1998, and 2012, the guide provides general principles applicable to all environmental marketing claims, offers insights into how consumers are likely to interpret specific claims, and advises marketers on how to substantiate and qualify their claims to prevent misinterpretation. Key topics covered include claims related to compostable, degradable, recyclable, non-toxic, and renewable energy or materials. In 2023, the Green Guide held a discussion addressing primarily recyclability claims related to plastic and explored potential updates to the Green Guide to enhance its comprehensibility and effectiveness. The discussions addressed issues such as confusion over the use of Resin Identification Codes (RICs), consumer comprehension of the meaning of "recyclable," the use of qualified claims to avoid misleading information—such as clarifying whether

only the packaging or also the product is recyclable—and access to recycling thresholds (Carra et al., 2023).

Regional and international initiatives also advise governments on policymaking and enforcing consumer protection laws (UNCTAD, 2023). For example, under the UNCTAD informal working group on consumer protection in e-commerce,[4] the Superintendence of Industry and Commerce of Colombia prepared a report on environmental claims in electronic commerce. The report gathered insights from 18 countries on actions taken against misleading environmental advertising. The findings suggested that governments review their current laws on deceptive advertising to address false green claims and recommended the inclusion of clauses specifically targeting environmental claims in digital markets. The report also advised strengthening cooperation and knowledge-sharing among countries (UNCTAD, 2022). These initiatives pave the way for more effective enforcement, progressively reducing mislabelling practices.

Indonesia presents a notable case of mislabelling. According to assessments by UNEP and Consumers International (UNEP, 2020), the 'Ramah Lingkungan' (Environmentally Friendly) label references a specific standard but remains vague and potentially misleading. Although the label translates to "Environmentally Friendly," it conveys a general and positive message without providing specific details about the product's actual environmental impact. Mislabelling creates confusion for consumers, who may assume the product is biodegradable or recyclable, even when it is not.

Ensuring transparency and accountability protects consumers from deception and supports a marketplace where sustainable consumption is achievable. The Extended Producer Responsibility (EPR) framework is key to holding businesses accountable for their products' entire lifecycle. EPR promotes transparency by requiring producers to disclose material composition and manage waste streams, enabling consumers and regulatory bodies to validate environmental claims. For example, EUROPEN (European Organisation for Packaging and the Environment) has advocated for EPR schemes to manage plastic packaging waste in Europe.

3.3. Recycling infrastructure

Adopting labelling practices from developed countries in developing contexts can be challenging due to significant differences in infrastructure, resources and technological capacity. Developed countries typically benefit from well-established waste management systems and advanced production capabilities, which support the implementation of sophisticated labelling schemes. In contrast, many developing countries lack the necessary infrastructure to manage waste effectively, particularly for recycling. Labelling systems must therefore reflect local realities and be aligned with available waste management capacities locally.

According to the Organisation for Economic Co-Operation and Development (OECD) regions such as Africa; Northern Africa and Western Asia; Latin America and the Caribbean; India; China; and non-OECD countries in Eastern and South-Eastern Asia experience the highest levels of mismanaged and uncollected plastic litter. In contrast, the United States of America mismanages only four per cent of its plastic waste, compared to 64 per cent in Africa (Plastic pollution is growing, OECD, 2022).

As efforts to raise consumer awareness grow, the actual capabilities of waste management systems are coming under greater scrutiny, challenging traditional labelling methods. In developing countries, limited waste sorting, processing, and management infrastructure exacerbates

[4] https://unctad.org/Topic/Competition-and-Consumer-Protection/working-group-on-consumer-protection-in-e-commerce

these challenges, diminishing the effectiveness of labelling initiatives. Even with improved plastic packaging label designs and awareness campaigns, developing countries often lack the necessary recycling facilities to process recyclable waste effectively. For instance, Africa's current recycling capacity for plastics ranges from 0.5 per cent to 14 per cent, with complex plastics requiring more advanced infrastructure (Nsereko, 2023). Without adequate collection and recycling infrastructure, recyclable materials may still end up as waste. Similar issues arise with compostable packaging, as limited industrial composting facilities exist globally (UNEP, 2020).

However, some non-governmental organizations (NGOs) are actively involved in developing and improving recycling infrastructure and supporting waste management in developing countries. For instance, Waste Concern is an NGO established in Bangladesh, which has been involved in testing, piloting, and spreading suitable technologies for the waste management, wastewater, and sanitation industries in projects spread across South and South-East Asia (Waste Concern, nd.).

Another important issue for developing countries is the role of the informal sector in the sustainability space, particularly in waste management and recycling. The introduction of formal recycling facilities may threaten the informal sector, adding a layer of complexity that must be considered when creating new policies and labelling frameworks (EURASIA Group, 2021). The success of new policy implementations in these regions depends on balancing effectiveness, infrastructure, and the diverse interests within society.

While effective labelling is essential for advancing consumer awareness, adequate infrastructure must support it to drive meaningful changes and close the plastic economy loop.

Chapter 4

Requirements for an effective label for plastics and plastic alternatives

Effective plastic labels require consumer-centric design, multi-stakeholder collaboration, education campaigns, and adaptive strategies—tailored to local contexts to ensure accessibility, trust, and real impact in developing countries.

Based on the analysed limitations and barriers in developing countries, as well as best practices observed in the plastics, energy, and nutrition sectors, it is clear that a context-sensitive approach is necessary for effective plastic labelling that acknowledges the respective economic, infrastructural, regulatory, and cultural challenges of each regional and local context and crafts tailored solutions accordingly. Incorporating successful strategies from developed countries while addressing the unique conditions of developing countries can improve label effectiveness. The following recommendations outline the essential criteria for a robust and impactful plastic labelling system that can drive positive environmental outcomes and influence consumer behaviour.

4.1 Consumer-centric design

A clear and simple label design maximizes comprehensibility and minimizes confusion among diverse consumers, accounting for varying literacy levels and language barriers. The use of local languages and effective symbols is essential. Labels should provide critical information about a product's recyclability, biodegradability, compostability, and environmental impact.

Readable, easily recognizable symbols, images, and standardized icons with colour codes can enhance quick recognition and promote consumer trust. Straightforward text and large, bold letters improve readability. To avoid misleading consumers and prevent greenwashing, symbols like the green chasing arrows should only be used when the product is genuinely recyclable.

For this reason, an evidence-based approach is essential when designing labels. Testing the effectiveness of it before and after its adoption is crucial for understanding its impact on consumer behaviour. A comprehensive approach is recommended, combining pre-implementation surveys, interviews and workshops, alongside insights from successful labelling cases, such as the Republic of Korea. Countries should also conduct post-implementation surveys to evaluate the label's effectiveness. Gathering first-hand information from consumers through these methods can help adapt the label to meet their needs, improve label comprehensibility and address industry developments over time.

An effective strategy is to launch the label as a voluntary initiative with government support, as demonstrated by the Australasian Recycling Label (ARL). This approach allows for assessing impact and effectiveness before committing to a mandatory rollout, which would require substantial dissemination efforts and investment. It is equally important to include the perspectives of vulnerable and disadvantaged consumers, ensuring that labels are accessible and relevant to all consumer groups. Special attention should be given to consumers in developing countries, where demographic variability, inequality, and differing urbanization trajectories necessitate a more tailored approach.

By examining effective practices in other areas, such as nutrition labelling, we see examples like Chile, which used sample groups across regions to assess label comprehension, specifically targeting mothers of schoolchildren purchasing snacks. Similarly, the Republic of Korea's plastic labelling proposal underscores the success of involving consumers in label design to improve understanding. Such practices can be replicated during the initial label design phase, with provisions for design adjustments post-implementation to enhance effectiveness.

In addition to prioritizing consumer input, leveraging modern technology can significantly increase the effectiveness of plastic labelling schemes.

Technological solutions like QR codes in plastic labelling can significantly enhance transparency and consumer empowerment in plastic waste management. Inspired by the Republic of Korea's successful system,

QR codes provide comprehensive product information, promote proper recycling practices, and support environmental sustainability. By scanning a QR code, consumers can access detailed information about materials, recycling instructions, and environmental impact, which aids in making more informed purchasing decisions. However, limited smartphone or internet access are challenges in some countries that must be considered when formulating solutions that are inclusive and equitable. Even for those consumers with the resources to engage with a QR code system, there are still practical concerns, as some consumers could be discouraged by the extra effort required to scan an item.

This approach not only improves recycling practices by reducing label waste and enhancing the recyclability of materials but also helps reduce contamination in recycling streams. Additionally, QR codes offer the advantage of providing more detailed information without the spatial limitations of traditional labels, serving as a valuable complement to existing on-product labels. All of this must be implemented with careful consideration of vulnerable and disadvantaged consumers, ensuring that the technological aspects remain accessible and inclusive for all groups, regardless of literacy levels or access to technology.

4.2 Stakeholder collaboration

Building partnerships with government agencies, consumer associations, manufacturers, business associations, universities, and research institutions is paramount. Tailored communication strategies from these stakeholders can enhance participation (Wright et al., 2017), while collaborative efforts provide valuable data and credibility (Leach et al., 2016). Establishing multi-stakeholder committees to oversee the development of plastic labelling standards is crucial for incorporating diverse perspectives and ensuring greater accountability at the administrative level. These committees should include feedback from varied representatives to ensure inclusivity and responsiveness to local needs. Engaging multiple voices enhances the labelling scheme's relevance, effectiveness, and trust, increasing the likelihood of successful implementation and compliance (Gama et al., 2014; Baidari & Honnikoll, 2021).

This collaborative approach provides a robust foundation for long-term environmental and health benefits. However, some stakeholders might have concerns about changes to labelling, including potential costs, the additional work involved in relabelling, or a lack of awareness regarding the importance of updating labelling practices. To address these concerns, extensive stakeholder mapping and clear role identification are essential. Producers of plastic products and consumers play a crucial role in effectively implementing new plastic labels, making their involvement vital to ensuring a smooth transition and successful adoption.

4.3 Importance of consumer education

To implement a plastics labelling scheme effectively, a multifaceted approach is needed to establish stakeholder credibility and support consumers' right to education and information (Giner & Brooks, 2019; Kelly & Jewell, 2018). Dissemination campaigns should focus on educating consumers about the health and environmental impacts of plastics, recycling processes, and how to interpret labels. Consumer education should also cover the environmental, social, and economic consequences of consumer choices.

Utilizing traditional and social media channels is crucial for broad dissemination. Regular updates, engaging content, and collaborations with local influencers and organizations can amplify the message. Writing articles, issuing press releases, and participating in relevant events can further raise awareness and connect with

key stakeholders. Interactive activities, workshops, and partnerships can also enhance understanding and engagement (Adams et al., 2020). Additionally, visually appealing content, such as infographics and videos, can effectively communicate key messages (Krum, 2013).

4.4 Adaptive implementation strategies

A phased implementation approach is essential, starting with critical information and complemented by dissemination strategies, stakeholder involvement, and effectiveness reviews (Zhou et al., 2023). Gradually incorporating more detailed data ensures manageable and harmonized standards coherent with available and emerging infrastructure (Wu et al., 2023). Continuous updates, driven by new data and stakeholder feedback, help maintain relevance and effectiveness without resource-intensive overhauls (Guo et al., 2021). Prioritizing high-impact areas allows for the optimization of limited resources, ensuring systematic and sustainable scaling of labelling efforts while minimizing costs (Zheng & Yang, 2021).

Chapter 5

Conclusion

Harmonized, transparent plastic labelling —grounded in education, regulation, and collaboration— empowers consumers, enhances trade, and supports circular economy goals across developed and developing countries alike

This review highlights the urgent need for a comprehensive overhaul of plastic labelling practices, particularly in developing countries, to address the pressing challenges of plastic pollution and align with multilateral processes such as the Intergovernmental Negotiating Committee (INC) and the WTO Dialogue on Plastic Pollution. The analysis underscores the importance of harmonising labelling standards globally, facilitating better consumer understanding and enhancing international trade efficiency.

A clear shift towards more transparent and accurate labelling is essential, moving beyond potentially misleading symbols such as the chasing arrows. Effective labelling not only empowers consumers to make responsible choices, but also complements supply-side measures and strengthens waste management by clarifying recyclability and end-of-life options. It plays a critical role in bridging the information gap between producers, policymakers and consumers, supporting the implementation and success of broader sustainability policies. By providing essential, easy-to-understand information, labels enable informed decision-making and contribute to reducing plastic waste. Ultimately, harmonized and effective labelling systems are key to advancing circularity in plastic packaging by promoting recyclability, sustainability and transparency.

This study also draws on lessons from nutrition and energy labelling, where clear, visually impactful designs—such as the European Union Energy Efficiency label—have proven effective and adaptable across diverse contexts. By examining how different regions have implemented labelling across sectors, the study offers practical insights for improving plastic labelling systems in both developed and developing countries.

The study examines both the successes and limitations of labelling practices in the nutrition and energy sectors, where clear, visually striking designs—such as the European Union Energy Efficiency label—have proven universally adaptable. Its conclusions are based on how different regions and countries have adapted labelling practices in different sectors, offering insights that can be applied to the evolving trends in the plastics industry in both, developed and developing countries.

While many label designs from developed countries serve as reference points, the success of nutrition labelling practices in Chile and Colombia and the South Africa's OPRL demonstrate how developing countries can tailor approaches to meet local challenges effectively.

As seen in efforts to harmonize other labelling sectors, such as the national nutritional label scheme in Colombia, stakeholder engagement is essential for the successful implementation and continuous improvement of labelling systems. Effective collaboration between policymakers, industry leaders, consumers, and environmental institutions is required to ensure broad participation and support. Additionally, robust regulatory frameworks are critical to enforce these standards and ensure their effectiveness. This combination of stakeholder engagement and strong regulation has been the cornerstone of success in countries like Australia, Colombia, Japan, the Republic of Korea, and the European Union.

Finally, consumer education remains a cornerstone of effective labelling. Providing clear, accessible information empowers individuals to make sustainable choices and to more easily sort waste correctly. As standardized plastic labelling becomes increasingly vital in global efforts to combat plastic pollution, well-designed labels not only promote environmentally responsible consumption, higher rates of recycling and trade, but also advance broader sustainability goals.

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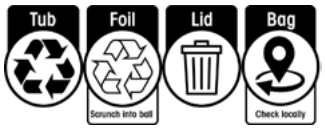
Appendix

Benchmarking global best practices

The mapping and benchmarking analysis provides information on key consideration while determining the best plastic labelling practice globally. The table combines developed and developing countries, based on data availability. The table highlights how effectively authorities or organizations have disseminated the labels, how well they aid consumers, how easy they are to understand, and the extent of regulatory backing. The recommendation criteria is developed on the basis of how effectives these labels have been since their inception. The main text above highlights the gaps in these labels, such as mislabelling and greenwashing, to account for their shortcomings when considering them for recommendation.

Table 3
Global best practices in plastic packaging labelling

Country	Label picture	Guiding framework	Implementing agency	Meaning of symbol	How does it aid consumer decision-making (biodegradability/ compostability/ recycling)	Compre-hensibility	Dissemination initiatives/ campaigns
Australia and New Zealand		Australian Packaging Covenant Organisation's (APCO) Packaging Recycling Label Program	Australasian Recycling Label (ARL)	The ARL indicates the sorting rules for different products	This label aids in the correct sorting and waste management of products. In New Zealand, ARL is applicable keeping in view the curbside collection of materials and in relation to the respective regional authorities	In 2023, the awareness of the ARL with Australians is high at 76%, thus showcasing the success of the label in providing accurate, transparent information and promoting clean practices.	SME ARL campaign aims to educate small businesses about the benefits of using the Australasian Recycling Label (ARL) Launched in 2023, the ARL Marketplace is a new, convenient site for SMEs to source packaging ready for the Australasian Recycling Label (ARL) "Check It! Before You Chuck It" social media campaign Digital information resources on government websites

Japan		Law for Promotion of Sorted Collection and. Recycling of Containers and Packaging [1997, revised 2003]	Ministry of Economy, Trade and Industry	There 2 different labels for plastic: For PET bottles, Japan uses the RIC 1 followed by the word PET. For other plastic containers and packaging excluding PET for beverages, liquor and soy sauce, Japan has its own national label.	The label was introduced under the Containers and Packaging Recycling Law and provides a comprehensive view of the packaging regulations. The labelling regulation is also intended to provide substantial information on all aspects of a product so as to fully understand the recycling procedure.	The differentiation in labelling has an attempt to promote better sorting and collection of household trash in the local municipalities. With the enactment of this mandatory label, people's awareness and municipal participation have been steadily increasing since 2006. (Kotera, 2023)	News articles, informative documents by The Japan Containers and Packaging Recycling Association (JCPRA)
Republic of Korea		"Guidelines on Separate Discharge Mark" (MOE Notification No. 2022-361) - [Act on the Promotion of Saving and Recycling of Resources.]	Ministry of Environment of the Republic of Korea	Plastics are mandated to be marked with the 'Separate Discharge Mark' for easy separation (sort) and discharge of packaging plastics.	The mark allows for easy separation and collection of recyclable wastes.	Based on the consumer survey undertaken by the MOE, 66.85% believed that the label is helpful but not effective. Of this, 46.7% raised concerns about the recycling label and the lack of connection with the recycled waste collection box, and 34% raised concerns about the lack of clear information following the label.	Guide to the Separate Discharge Marks by the Republic of Korea Environment Corporation. Consumer surveys followed by amendments to make the policy more effective

Thailand	 (eco-labelling/green label) https://www.tei.or.th/greenlabel/en/download/TGL-105-R1-22.pdf https://www.tei.or.th/greenlabel/download/TGL-105-R1-22.pdf		Thailand Environment Institute (TEI) TGL-105-R1-22	This green label certification for plastic packaging is awarded to products that meet specific environmental standards, including reduced waste and pollution, efficient use of resources, and recyclability.	Intended to promote consumption of green products and environmentally conscious decisions from consumers, for plastic packaging the product must contain >20% plastic recycled content.	Symbols and green colour suggest that it is environmentally friendly, text clearly states whether a product is recyclable, compostable or biodegradable	Public engagement campaigns led by the Thailand Environmental Institute (TEI) offer economic and reputational incentives for businesses. Capacity and technical support include collaborations with the Central Laboratory of Thailand to reduce testing costs for SMEs and continuous training sessions to help suppliers meet eco-label criteria.

South Africa	 https://www.oneplanetnetwork.org/sites/default/files/from-crm/unep_ci_2021_wwf_south_africa_oprl_case_study.pdf https://consumersinternational.org/media/352255/canirecyclethis-finalreport.pdf https://greencape.co.za/assets/1._South_Africa_s_New_Simplified_Recycling_Label_Zaynab_Sadan.01.pdf https://www.oneplanetnetwork.org/sites/default/files/on_pack_recycling_guidelines.pdf		The standardized On-Pack Recycling Labels (OPRLs) are spearheaded by WWF South Africa. he initial OPRL guidelines were collectively agreed upon, accepted and endorsed by six of South Africa's retailers, namely; Clicks, Food Lovers, Pick n Pay, Spar, Shoprite and Woolworths.	The symbol mainly consists of four main parts 1)Packaging component definition - Sleeve/Film 2) The three chasing arrows with or without a strike representing recycled / not recycled respectively. 3) The basic substrate of the packaging component 4) And the relevant classification of the component as recycled / not recycled	These labels clearly indicate whether packaging can be recycled, helping consumers to make informed decisions.	The On-Pack Recycling Label (OPRL) provides clear instructions to give consumers detailed guidance about if the product packaging can be recycled and also transparency with the specified source material.	The WWF South Africa website issued a press release announcing the labels and their features; WWF South Africa's OPRL guidelines (technical report) and a Consumer Communication guideline have been sent to all relevant stakeholders

Implementation strategy

The following section presents an implementation strategy for the above-outlined recommendations. These have been designated to key stakeholders involved in plastic labelling at various levels, such as governments, standardizing bodies and industry alliances and given a timeline of tasks to prioritize in the improvement and implementation of improved plastics consumer labels. Furthermore, recognizing the importance of post-implementation actions, this section provides the key strategies for monitoring and evaluating the effectiveness of new labelling practices.

Table 4

Stakeholders, power of influence, roles and timelines

Stakeholder	Power of influence	Role in plastic labelling improvement	Timeline/priorities
Governments	High	Regulate labelling to align with "Guidelines for Providing Product Sustainability Information" principles. (UNEP, 2017). Enforce regulations against greenwashing. Fund and promote consumer education campaigns on label meanings and actions.	Short-term: Implement regulations, launch initial campaigns and support existing campaigns. Long-term: Monitor effectiveness and adapt strategies.
Standardizing bodies	High	Develop and harmonize global definitions used in plastic packaging standards and labels.	Medium-term: Focus on core definitions and achieving international consensus. Long-term: Maintain and update definitions as needed.
Business (including consumer packaged goods, plastic packaging manufacturing, retail, and consultancy)	Medium–high	Adopt and implement labelling practices aligned with "Guidelines for Providing Product Sustainability Information." Invest in initiatives to increase consumer "circular literacy" (understanding of circular economy principles).	Short-term: Adopt compliant labelling practices. Medium-term: Enhance consumer education efforts.
Industry alliances	High	Collaborate with stakeholders to harmonize labelling symbols and encourage adoption. Develop and promote clear guidelines for label use.	Short-term: Facilitate industry consensus on harmonization. Medium-term: Increase industry adoption and consumer awareness. Long-term: Advocate for wider adoption and ongoing improvement.
Civil society (including environmental advocacy, consumer advocacy, and ecolabelling groups)	Medium	Collaborate and participate on surveys and studies. Raise public awareness about plastic labelling issues. Advocate for stricter regulations and enforcement. Support research on consumer behaviour.	Short-term: Raise public awareness and advocate for policy changes. Medium-term: Collaborate with stakeholders on solutions. Long-term: Continuously monitor progress and advocate for ongoing improvement.
Academia	Medium–low	Conduct research on consumer behaviour and the effectiveness of different labelling approaches. Identify and highlight gaps in current mandatory label governance.	Medium-term: Conduct research and publish findings. Long-term: Continuous research and adaptation based on evolving knowledge.
Foundations	Low	Fund research and development initiatives related to improved labelling practices. Support educational campaigns and capacity-building programs.	Medium-term: Fund-targeted research policy briefs. Long-term: Provide sustained financial support for ongoing initiatives.

Strategies for monitoring and evaluating the effectiveness of new labelling practices.

To complement the recommendations presented in the main text, the following long-term strategies are proposed to support the continued effectiveness of labelling for plastics and plastic substitutes. These strategies are based on observed trends and insights from the literature review.

Establish clear objectives and metrics

- Define specific goals for the labelling system, such as improving consumer understanding, promoting healthier choices, or incentivizing producers to adopt more sustainable practices
- Determine measurable outcomes and key performance indicators (KPIs) to track progress, such as changes in consumer awareness, attitudes, and behaviour

Conduct consumer research

- Assess consumer understanding, perceptions, and responses to the new labels through surveys, interviews, and experimental studies
- Evaluate the effectiveness of different label formats, content, and designs in guiding consumers towards healthier or more sustainable choices
- Identify any differences in effectiveness across consumer segments based on factors like age, gender, education, language and cultural barriers, as well as motivation

Monitor market impacts

- Track changes in product sales, market shares, and consumer purchasing patterns in response to the new labels
- Assess the impact on producer behaviour and practices, such as the reformulation of products or the adoption of more sustainable methods
- Evaluate the overall market penetration and uptake of the labelling system

Ensure consistency and compliance

- Regularly audit the accuracy and consistency of label information across products
- Monitor compliance with labelling regulations and standards by producers and retailers
- Address any issues or inconsistencies in label application or interpretation

Engage stakeholders

- Gather feedback and input from key stakeholders, including consumers, producers, retailers, and public health experts
- Collaborate with stakeholders to identify areas for improvement and refine the labelling system over time
- Communicate the results of monitoring and evaluation efforts to stakeholders to promote transparency and accountability

By implementing these strategies, organizations can effectively monitor and evaluate the impact of new labelling practices, identify areas for improvement, and ensure that labelling systems are achieving their intended objectives

Comparative analysis for energy and nutrition labelling:

The table below illustrates the commonalities among successful labelling schemes in Colombia, Chile, China, Germany and the European Union. These best practices consistently exhibit clear and straightforward label designs, evidence-based development, comprehensive dissemination strategies, integration with broader initiatives, robust legislative support, stakeholder involvement, consumer education and outreach, and adaptive implementation. These points identify the elements present in all cases and, hence, can be inferred to be the main contributors to the effectiveness of these schemes. They succeed in ensuring that consumers receive vital health and energy efficiency information in an accessible manner while also fostering industry innovation and promoting broader public health and sustainability goals.

Table 5
Comparative table of commonalities for energy and nutrition labelling

Commonalities	Colombia	Chile	China	Germany	European Union
Clear and simple design.	Colour-coded system with black octagonal warnings on the front of the package, indicating high levels of specific nutrients, initially designed in Chile.	Black octagons with the words “high in [nutrient],” for nutrients such as sugar, sodium, saturated fat, or calories.	Labels identify a product’s efficiency on a scale of 1 to 5.	The label used in Germany follows the European Union design (see EU column).	Uses a categorical scale (A to G) with colour codes.
Evidence-based design.	Design was based on the Chilean nutrition label, which used surveys to create its label design (see Chile column for further detail).	Surveys resulted in changing from the initial black-and-white stop sign and black-and-white hand to a sign stating “excess of [nutrient]”.	Surveys provided important evidence for design, for example, labels using bold letters achieved highest comprehension.	Design is the same across all European Union member states and was informed by consumer research (see European Union column).	Extensive consumer research guided the development of the A to G colour coded scale.
Comprehensive dissemination strategies.	TV commercials, radio spots, and social media initiatives under the hashtags #ReadTheLabel and #HealthyColombia engaged influencers and health experts.	Chile opted for a restrictive advertising strategy, banning the marketing of “high in” foods to children under 14. Additionally, television, radio, newspaper, and online media were used to promote the label.	Newspapers, in-store posters, TV advertisements, product brochures, in store sample appliances and information from sales staff.	Same as European Union, and established a hotline for quick access to label information.	Displayed in both physical retail outlets and online stores, and promoted through TV channels and social media.
Integration with broader initiatives.	“Healthy Kids, Healthy Future” in schools and “Nutrition Literacy for All” campaigns.	Chile has yet to implement further initiatives which would promote the nutrition label.	The CEL was further encouraged through the Promoting Energy-Efficient Appliance for the Benefit of People Program, Appliances to Rural Areas Program, Appliances Trade-in Program.	The ‘Germany Makes It Efficient’ campaign and National Top Runners initiative.	Educational campaigns and public outreach initiatives, such as workshops and informational sessions, partnerships with other programs e.g. Topten Switzerland’s criteria used in rebate programs.

Legislative support.	Resolution 810 (2021), Junk Food Law (2024), legislative prohibition of misleading claims.	Chilean Food Labelling and Marketing Law (Law 20 606/2012) on mandatory front-of-package labelling (FOPL).	Energy Conservation Law, Product Quality Law, Legislation on Certification & Accreditation, Administration Regulation on Energy Efficiency Label (2005).	European Union Framework Regulation, recast Act on Energy Consumption Labelling (2012), revised Ordinance on Energy Consumption Labelling (2012).	Council Directive 79/530/EEC (1979), Council Directive 92/75/EEC (1992), Energy Labelling Framework Regulation (EU) 2017/1369, Directive 2010/30/EU, regular updates and revisions to energy labelling regulations.
Stakeholder involvement.	Educational programs, health organisations (Colombian Association of Dietitians and Nutritionists (ACDN), Colombian Heart Foundation), industry workshops (National Business Association of Colombia (ANDI), major supermarket chains like Éxito and Carulla).	Feedback before implementation, with over 3,000 suggestions, food industry (phased adoption of the policy with flexibility in implementation), media campaigns (banned TV ads for unhealthy foods to limit children's exposure), consumers though surveys and feedback sessions to refine the FOPL.	Consumer research involvement (semi-structured interviews with consumers, retailers, manufacturers, and policymakers), manufacturers (allowed to print labels and include them in product literature), retailers (support compulsory energy labelling).	Freephone service hotline for information and advice on energy efficiency programs, SMEs through advisory and funding programs for energy management systems, waste heat prevention, and efficient production processes, energy consultations (help companies identify and implement energy-saving measures).	Consumer research involvement (guided development of scale (A to G) with colour codes), national and local media campaigns (TV segments, radio shows, news articles, social media platforms), public outreach (workshops, partnerships with programs like Topten Switzerland, competitions for manufacturers and consumers), public sector (energy label criteria into green public procurement policy briefs).
Consumer information and outreach.	"Choose Well, Live Well" campaign commercials and radio spots, social media initiatives #ReadTheLabel and #HealthyColombia, educational programs "Healthy Kids, Healthy Future" in schools and "Nutrition Literacy for All" in community centres, partnerships with health organizations for informative materials, webinars, and community health fairs.	Surveys and feedback sessions with consumers to refine the FOPL design, public awareness efforts to highlight the "high in" warning labels, educational outreach to improve label comprehension.	Consumer intercept surveys, focus groups, and semi-structured interviews with consumers, research on label design preferences (colour associations, comprehension of labels), educational campaigns on the benefits of energy-efficient products.	'Germany Makes It Efficient' campaign for consumer education and support, freephone service hotline for information and advice, National Top Runners Initiative's Label Guide with step-by-step guidance on selecting and using appliances efficiently, infographics and checklists for better understanding.	National and local media campaigns (TV segments, radio shows, news articles), social media posts, educational campaigns (workshops, informational sessions), competitions aimed at manufacturers and consumers.

Adaptive and Progressive Implementation.	Resolution 810 of 2021 with phased adoption of stricter nutrient thresholds, initial phase implementation followed by further tightening of standards, partnerships with industry to ensure compliance and adaptability.	Phased adoption of the Food Labelling and Marketing Law with progressively stricter nutrient thresholds (Phase 1 in June 2016, Phase 2 in June 2018, Phase 3 in June 2019), adjustments to the FOPL design based on consumer feedback, flexible implementation to accommodate the food industry's requests.	Iterative research process combining qualitative and quantitative methods to refine label design, phased implementation of mandatory energy information labels, continuous updates based on consumer feedback and technological advancements.	Recast Act on Energy Consumption Labelling and revised Ordinance on Energy Consumption Labelling (May 17, 2012), flexible support for SMEs with advisory services and funding programs.	Regular updates and improvements to labelling standards reflecting technological advancements and market changes, consistent labelling system across all member states, harmonized framework ensuring broad impacts and market transformation.