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MILANO 1863

SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

Packaging Sustainability and Labelling under PPWR 2025/40: Regulatory Impacts and Industry adaptation

TESI DI LAUREA MAGISTRALE IN
FOOD ENGINEERING

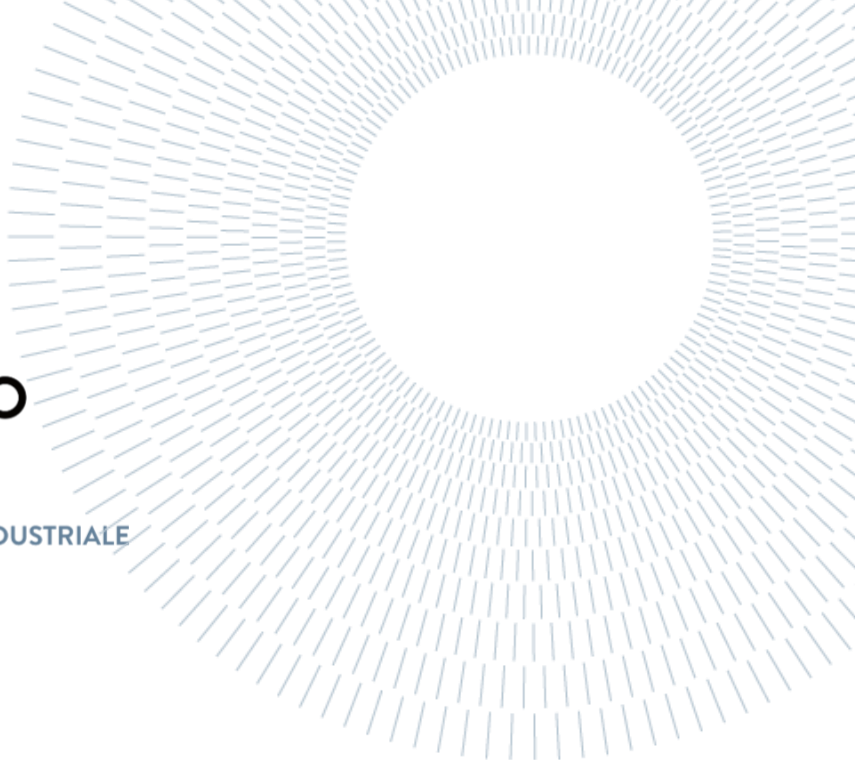
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Abstract

The management and reduction of packaging waste are central components of sustainability efforts within the European Union (EU), driven by significant environmental impacts due to low recycling rates and complexities in waste handling, particularly regarding plastic packaging. This thesis critically examines EU Regulation 2025/40 on Packaging and Packaging Waste (PPWR), positioning it within the broader context of the European Green Deal and Circular Economy Action Plan (CEAP). The research utilizes a qualitative methodology that involves a comprehensive literature review and detailed analysis of the regulation's structural framework, emphasizing Chapter II (Sustainability Requirements) and Chapter III (Labelling, Marking, and Information Requirements). It identifies critical challenges such as technological adaptation for recyclability grading, control of PFAS concentration, compliance with mandatory recycled content thresholds, and the development of a unified, harmonized labelling system across diverse national contexts. The study concludes that despite these complex challenges, the PPWR represents a significant advancement toward sustainable packaging systems, necessitating coordinated innovation, collaborative industry and strategic investments to achieve a solid sustainable circular economy within the EU.

Abstract in italiano

La gestione e la riduzione dei rifiuti di imballaggio rappresentano elementi cruciali all'interno degli sforzi di sostenibilità dell'Unione Europea (UE), spinti dagli impatti ambientali significativi derivanti dai bassi tassi di riciclo e dalle complessità nella gestione dei rifiuti, specialmente per quanto riguarda gli imballaggi in plastica. Questa tesi analizza criticamente il Regolamento UE 2025/40 sugli Imballaggi e i Rifiuti da Imballaggio (PPWR), collocandolo nel più ampio contesto del Green Deal Europeo e del Piano d'Azione per l'Economia Circolare (CEAP). La ricerca utilizza una metodologia basata sulla revisione completa della letteratura e sull'analisi dettagliata della struttura normativa, focalizzandosi in particolare sul Capitolo II (Sustainability Requirements) e sul Capitolo III (Labelling, Marking, and Information Requirements). Vengono identificate sfide critiche quali l'adattamento tecnologico per la classificazione della riciclabilità, il controllo delle concentrazioni di PFAS, la conformità con le soglie obbligatorie di contenuto riciclato e lo sviluppo di un sistema di etichettatura unico e armonizzato. La tesi conclude che, nonostante tali complesse sfide, il PPWR rappresenta un progresso significativo verso sistemi di imballaggio sostenibili, richiedendo innovazione coordinata, collaborazione industriale e investimenti strategici per raggiungere un'economia circolare solida e sostenibile nell'UE.

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Introduction

Managing and reducing packaging waste is a major challenge for sustainability efforts, both in the European Union (EU) and around the world. Recent data from Eurostat shows that packaging waste makes up about 36% of all municipal solid waste in the EU, showing its significant impact on the environment. Plastic packaging, which accounts for around 40% of all plastic use, is especially problematic due to its long-lasting environmental effects, low recycling rates, and the complexity of handling its waste.

Despite previous legislative efforts to tackle packaging waste, such as Directive 94/62/EC and its subsequent amendment Directive (EU) 2018/852, differences in how member states implemented these laws have resulted in inconsistent outcomes. This lack of uniformity has slowed progress toward the EU's circular economy goals (Directive 94/62/EC, 1994; Directive (EU) 2018/852, 2018). To solve this issue, the EU introduced Regulation (EU) 2025/40 on Packaging and Packaging Waste (PPWR), shifting from a directive-based to a regulation-based approach to ensure uniform and enforceable standards across member states.

This regulation is strategically aligned with the European Green Deal and the Circular Economy Action Plan (CEAP), introducing stringent measures such as harmonized labelling requirements, rigorous criteria for plastic packaging sustainability, including restrictions on harmful substances like per- and polyfluoroalkyl substances (PFAS), and clearly defined recyclability performance grades to promote higher recycling standards.

This thesis critically reviews Regulation (EU) 2025/40, focusing specifically on the innovations in labelling rules, sustainability mandates for packaging, and the newly established recyclability criteria. The research aims to evaluate the regulatory impacts on industry practices and technological adaptation, contributing meaningful insights into the regulation's potential to achieve a genuine transition towards sustainable packaging systems within the EU circular economy framework.

Acronyms

CE – Circular Economy

CEAP – Circular Economy Action Plan

FAO – Food and Agriculture organization

EGD – European Green Deal

EPR – Extended Producer Responsibility

GMP – Good Manufacturing Practice

PPWR – Packaging and Packaging Waste Regulation

ISO - International Organization for Standardization

LCAs - life cycle assessments

1. State of the Art

1.1 Theoretical framework

1.1.1 Circular economy theory

The concept of Circular Economy (CE) represents an innovative approach designed to significantly change how economic activities operate, by including environmental sustainability within production and consumption processes. Circular economy strongly differs from the traditional linear economic model, commonly described as "take, make, dispose." Instead, it follows principles of regeneration and sustainability, aiming to develop a system where resources are continuously reused, waste is minimized, and environmental damage is greatly reduced. Circular economy is defined as "an economic model that functions more like a natural ecosystem" [1], highlighting that, just like ecosystems produce no waste and constantly recycle materials, human economic activities should follow the same pattern.

This economic model prioritizes the efficient use of resources throughout the entire life cycle of products (As per figure 1)—from raw material extraction and production to distribution, consumption, and ultimately, end-of-life recovery. It is built on three key pillars:

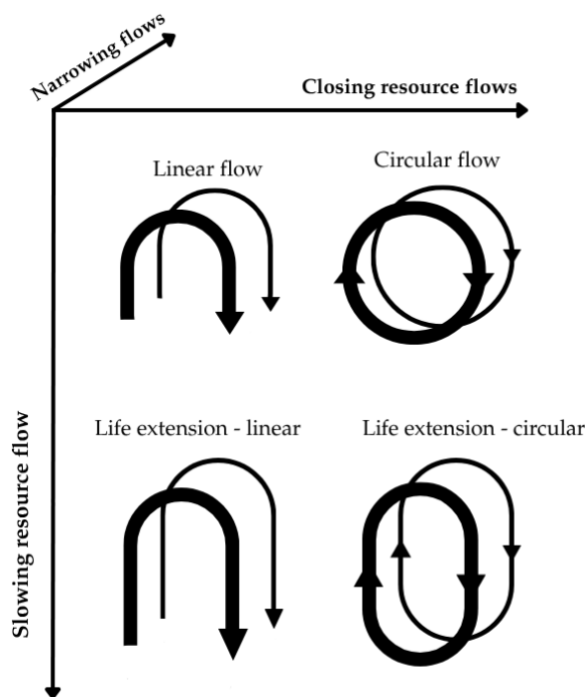


Figure 1. Circular economy principles [2]. The loops become more long by slowing the resource flow indicating a longer life-cycle of the product while becoming narrower in the background by utilizing less resource for each loop.

- **Slowing resource loops:**

The aim is to extend or intensify the usage period of products, this can be achieved by designing products that last longer and by extending the life of existing products (for example, through repair or remanufacturing). This approach slows down the rate at which resources are consumed.

- **Closing resource loops:**

The objective is a circular flow of resources, where materials are reused and recycled, minimizing waste and maximizing resource efficiency.

- **Narrowing resource flows:**

Narrowing flows does not address the loops but focus on reducing the needed raw materials per product.

Even though the circular economy offers many advantages, there are still several challenges to its implementation. These include economic issues, limited technological development, complex regulations, and cultural habits that prioritize short-term convenience over long-term sustainability. To successfully move toward a circular economy, cooperation between governments, companies, and consumers is necessary.

1.1.2 Sustainability frameworks

Sustainability frameworks serve as structured methodologies aimed at guiding systems and organizations toward sustainable practices by balancing environmental, social, and economic considerations. These frameworks are essential for addressing complex global challenges such as resource depletion, climate change, and social inequities by providing clear principles and measurable indicators. Specifically, the environmental dimension addresses issues related to ecological preservation, resource management, and minimizing negative impacts on the ecosystem. Sustainability frameworks are particularly important as they facilitate assessment and improvement throughout the entire food supply chain, from production and processing to distribution and consumption. The Food and Agriculture Organization (FAO) defines a sustainable food system as one that "delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised." [3].

1.2 Eu green deal

The European Green Deal (EGD), presented by the European Commission on December 11, 2019, under the presidency of Ursula von der Leyen, represents a comprehensive and ambitious strategy aiming to transform the European Union into a fair, sustainable, and resource-efficient society. This new growth strategy was introduced as a direct response to the urgent climate and environmental challenges facing Europe and the globe, particularly addressing the crises of climate change, biodiversity loss, and environmental degradation. According to the European Commission, the EGD "aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use" [4].

Central to the EGD is a commitment to achieve climate neutrality by 2050, alongside an intermediate milestone set for 2030, a reduction of at least 55% in greenhouse gas (GHG) emissions compared to 1990 levels. To ensure these targets become legally binding, the European Commission proposed a Climate Law intended to integrate climate neutrality in EU legislation, establishing clear conditions for a fair transition and providing predictability to investors and policymakers alike. [4]

To achieve these targets, the European Green Deal outlines a transformative framework addressing multiple sectors, including energy, industry, agriculture, transportation, and construction. Decarbonization of the energy sector through a shift towards renewable energy sources, such as offshore wind, solar power, and the decarbonisation of gas, is central to the strategy. Moreover, the plan emphasizes enhancing energy efficiency and addressing energy poverty, ensuring secure, clean, and affordable energy for all of Europe.

Additionally, the EGD updated The Circular Economy Action Plan (CAEP) the plan seeks to reduce waste generation and increase resource efficiency across all sectors, with a particular emphasis on packaging. The plan also strengthens producer responsibility through regulatory measures such as Extended Producer Responsibility (EPR), aiming to achieve more sustainable industrial systems throughout Europe [5]

Another crucial component is the "Farm to Fork" strategy, which aims at a healthier and more environmentally sustainable food production. This strategy addresses critical issues such as reducing pesticide usage, enhancing organic farming practices, reduce food waste, and ensuring affordable and nutritious food to all the consumers. The European Commission explicitly links these agricultural reforms to broader environmental objectives, including the protection of biodiversity and the reduction of environmental impacts from farming practices

The European Green Deal also addresses transportation, seeking to reduce transport emissions by 90% by 2050, reflecting the substantial contribution of transport to

current EU greenhouse gas emissions. This strategy involves a significant shift towards multimodal transport, reducing reliance on fossil fuels through improved emission standards and the promotion of zero and low emission vehicles.

Regarding implementation and effectiveness, an evaluation report published by the Joint Research Centre (JRC) in 2025 indicates a mixed but progressive state of advancement towards EGD objectives. Of the 154 quantifiable targets, grouped in 7 main thematic areas, significant progress has been recorded in some of them, yet notable acceleration is necessary.

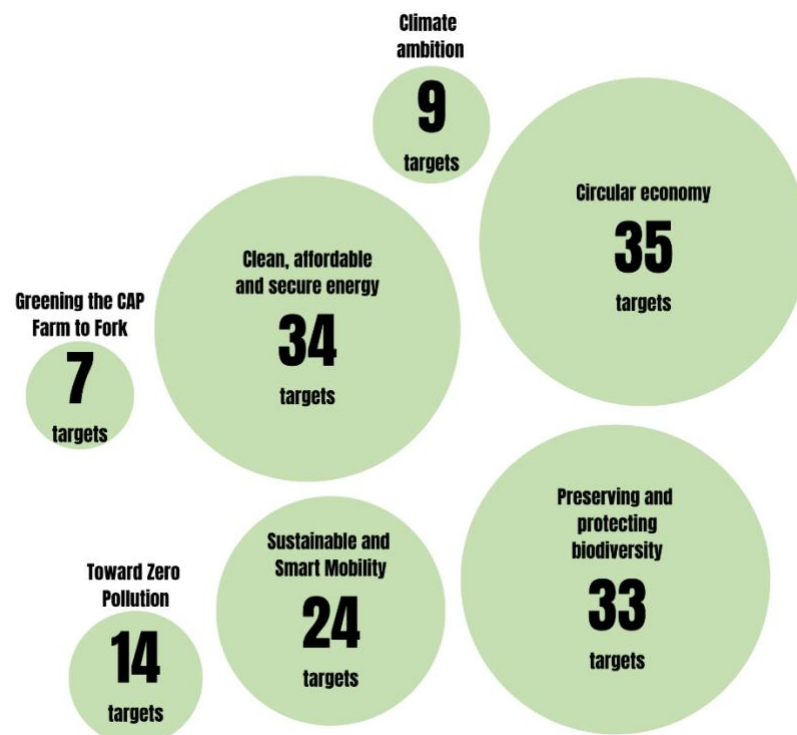


Figure 2 - Number of targets per thematic area [6]. Two targets are in common between thematic areas 5 (Farm to Fork) and 6 (Biodiversity) with a total of 156 targets

“As of mid-2024, 32 of the 154 targets are currently ‘on track’ and 64 are identified as ‘acceleration needed’ meaning that more progress is needed to meet the targets on time. Furthermore, 15 of the targets are found to be ‘not progressing’ or ‘regressing’, and for 43 of the targets no data is currently available.” [6]. Despite substantial achievements, the pace of implementation varies across sectors and member states, demanding more targeted efforts and policy coherence to align with the set timelines and objectives.

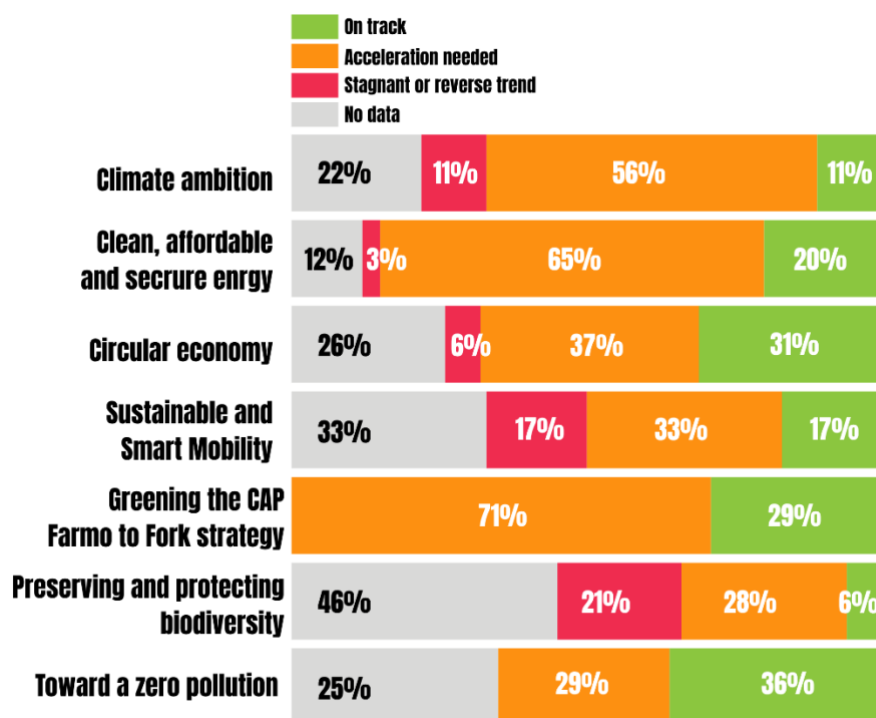


Figure 3 - Progress assessment of targets per thematic area [6]

1.3 Circular economy action plan

The European Union's Circular Economy Action Plan (CEAP), launched in 2020 as part of the European Green Deal [4], sets out a strategic roadmap to reshape the EU economy into a more sustainable and climate-neutral system. Its central aim is to move away from the traditional linear model toward a circular model that focuses on reusing, repairing, and recycling resources to reduce environmental harm. As highlighted in the official document, the plan calls for a shift to "a regenerative growth model that gives back to the planet more than it takes" [5]. One of the key points is that the design phase of a product determines up to 80% of its environmental impact, meaning that a well-designed product is crucial for sustainability. For this reason, the CEAP proposes new legal measures to ensure that products placed on the EU market are more durable, easier to repair, and more efficient in their use of energy and materials.

The CEAP also focuses on sectors that have a significant impact on resource use and waste generation, such as electronics, packaging, textiles, and construction. In these areas, the plan introduces tailored strategies to reduce waste and extend product lifespans. For instance, it includes the promotion of a "right to repair", new rules for green public procurement, and stricter guidelines to prevent misleading environmental claims protecting the consumer from greenwashing. In parallel, the plan supports innovation in how goods and services are produced, encouraging

companies to adopt circular business models and use digital tools like product passports to track a product's materials and repair history. Importantly, the CEAP sees European businesses as vital players in this transformation and proposes specific funding and support mechanisms to help them implement circular practices.

To ensure that the CEAP's goals are achieved, and progress is measurable, the EU has also implemented its monitoring framework in 2023. This system tracks key indicators such as material consumption, recycling rates and waste generation, all the indicators are available for both the EU and the single states. Most of the data in the framework are official statistics provided by Eurostat, while others are compiled by the Joint Research Centre (JRC) and the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW). As stated in the plan, the goal is to ensure that "the circular economy works for people, regions and cities" [5], and the monitoring framework plays a crucial role in achieving that. It not only supports transparency and accountability but also helps adapt the plan over time to new challenges, making it a dynamic and responsive tool for guiding the EU's transition toward a sustainable and competitive future.

1.4 Legislative Framework

The necessity for sustainable packaging practices did not emerge suddenly; instead, it was gradually established over decades of legislative development and increasing environmental awareness, particularly within the European Union. The initial significant step towards a structured approach to packaging waste was Directive 85/339/EEC, introduced in 1985 with the aim to manage waste from beverage containers. Recognizing its limitations, the 20th of December 1994 the directive was repealed and replaced by **Directive 94/62/EC**, after amended in 2018 by the **Directive (EU) 2018/85**, which significantly broadened the regulatory framework, laying the cornerstone for modern end of life packaging policies.

The influence of Directive 94/62/EC on subsequent legislation is evident, key concepts such as Extended Producer Responsibility (EPR) schemes, circular economy principles, and lifecycle assessment of packaging materials have since been integrated into EU environmental law.

In addition to waste management directives, the EU has also introduced a series of **manufacturing legislations** aimed at ensuring higher safety and quality standards. A key example is **Regulation (EC) No 1935/2004**, which establishes a harmonized framework to ensure that materials and articles intended to come into contact with food do not pose risks to human health or cause unacceptable alterations to the composition or sensory properties of food. Complementing this, **Regulation (EC) No 2023/2006** establishes Good Manufacturing Practices (GMP) specifically for materials

intended to contact food, thereby ensuring rigorous standards of quality throughout the production and supply chain.

Recent advancements, including the **Single Use Plastics Directive (EU) 2019/904**, established in 2019, reinforce this trajectory towards more stringent sustainability goals, aiming at reducing the environmental footprint of packaging and promoting recyclable and reusable alternatives.

Further expanding on these measures, the more recent **Regulation (EU) 2022/1616** introduces detailed conditions and guidelines for the safe incorporation of recycled plastic materials into food packaging, promoting circular economy principles while safeguarding consumer health. [7]

1.4.1 Directive 94/62/EC on packaging and packaging waste

Directive 94/62/EC of the European Parliament and Council, enacted in 1994 and significantly amended by Directive (EU) 2018/852 in 2018, establishes a unified framework for managing packaging and packaging waste within the European Union. Its primary purpose is to reduce the environmental impact of packaging by harmonizing national practices and promoting a transition towards a circular economy. Key points of the directive include the prevention of packaging waste, enhancement of reuse and recycling strategies, and implementation of specific recycling targets for various packaging materials, alongside obligations for member states to establish systems ensuring effective packaging waste management and producer responsibility [8]

1.4.2 Regulation (EC) No. 1935/2004 and Regulation (EC) No. 2023/2006 on food contact/packaging materials

Directive (EC) No. 1935/2004 of the European Parliament and Council, originally enacted in 2004 and subsequently amended notably in 2009 and 2019, outlines general provisions regarding materials and articles intended to directly or indirectly contact food. Its main purpose is to safeguard human health and protect consumer interests by ensuring that these materials and articles, when under normal or foreseeable conditions of use, do not transfer constituents to food in quantities harmful to human health or causing an unacceptable alteration of the food's composition or sensory properties. The regulation also includes specific requirements for "active and intelligent packaging," which can deliberately alter the condition or shelf-life of the food it contacts.

Complementary to this, Commission Regulation (EC) No. 2023/2006, adopted in December 2006, specifically establishes good manufacturing practice (GMP) standards to produce food-contact materials. It mandates that all operators within the food

packaging supply chain adhere to an effective quality assurance and quality control system, ensuring consistency in product quality and compliance with defined safety standards. The regulation covers general operational procedures, documentation requirements, and quality management systems aimed at preventing contamination from packaging processes, particularly focusing on critical areas like the application of printing inks, to ensure substances do not migrate into food products unintentionally.

1.4.3 Directive (EU) 2019/904 on single-use plastics

Directive (EU) 2019/904 of the European Parliament and Council, enacted on 5 June 2019, aims specifically at reducing the environmental impact of certain plastic products, particularly addressing single-use plastics. The directive emerges from broader European objectives aligned with the Circular Economy Action Plan, seeking to minimize waste generation, promote sustainable product design, and improve recycling practices. Amended regulations under this directive impose consumption reduction targets, marketing restrictions, and specific product design requirements, such as mandating tethered caps and lids for beverage containers to prevent littering. The directive further establishes clear extended producer responsibility (EPR) obligations, making producers financially responsible for the cleanup, awareness campaigns, and waste management of plastic products placed on the market.

1.4.4 Commission Regulation (EU) 2022/1616 on recycled plastic materials and articles intended to come into contact with food

Commission Regulation (EU) 2022/1616, adopted on 15 September 2022, repeals the previous Regulation (EC) No 282/2008 and sets comprehensive requirements for recycled plastic materials and articles intended for food contact. This regulation is part of the EU's strategy towards a circular economy, aiming particularly to enhance plastic recycling capacity and to increase recycled content within plastic products, especially food packaging. Regulation 2022/1616 stipulates strict conditions ensuring that recycled plastics do not compromise food safety, mandating robust decontamination processes to eliminate incidental contaminants derived from previous usage of plastic materials. It outlines clear rules for different recycling technologies, distinguishing mechanical and chemical recycling methods, and requires specific authorizations for certain recycling processes to ensure they can reliably produce safe materials. Additionally, the regulation mandates detailed documentation and labelling for transparency, quality assurance, and traceability of recycled plastic products throughout the supply chain.

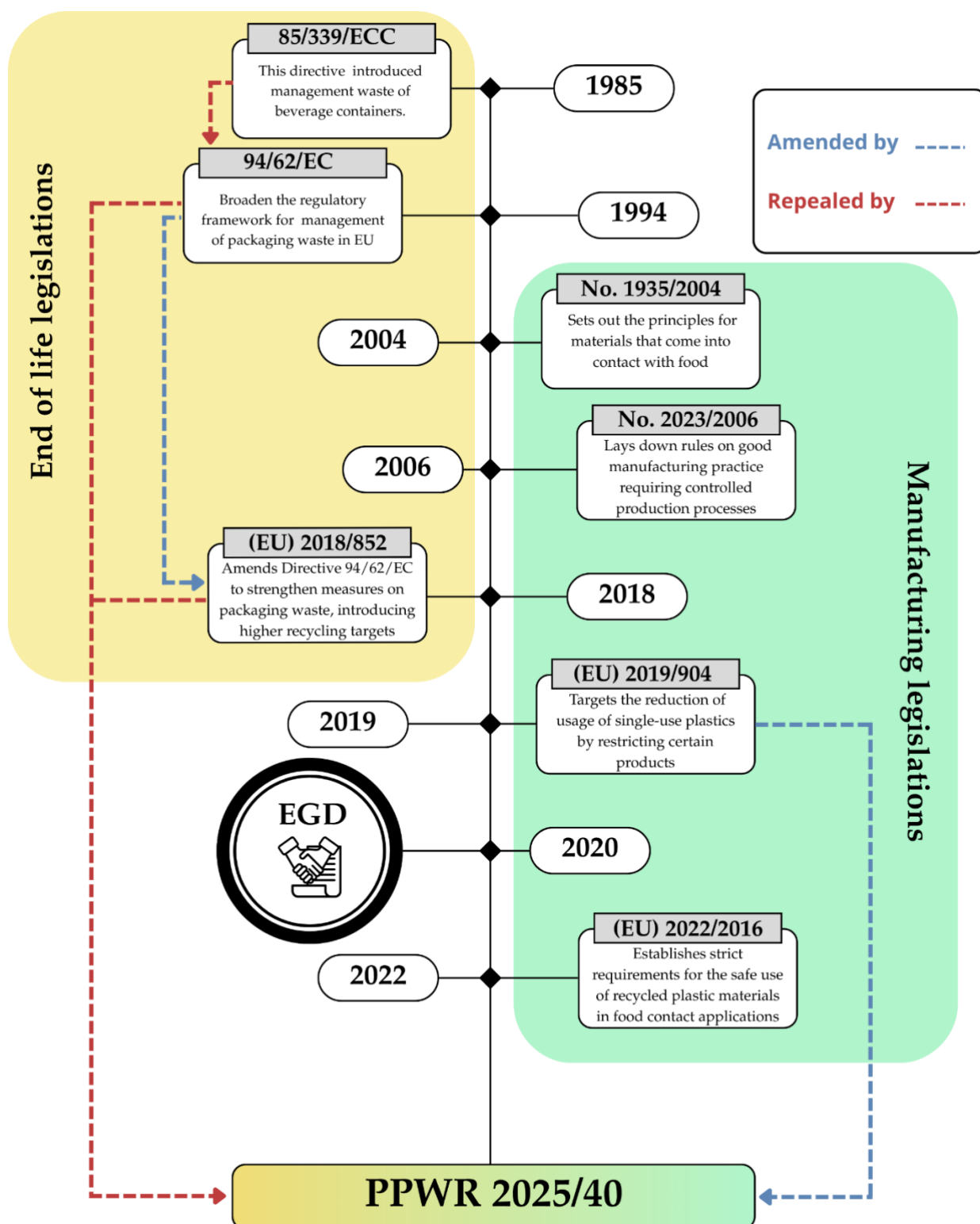


Figure 4 - Timeline (1985-2025) food packaging regulations

2.PPWR 2025/40

The Regulation (EU) 2025/40, also known as the **Packaging and Packaging Waste Regulation** (PPWR), represents a significant legislative development by the European Union aiming to harmonize and intensify sustainability standards across the lifecycle of packaging. Adopted by the European Parliament and Council on 19 December 2024, this Regulation replaces Directive 94/62/EC and modernizes the legislative framework in line with the EU's Circular Economy Action Plan and the European Green Deal. As explicitly stated, its principal objective is to “contribute to the efficient functioning of the internal market by harmonising national measures, while preventing and reducing the adverse impacts of packaging and packaging waste on the environment and human health” [9]. This is achieved through the introduction of binding sustainability requirements for all packaging types and the establishment of extended producer responsibility obligations to ensure effective waste prevention, re-use, collection, and recycling.

The structure of the PPWR is methodically organized into thirteen chapters, comprising a total of 71 articles, supported by thirteen annexes. Each chapter addresses distinct yet interconnected aspects of packaging governance, reflecting the comprehensive nature of the regulation.

- **Chapter I, entitled “General Provisions”,** defines the scope, subject matter, and key terminologies applicable throughout the text, laying the groundwork for the regulatory framework.
- **Chapter II, “Sustainability Requirements”,** establishes core obligations related to the design of packaging for recyclability, the use of recycled content in plastic packaging, compostability, and packaging minimization. This chapter introduces the concept of recyclability performance grades (A to C) and mandates the progressive achievement of high recyclability standards by 2030 and 2035.
- **Chapter III, “Labelling, Marking and Information Requirements”,** standardizes consumer-facing labels to facilitate waste sorting, including harmonized symbols for material composition, and deposit-return systems, while prohibiting misleading environmental claims.
- **Chapter IV, titled “General Obligations”,** establishes core responsibilities for all economic operators placing packaging on the EU market, including manufacturers, importers, distributors and authorised representatives.
- **Chapter V, “Obligations of Economic Operators to Reduce Packaging and Packaging Waste”,** aims to reduce packaging generation at source by setting

reduction targets, promoting re-use, and introducing restrictions on unnecessary packaging types and volumes.

- **Chapter VI**, entitled "**Plastic Carrier Bags**", focuses specifically on measures to reduce the consumption of lightweight plastic carrier bags. It requires Member States to ensure that, by the end of 2025, the annual use does not exceed 40 bags per person. From this target lightweight plastic bag used for hygiene purposes or to prevent food wastage are excluded.
- **Chapter VII**, "**Conformity of Packaging**", defines how packaging must meet EU sustainability requirements through testing, technical documentation, and harmonised standards. It also allows the Commission to set common specifications where needed.
- **Chapter VIII**, "**Management of Packaging and of Packaging Waste**", outlines the responsibilities of Member States in enforcing and coordinating packaging policies. It includes the designation of competent authorities, development of waste prevention strategies, national registers for producers, and implementation of extended producer responsibility systems. The chapter also enforces new recycling targets and mandates new regulations for return, collection and deposit systems.
- **Chapter IX**, titled "**Safeguard Procedures**", sets out how Member States must respond to packaging that poses risks to health or the environment, enabling market surveillance authorities to enforce corrective actions and coordinate measures across the EU.
- **Chapter X**, "**Green Public Procurement**", introduces obligations to promote the uptake of sustainable packaging through public sector purchasing.
- **Chapter XI**, titled "**Delegated Powers and Committee Procedure**", outlines the legal basis for the European Commission to adopt delegated acts. It defines the scope, duration, and conditions under which the Commission may update elements of the Regulation.

Chapters XII and XIII complete the legislative framework by addressing legal continuity and enforcement. **Chapter XII**, "**Amendments**", formally modifies existing EU legislation, specifically Regulation (EU) 2019/1020 on market surveillance and compliance of products and Directive (EU) 2019/904 on the reduction of the impact of plastic products on the environment, to align them with the new rules established by the PPWR. **Chapter XIII**, entitled "**Final Provisions**", includes the repeal of Directive 94/62/EC, and the establishment of penalty systems to be enforced by Member States by 2027. It also sets a timeline for the Regulation's application, with most provisions taking effect from August 2026, and requires the Commission to evaluate the Regulation's effectiveness by 2034. The Regulation also comprises extensive annexes detailing performance criteria, recyclability thresholds, technical documentation

requirements, and material classifications, which are critical for implementation and compliance.

This thesis will specifically concentrate on Chapter II and Chapter III of the Regulation. Chapter II is of fundamental importance as it defines the sustainability requirements that must be fulfilled by all packaging placed on the EU market. These include recyclability, the presence and control of substances of concern, mandatory recycled content in plastic packaging, and minimization of packaging volume and weight. Chapter III complements these obligations by introducing mandatory labelling and information requirements, essential to ensure transparency, consumer awareness, and proper waste separation. Together, these chapters form the heart of the PPWR's environmental objectives and are central to understand the shifts imposed by the regulation on packaging design and waste governance in the European Union.

2.1 CHAPTER II - Sustainability Requirements

Article	Title	Annex	Linked Regulations
Art. 5	Requirements for substances in packaging	Annex VII	Reg. EC 1907/2006 Reg. EC 1935/2004
Art. 6	Recyclable packaging	Annex II, VII	Reg. EC 1935/2004
Art. 7	Minimum recycled content in plastic packaging	Annex II, VII	Reg. EC 1935/2004 Reg. EC 2022/1616
Art. 8	Biobased feedstock in plastic packaging	-	Reg. EC 2022/1616
Art. 9	Compostable packaging	Annex III, VII	-
Art. 10	Packaging minimisation	Annex IV	-
Art. 11	Reusable packaging	Annex VI, VII	Reg. EC 1935/2004

Table 1 - Chapter II Articles overview

2.1.1 Article 5 – Requirements for substances in packaging

Overview	Regulatory Compliance
Restricts substances of concern in packaging, including specific limits for heavy metals and PFAS in food-contact packaging	Regulation (EC) No 1935/2004 (food-contact safety) Regulation (EC) No 1907/2006 (chemical safety).
Actors	Obligation
Manufacturers	-Minimize substance of concern in packaging -Demonstrate compliance through technical documentation
The Commission	-Prepare a report on substances of concern -Adopt delegated acts to amend thresholds

Table 2 - Summary Article 5

Article 5 mandates that “all packaging placed on the market must be manufactured in such a way that the presence and concentration of substances of concern are minimized. This includes their emissions and any residual impact on waste management outputs such as secondary raw materials and final disposal residues”. [9]

To enforce and monitor these requirements, the European Commission, supported by the **European Chemicals Agency**, is tasked with preparing a detailed **report by 31 December 2026**. This report will assess the presence of substances of concern and their potential to hinder material reuse and recycling or pose chemical safety risks. The findings may lead to follow-up regulatory measures, including new restrictions under Regulation (EC) No 1907/2006, or the integration of restrictions within the design for recycling criteria under Article 6(4) of the current Regulation.

A critical quantitative requirement introduced by paragraph 4 is the imposition of a maximum **combined concentration threshold of 100 mg/kg for lead, cadmium, mercury, and hexavalent chromium** in packaging materials. This requirement operates without prejudice to pre-existing restrictions established under Annex XVII of Regulation (EC) No 1907/2006 or to rules under Regulation (EC) No 1935/2004.

Paragraph 5 prohibits food-contact packaging containing per- and polyfluorinated alkyl substances (PFAS)¹ above defined thresholds **from 12 August 2026**, with further evaluations scheduled for the 12 August 2030 to align with broader Union legislation. The Regulation defines **three distinct thresholds**:

- 25 parts per billion (ppb) for any PFAS as measured with targeted PFAS analysis (excluding polymeric PFAS).
- 250 ppb for the total of targeted PFAS after precursor degradation (excluding polymeric PFAS).
- 50 parts per million (ppm) for PFASs (including polymeric PFAS).

Where **total fluorine** content **exceeds 50 mg/kg**, economic operators shall, upon request, provide specific proof identifying whether the fluorine derives from PFAS or other compounds. Compliance with these limits must be demonstrated through technical documentation prepared in accordance with **Annex VII**, as stipulated in paragraph 6.

Annex VII details the conformity assessment procedure under Module A (Internal Production Control). Manufacturers must develop technical documentation, including risk analyses, design specifications, manufacturing processes, and test reports. This documentation must contain a general description of the packaging, design drawings, applied standards, and qualitative assessments of recycling and safety criteria. Additionally, manufacturers are required to maintain a written declaration of conformity for each packaging type after has been placed on the market, retained for five years for single-use type, or ten years for reusable packaging, and provide it to authorities upon request.

Paragraphs 7 and 8 grant the Commission the authority to adopt delegated acts to amend concentration thresholds or to exempt certain recycled materials and packaging formats operating within closed and controlled loops.

Lastly, the long-term effectiveness of Article 5 will be assessed through a **scheduled evaluation by 12 August 2033**. This assessment will determine whether the adopted measures, together with the Article 6(4), have effectively minimized the presence of substances of concern in packaging materials.

¹ PFAS' means any substance that contains at least one fully fluorinated methyl (CF₃-) or methylene (-CF₂-) carbon atom (without any H/Cl/Br/I attached to it), except substances that only contain the following structural elements: CF₃-X or X-CF₂-X', where X = -OR or -NRR' and X' = methyl (-CH₃), methylene (-CH₂-), an aromatic group, a carbonyl group (-C(O)-), -OR'', -SR'' or -NR''R'''; and where R/R'/R''/R''' is a hydrogen (-H), methyl (-CH₃), methylene (-CH₂-), an aromatic group or a carbonyl group (-C(O)-)

2.1.2 Article 6 – Recyclable packaging

Overview	Regulatory Compliance
Establishes mandatory recyclability requirements, outlining criteria and performance grades (A, B, C) to evaluate packaging recyclability.	Regulation (EC) No 1935/2004 (ensuring recyclability without compromising food safety).
Actor	Obligation
Manufacturers	-Ensure packaging is recyclable -Assess recyclability based on the new system -Ensure compliance documented
The Commission	- Adopt delegated acts to define design for recycling criteria, recyclability performance grades, financial modulation and methodology for the recycled-at-scale assessment

Table 3 - Summary Article 6

The article mandates that **all packaging placed on the market must be recyclable**, with compliance determined through criteria and methodologies outlined in the Article and referenced in **Annex II**. Packaging is considered recyclable if it fulfils the following conditions:

- It is designed for material recycling to produce secondary raw materials of sufficient quality to substitute primary materials.
- It can be separately collected, sorted into specific waste streams, and recycled at scale.

The entry into force of these obligations follows a phased timeline. The requirement for design for recycling will become applicable from 1 January 2030 or 24 months after the entry into force of the relevant delegated acts, whichever is later. The requirement for recycling at scale will apply from 1 January 2035 or five years after the corresponding implementing acts enter into force.

Paragraph 3 introduces the **recyclability performance grading system**, which forms the basis for evaluating packaging under this framework. Packaging must be **graded as A, B, or C** in accordance with the methodology set out in delegated acts, Article 6(4), and implementing acts, Article 6(5), and as described in **Table 3 of Annex II**. From 2030, packaging that is not graded within A, B, or C will be prohibited from market placement, and from 2038, only grades A and B will be acceptable, effectively banning

packaging of grade C. Starting in 2035, the assessment of packaging recyclability will include a new factor: the **recycled-at-scale evaluation**. This evaluation will require an additional assessment based on the actual quantity, by weight, of material effectively recycled for each packaging category found in the Table I of Annex II.

2030		2035			2038		
Recyclability performance grade	Design for recycling (DfR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance grade (for DfR)	Design for recycling (DfR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance grade (for recycled-at-scale assessment)	Recyclability performance grade	Design for recycling (DfR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance grade (for recycled-at-scale assessment)
Grade A	higher or equal to 95 %	Grade A	higher or equal to 95 %	Grade A RaS	Grade A	higher or equal to 95 %	Grade A RaS
Grade B	higher or equal to 80 %	Grade B	higher or equal to 80 %	Grade B RaS	Grade B	higher or equal to 80 %	Grade B RaS
Grade C	higher or equal to 70 %	Grade C	higher or equal to 70 %	Grade C RaS	Grade C CANNOT BE PLACED ON THE MARKET	higher or equal to 70 %	Grade C RaS
TECHNICALLY NON-RECYCLABLE	lower than 70 %	TECHNICALLY NON-RECYCLABLE	lower than 70 %	NOT RECYCLED AT SCALE (below thresholds of Article 3(1), point (39).	TECHNICALLY NON-RECYCLABLE	lower than 70 %	NOT RECYCLED AT SCALE (below thresholds of Article 3(1), point (39).

Figure 5 - Annex II Table 3 - Recyclability performance grades

The classification system present in Table I of Annex II provides a comprehensive breakdown of packaging categories by predominant material, structural type and example formats, facilitating a technical understanding of packaging types placed on the market. Special attention should be paid to composite and multi-material formats which may pose significant challenges for Recyclability at scale.

Category No	Predominant packaging material	Packaging type	Format (illustrative and non-exhaustive)	Colour / Optical transmittance
1	Glass	Glass and composite packaging, of which the majority is glass	Bottles, jars, flacons, cosmetics pots, tubs, ampoules, vials made of glass (soda lime silica), aerosol cans	-
2	Paper/cardboard	Paper/cardboard packaging	Boxes, trays, grouped packaging, flexible paper packaging (e.g. films, sheets, pouches, lidding, cones, wrappers)	-
3	Paper/cardboard	Composite packaging of which the majority is paper/cardboard	Liquid packaging board, and paper cups (i.e. laminated with polyolefin and with or without aluminium), trays, plates and cups,	-

			metallised or plastic laminated paper/cardboard, paper/cardboard with plastic liners/ windows	
4	Metal	Steel and composite packaging of which the majority is steel	Rigid formats (aerosols cans, cans, paint tins, boxes, trays, drums, tubes) made of steel, including tinplate and stainless steel	-
5	Metal	Aluminium and composite packaging of which the majority is aluminium – rigid	Rigid formats (food and beverage cans, bottles, aerosols, drums, tubes, cans, boxes, trays) made of aluminium	-
6	Metal	Aluminium and composite packaging of which the majority is aluminium – semi-rigid and flexible	Semi rigid and flexible formats (containers and trays, tubes, foils, flexible foil) made of aluminium	-
7	Plastic	PET – rigid	Bottles and flasks	Transparent clear / coloured, opaque
8	Plastic	PET – rigid	Rigid formats other than bottles and flasks (including pots, tubs, jars, cups, mono- and multilayer trays and containers, aerosol cans)	Transparent clear / coloured, opaque
9	Plastic	PET – flexible	Films	Natural / coloured
10	Plastic	PE – rigid	Containers, bottles, trays, pots and tubes	Natural / coloured
11	Plastic	PE – flexible	Films, including multilayer and multi-material packaging	Natural / coloured
12	Plastic	PP – rigid	Containers, bottles, trays, pots and tubes	Natural / coloured
13	Plastic	PP – flexible	Films, including multilayer and multi-material packaging	Natural / coloured
14	Plastic	HDPE and PP – rigid	Crates and pallets, corrugated board plastic	Natural / coloured

15	Plastic	PS and XPS – rigid	Rigid formats (including dairy packaging, trays, cups and other food containers)	Natural / coloured
16	Plastic	EPS – rigid	Rigid formats (including fish boxes / white goods and trays)	Natural / coloured
17	Plastic	Other rigid plastics (e.g. PVC, PC) including multi- materials – rigid	Rigid formats, including intermediate bulk containers, drums	-
18	Plastic	Other flexible plastics including multi-materials – flexible	Pouches, blisters, thermoformed packaging, vacuum packaging, modified atmosphere/modified humidity packaging, including flexible intermediate bulk containers, bags, stretch films	-
19	Plastic	Biodegradable plastics ⁽¹⁾ – rigid (e.g. PLA, PHB) and flexible (e.g. PLA)	Rigid and flexible formats	-
20	Wood, cork	Wooden packaging, including cork	Pallets, boxes, crates	-
21	Textile	Natural and synthetic textile fibres	Bags	-
22	Ceramics or porcelain stoneware	Clay, stone	Pots, containers, bottles, jars	-
(1) Please note that this category contains plastics that are readily biodegradable (meaning a proven ability to convert >90 % of the original material into CO₂, water and minerals by biological processes within 6 months) and regardless of the feedstock used for their production. Biobased polymers that are not readily biodegradable are covered under the other relevant plastic categories.				

Table 4 - Annex II Table 1 - Indicative list of packaging materials, types and categories referred to in Article 6

The delegated acts to be adopted by 1 January 2028 under Article 6(4) will establish:

- The **design for recycling criteria and the recyclability grades** based on Table 3 of Annex II and the parameters listed in Table 4 of Annex II.
- The **assessment method for recyclability and the conditions for grading compliance** for each category listed in Table 1 of Annex II.
- The **financial modulation framework** linked to Extended Producer Responsibility (EPR) schemes under Article 45(1).

These criteria are tailored to the predominant material of the packaging and incorporate several factors such as additives, labels, adhesives, and ease of dismantling —elements detailed in **Table 4 of Annex II**, which significantly affect the ability to recycle the packaging without compromising the quality of the recovered materials.

Further, under paragraph 5, **by 1 January 2030**, the Commission is required to adopt implementing acts that **establish the methodology for the recycled-at-scale assessment**. This assessment ensures that the recycling of packaging is not only technically feasible but is practiced extensively across Member States. It will be grounded in empirical data on quantities placed on the market and quantities recycled per packaging category listed in Table 2 of Annex II, supplementing Table 3 of Annex II with thresholds for the recycled-at-scale assessment.

Paragraph 9 further links these requirements to the technical documentation obligations under Annex VII, making it **mandatory for manufacturers to include data and analysis** supporting the packaging's conformity with Article 6. This includes **assessments of all components**, both integrated and separate, and ensures they do not interfere with the recyclability of the main body. Article 6 also provides a framework for innovation, which allows the temporary placement of non-compliant **innovative packaging** on the market for up to five years from the end of the year it is first marketed.

Exemptions are outlined in paragraph 11, which **excludes specific types of packaging**:

- Contact-sensitive packaging² for medical and infant use.
- Packaging used for the transport of dangerous goods.
- Sales packaging made from lightweight wood, cork, textile, rubber, ceramic, porcelain or wax.

2.1.3 Article 7 – Minimum recycled content in plastic packaging

Overview	Regulatory Compliance
Sets minimum recycled content levels for different plastic packaging types	Regulation (EC) No 1935/2004 (food-contact material safety); Regulation (EU) 2022/1616 (recycled plastics in food-contact)

² ‘contact-sensitive packaging’ means packaging that is intended to be used for products falling within the scope of Regulations (EC) No 1831/2003 of the European Parliament and of the Council, (EC) No 1935/2004, (EC) No 767/2009 of the European Parliament and of the Council , (EC) No 1223/2009 of the European Parliament and of the Council , (EU) 2017/745, (EU) 2017/746, (EU) 2019/4 of the European Parliament and of the Council or (EU) 2019/6, or of Directives 2001/83/EC, 2002/46/EC of the European Parliament and of the Council or 2008/68/EC, or for products as defined in Articles 1 and 2 of Commission Decision (EU) 2023/1809;

Actor	Obligation
Manufacturers/Importes	-Ensure plastic packaging contains specific % of recycled content -Technical info demonstrating compliance
The Commission	-Define methodology for calculating/verifying recycled content -Define sustainability criteria for recycling technologies and assess third-country compliance

Table 5 - Summary Article 7

Article 7 introduces binding obligations on the inclusion of recycled plastic content in packaging, setting minimum thresholds for recycled content in plastic packaging with the aim of reducing dependence on virgin plastics,

The core requirement is established in paragraph 1: **by 1 January 2030** or three years after the entry into force of the implementing act, whichever is the latest, **any plastic part of packaging placed on the market must meet specific recycled content percentages**. These vary depending on the packaging use and polymer base: 30% for contact-sensitive polyethylene terephthalate (PET) packaging (excluding single-use beverage bottles), 10% for other contact-sensitive plastic packaging (excluding again single-use beverage bottles), 30% for single-use plastic beverage bottles, and 35% for all other plastic packaging. Paragraph 2 extends this requirement further, setting the 2040 thresholds to 50%, 25%, 65%, and 65%, respectively, for the same categories. These targets are to be calculated as an annual average per manufacturing plant.

	2030	2040
type	% recycled plastic	% recycled plastic
PET packaging (single-use excluded)	30%	50%
Plastic packaging other than PET (single-use excluded)	10%	25%
Single-use beverage bottles	30%	65%
Other plastic packaging	35%	65%

Table 6- Recycled plastic requirements for diverse types of packaging.

Compliance with these requirements necessitates that recycled content originates from post-consumer waste collected within the EU under Directive 2008/98/EC or equivalent third-country standards and processed in facilities adhering to environmental regulations under Directive 2010/75/EU. Any recycled plastic intended for food-contact applications must still comply with its safety and quality requirements identified in the Regulation (EU) 2022/1616

The Regulation outlines several exemptions to these thresholds. Paragraphs 4 and 5 enumerate categories of packaging that are not subject to the minimum recycled content requirements. These include immediate packaging for pharmaceuticals, medical and diagnostic devices, compostable plastic packaging, packaging for dangerous goods, and packaging for food intended for infants or young children. Additionally, any plastic component that constitutes less than 5% of the total packaging unit by weight or that may compromise food safety under Regulation (EC) No 1935/2004 is excluded from the scope.

The Commission is tasked with developing the methodological and procedural infrastructure necessary for implementing this article. By 31 December 2026, it must adopt implementing acts to establish a methodology for calculating and verifying the recycled content and the format of technical documentation needed by manufacturers and importer to demonstrate compliance with the regulations. In parallel, paragraph 10 mandates the Commission to adopt additional implementing acts to verify the equivalency of standards applied in third-country recycling facilities.

2.1.4 Article 8 – Biobased feedstock in plastic packaging

Overview	Regulatory Compliance
Explores sustainability of biobased plastic packaging and proposes potential future targets or substitutions of recycled content with biobased alternatives	Regulation (EU) 2022/1616 (safety for food-contact materials)
Actor	Obligation
The Commission	-Review state of technology and sustainability of biobased plastic -Propose legislation to set requirements and target to allow biobased feedstock to be used instead of recycled content

Table 7 - Summary Article 8

This Article establishes a preparatory framework concerning the use of biobased feedstock in plastic packaging. It requires the European Commission, by **12 February 2028**, to conduct a review on the technological development and environmental performance of biobased plastic packaging, taking in consideration the sustainability criteria in Article 29 of Directive (EU) 2018/2001.

Based on the outcome of this review, the Commission may propose legislation to:

- Establish sustainability requirements for biobased feedstock.
- Set targets to increase its use in plastic packaging.
- Allows biobased feedstock to be used instead of recycled content to achieve the targets set out in Article 7.
- Revise the definition of biobased plastic in Article 3(1), point (53).

2.1.5 Article 9 – Compostable packaging

Overview	Regulatory Compliance
Specifies conditions under which compostable packaging can be placed on the market, particularly focusing on compatibility with composting standards in bio-waste treatment facilities	Regulation (EC) No 1935/2004 (indirect requirement for food-contact safety compliance)
Actor	Obligation
Manufacturers	-Ensure compostable packaging meets industrial/home standards
The Commission	-Request European standardisation organizations to prepare standards for compostability

Table 8 - Summary Article 9

Article 9 delineates a framework for the market placement and use of compostable packaging within the European Union. While maintaining the requirement under Article 6(1) that packaging must be recyclable, Article 9 introduces specific derogations and authorizations allowing for the use of compostable materials in certain circumstances.

The first paragraph stipulates that by **12 February 2028**, packaging types specified in Article 3(1), point (1)(f)³ and sticky labels affixed to fruit and vegetables must comply with standards for composting under industrially controlled conditions. Following paragraph 2 Member States that allow collection of packaging waste with bio-waste, may require the compostability of certain packaging formats. This includes packaging referred to in Article 3(1)(1)(g)⁴ that is non-metallic, as well as very lightweight and lightweight plastic carrier bags, and any additional packaging types that were already required to be compostable by national legislation prior to the Regulation’s date of application.

Paragraph 4 binds compliance with prior paragraphs to the technical documentation obligations outlined in Annex VII, mandating that proof of compostability must be included in the packaging documentation. While the fifth paragraph allow the Commission to consider expanding the compostable packagings included in paragraphs 1 and 2, based on technological or regulatory advancements, and subject to the conditions outlined in **Annex III** (condition to be considered when mandating or introducing the use of compostable packaging format):

- It could not have been designed as reusable packaging, or the products could not be placed on the market without packaging.
- It is designed to enter the organic waste stream at the end of its life.
- It is of such biodegradable nature that it allows the packaging to undergo physical or biological decomposition, including anaerobic digestion, resulting ultimately in conversion into carbon dioxide and water, new microbial biomass, mineral salts, and, in the absence of oxygen, methane.
- Its use significantly increases the collection of organic waste compared to the use of non-compostable packaging materials.
- Its use significantly reduces the contamination of compost with non-compostable packaging and does not cause any problems in bio-waste processing.
- Its use does not increase the contamination of non-compostable packaging waste streams.

2.1.6 Article 10 – Packaging minimisation

Overview	Regulatory Compliance
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³ Article 3(1), point(1)(f): permeable tea, coffee or other beverage bag, or soft after-use system single-serve unit that contains tea, coffee or another beverage, and which is intended to be used and disposed of together with the product.

⁴ Article 3(1), point(1)(g): a non-permeable tea, coffee or other beverage system single-serve unit intended for use in a machine and which is used and disposed of together with the product.

Requires packaging design to minimize weight and volume without compromising functionality, banning unnecessary features solely aimed at inflating product volume	Regulation (EC) No 1935/2004 (indirect requirement for food-contact safety compliance)
Actor	Obligation
Manufacturers/importers	-Ensure packaging uses minimal weight and volume -Demonstrate compliance via technical documentation
The Commission	-Request standards for packaging minimisation

Table 9 - Summary Article 10

By **1 January 2030**, any packaging placed on the market must be designed in such a way that it uses no more material than what is strictly necessary, designs that artificially enlarge the perceived volume of the product, such as false bottoms, double walls, or unnecessary layers are prohibited. However, two categories of exemptions are recognised:

- Packaging that are protected by registered design rights or trademarks established before 11 February 2025, where applying minimisation would compromise their individual character or novelty.
- Packaging used for products covered by Union-protected geographical indications or quality schemes.

The Commission shall request the European standardisation organisation, by 12 February 2027, the development or revision of harmonised standards. These standards must define the methodology to measure compliance with Article 10, by setting maximum allowable limits for weight, volume, wall thickness, and empty space for the most common types of packaging.

Compliance with these obligations must be assessed with a technical documentation containing a description of the technical specifications, standards and conditions used to assess the packaging against the performance criteria and methodology set out in Annex IV, an explanation of which design requirements prevent further reductions in weight or volume and supporting evidence that justify the minimised design.

2.1.7 Article 11 – Reusable packaging

Overview	Regulatory Compliance
Specifies criteria for packaging reuse including durability, safety, hygiene, and recyclability to ensure multiple cycles of reuse starting from 2025	Regulation (EC) No 1935/2004 (hygiene and safety for repeated food-contact applications)
Actor	Obligation
Manufacturers	-Ensure packaging meets all condition for reusability -Document compliance
The Commission	Adopt delegated act establishing minimum number of reuse cycles for most common formats

Table 10 - Summary Article 11

Packaging placed on the market from **11 February 2025** onward may only be classified as reusable if it meets all of nine specific requirements. These include:

1. The packaging must be conceived, designed, and placed on the market with the explicit objective of multiple uses.
2. It must be designed to allow for as many reuse rotations as possible under standard usage conditions.
3. It must comply with health, safety, and hygiene regulations.
4. It must allow for emptying or unloading without being damaged in a way that would prevent its further function and re-use.
5. it must enable emptying, unloading, refilling or reloading while maintaining the quality and compliance with food safety rules.
6. It must be suitable for reconditioning.
7. Allows for the provision of product and packaging information and for affixing of labels
8. it must be capable of being reused without risk to the health or safety of those responsible for the process.
9. It fulfils the requirements specific to recyclable packaging set out in Article 6.

2.2 CHAPTER III - Labelling, Marking and Information Requirements

Article	Title	Annex	Linked Regulations
Art. 12	Labelling of packaging	Annex VI	-
Art. 13	Labelling of waste receptacles for the collection of packaging waste	-	-
Art. 14	Environmental claims	Annex VII	-

Table 11 - Chapter III Article overview

2.2.1 Article 12 – Labelling of packaging

Overview	Regulatory Compliance
Requires harmonised labels on packaging to inform about material composition, reusability, compostability, and recycled content	-
Actor	Obligation
Manufacturers	-Ensure packaging is marked with the correct labels
The Commission	-Adopt implementing acts to establish harmonised labels and specifications -Establish methodology for digital identification of material composition/substances of concern

Table 12 - Summary Article 12

Starting from **12 August 2028** or 24 months after the adoption of the relevant implementing acts (whichever is later), all packaging must carry a harmonised label

that clearly communicates its material composition. This label must be based on pictograms, designed for universal comprehension including individuals with disabilities, to facilitate proper consumer sorting.

Packaging types

Packaging deemed compostable under Article 9, must additionally bear a label indicating that the material is compostable, not suitable for home composting, and must not be discarded in nature. Notably, this labelling obligation **excludes transport packaging and e-commerce packaging**, as well as packaging subject to a deposit and return systems, the latter shall be marked with a clear and unambiguous label. In addition to the national label, packaging used in **deposit and return systems** may be marked with a harmonised colour label.

Packaging that contains substances of concern, as defined in Article 5, must be marked using standardised, open, digital-marking technologies. Furthermore, economic operators may voluntarily affix a QR code or another digital data carrier to provide additional details about the sorting and destination of each packaging component.

From **12 February 2029**, **reusable packaging** must be labelled as reusable and shall include information, via a digital data carrier such as a QR code, on the existence of local, national, or Union-wide reuse systems and collection points. This digital tool should also facilitate the tracking of packaging rotations or provide an estimated average if exact tracking is not feasible. Reusable sales packaging must be clearly distinguishable from single-use alternatives at the point of sale.

However, packaging used in **open loop systems** that lack a system operator⁵ in accordance with Annex VI is exempt from the digital labelling and QR code requirement outlined above.

From **12 August 2028** (or 24 months after the implementing act is adopted), packaging to which Article 7 applies that includes a **label on recycled content or presence of biobased content** must do so according to the new specifications.

Practical requirements

Labels must be visible, legible, durable, and provided to consumers prior to purchase, including in the context of online sales. Where labelling directly on the item is not technically feasible due to the packaging's nature or size, the information may be affixed to grouped packaging, or, as a last resort, made available through a single electronically readable code. Additionally, this information must be accessible in one

⁵ Annex VI: 'system operator' means any natural or legal person who is a system participant and manages a re-use system

or more languages appropriate to the Member State market, and electronic labels must not be used for marketing purposes or collect unnecessary personal data, in line with Regulation (EU) 2016/679 (GDPR).

Commission obligations

The Commission is tasked with adopting, by **12 August 2026**, implementing acts to **establish harmonised labels, specifications and digital formats**. These must account for the complexity of composite packaging and respect the national variations for packaging subject to return systems under Article 50(2).

By the same 2026 deadline, the Commission will adopt a **methodology for identifying material composition** using digital-marking technologies. By **1 January 2030**, the Commission must also establish a system for **identifying substances of concern**, including their name and concentration, for each material in a packaging unit.

To prevent greenwashing or consumer deception, the **use of unofficial labels** or symbols that may mislead users regarding sustainability claims, recyclability, or other packaging characteristics are **prohibited**. The Commission may issue guidelines to clarify what constitutes misleading labelling

Special-type packaging and exemptions

Packaging covered by **extended producer responsibility (EPR) schemes** can be identified throughout the Member States using a QR code or similar digital symbol, indicating compliance without misleading consumers regarding recyclability or reusability.

Packaging under **national deposit and return systems**, other than those under Article 50(1), may, under national laws, be identified through a clear and unambiguous symbols that shall not mislead consumers or other end users about the packaging recyclability and reusability.

A three-year transitional period to remain on the market is given to **packaging manufactured or imported before** the entry into force of these requirements, even if it doesn't comply with the new labelling rules.

2.2.2 Article 13 – Labelling of waste receptacles for the collection of packaging waste

Overview	Regulatory Compliance
Mandates harmonised labels on receptacles for separate packaging waste collection facilitating proper sorting of different material fractions	-

Actor	Obligation
Member State	-Ensure all waste receptacles for packaging waste bear harmonised labels
Commission	-Adopt implementing acts defining harmonised labels and specifications for waste receptacle labelling

Table 13 - Summary Article 13

By **12 August 2028**, or 30 months after the adoption of the relevant implementing acts (whichever is later), Member States must ensure that receptacles used for the collection of packaging waste display visible, legible, and indelible labels. These labels must indicate the specific material fraction for which the receptacle is intended. Multiple labels may be affixed if a receptacle collects more than one type of packaging waste. However, this obligation does not apply to receptacles that are part of deposit and return systems.

the European Commission is required, by **12 August 2026**, to adopt implementing acts that establish harmonised label formats and specifications for these receptacles. When developing these acts, the Commission must consider both the collection systems in the Member States and the specificities of composite packaging. The labelling for waste receptacles must correspond to the harmonised labelling developed under Article 12(6) for packaging.

2.2.3 Article 14 – Environmental claims

Overview	Regulatory Compliance
Establishes strict criteria for making environmental claims about packaging properties. Claims must exceed legal minimum requirements and clearly specify their scope	-
Actor	Obligation
Economic Operators	-May make environmental claims only under specific circumstance -Demonstrate compliance via technical documentation

Table 14 - Summary Article 14

Environmental claims⁶, as defined in Article 2, point (o), of Directive 2005/29/EC, may only be made if they meet two cumulative conditions:

- The claims must refer to packaging properties that exceed the minimum legal requirements established in the Regulation.
- The claim must specify whether it applies to the entire packaging unit, a part of it, or all the packaging placed on the market by the economic operator.

Compliance must be demonstrated in the technical documentation required under Annex VII.

⁶ Article 2, point(o) Directive 2005/29/EC : “environmental claim” means any message or representation which is not mandatory under Union or national law, in any form, including text, pictorial, graphic or symbolic representation, such as labels, brand names, company names or product names, in the context of a commercial communication, and which states or implies that a product, product category, brand or trader has a positive or zero impact on the environment or is less damaging to the environment than other products, product categories, brands or traders, or has improved its impact over time.

3. Food Labelling

Food labelling represents a critical tool that allows consumers to make informed choices about their food purchases. Labelling serves multiple functions, including providing necessary information for safe and appropriate consumption, enhancing transparency, and facilitating consumer protection. The primary regulation governing food labelling in the EU is Regulation (EU) No 1169/2011, established on 25 October 2011, which outlines general principles, specific requirements, and responsibilities for food business operators. This regulation emphasizes a high level of consumer protection, ensuring food information is clear, accurate, and not misleading, assisting consumers in recognizing product composition, nutritional value, and potential allergens, as per figure 4. According to this legislation, labelling requirements cover essential aspects like the product name, ingredient list, net quantity, date of minimum durability, storage conditions, and usage instructions. [10]

energy	kJ/kcal
fat	g
of which	
— saturates,	g
— mono-unsaturates,	g
— polyunsaturates,	g
carbohydrate	g
of which	
— sugars,	g
— polyols,	g
— starch,	g
fibre	g
protein	g
salt	g
vitamins and minerals	the units specified in point 1 of Part A of Annex XIII

Figure 6 - Expression and presentation of nutrition declaration , Annex XV of Regulation 1169/2011

In addition to these fundamental components, the regulation addresses the necessity of including details about the origin or provenance of food products. This aspect of labelling has gained particular importance in recent years, reflecting increasing consumer interest in traceability and the ethical implications of food production, such as environmental sustainability, animal welfare, and support for local economies. [11]

Beyond mandatory regulatory requirements, labels often incorporate additional voluntary information aimed at distinguishing products in competitive markets. These **voluntary labels might include quality certifications, sustainability indicators, fair trade marks, organic production logos, and eco-friendly packaging indicators**. Furthermore, in response to growing environmental consciousness, labels increasingly include details regarding packaging materials and recyclability. Clearly marked recyclable packaging and the use of sustainable packaging materials not only respond to environmental concerns but also significantly influence consumer perceptions and enhance brand reputation. [12]

3.1 Sustainability labelling

Sustainability has become a central component of consumer decision-making, prompting significant shifts in food labelling practices within the European Union. Labels related to sustainability practices are increasingly prevalent, driven by consumer awareness and environmental concerns.

The International Organization for Standardization (ISO) recognizes three types of sustainable labels in the ISO 14020:

- **Type I:** Are voluntary, third-party certified ecolabels based on multiple environmental criteria that assess the overall environmental performance of a product within a specific category.
- **Type II:** Refer to self-declared environmental claims made by manufacturers or retailers without independent verification.
- **Type III:** involve detailed Environmental Product Declarations (EPDs) that provide quantified environmental data based on life cycle assessments (LCA), verified by a qualified third party.

Criterion	Type I	Type II	Type III
Primary target group	Consumers	Consumers	Economic stakeholders
Objective	Product assessment	Product assessment	Transparently provide information

External third-party administration	yes	no	yes
Independent verification	yes	no	yes
Content	Testing based on environmental or health-related criteria previously established by the communicator	Environmental or health-related properties that the provider wishes to emphasise	Quantified environmental information

Table 15 - Ecolabels summary [13]

3.1.1 Type I labels – Ecolabels and sustainability certificates

Ecolabels and sustainability certificates are formal mechanisms developed to identify and communicate the environmental performance of products, services, or organizations. An ecolabel is a voluntary label given to products that meet specific environmental criteria verified through third-party certification.

Unlike general marketing claims, these labels rely on defined standards and assessment processes to validate sustainability attributes such as energy efficiency, recyclability, or low environmental impact over a product's life cycle, 95% of ecolabels require certification before granting the label, and many include mandatory corrective action reports to ensure compliance with evolving standards [14]

Ecolabels are widely applied across food sector, and they are used by businesses to demonstrate environmental responsibility, enhance brand credibility, and meet consumer demand for sustainable goods. The presence of an ecolabel can also influence procurement decisions, especially among institutional buyers, who use them to reduce risk and promote sustainable supply chains [14]

Overall, ecolabels serve as crucial tools in sustainability communication, aiming to enhance transparency, encourage continuous improvement in environmental performance, and empower consumers to make informed choices aligned with sustainable development goals. Some examples of ecolabels are reported below:

Forest Stewardship Council

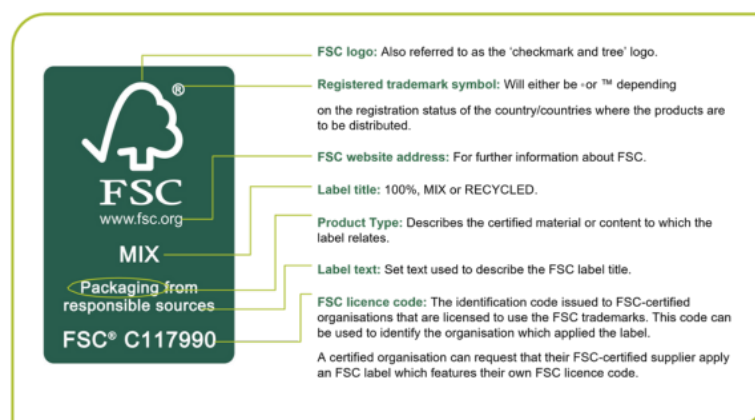


Figure 7 - How FSC label work [15]

The FSC (Forest Stewardship Council) label is a globally recognized certification mark that ensures that wood, paper, and other forest-based materials are sourced from responsibly managed forests or recycled sources, contributing to environmental preservation, social equity, and economic viability. FSC certification is governed by rigorous standards that promote sustainable forestry practices, protect biodiversity and ensure legal and traceable sourcing.

There are three main types of FSC labels, each conveying different sourcing information:

- **FSC 100%:** This label signifies that the product is made entirely from virgin material sourced from FSC-certified forests. This label is typically used on primary wood products, where full traceability and responsible forest management are crucial.
- **FSC Recycled:** This label indicates that the product is made exclusively from post-consumer and/or pre-consumer recycled materials
- **FSC Mix:** This label applies to products containing a combination of FSC-certified material, recycled content, and/or controlled wood (from sources that are not FSC-certified but meet minimum standards).

The FSC certification process is based on a rigorous and transparent system of third-party verification to ensure the credibility and integrity of the FSC label. This system is known as **Chain of Custody (CoC) certification**, and it traces the path of FSC-certified materials through every stage of the supply chain, from forest to finished product, ensuring that certified content is identifiable and kept separate from non-certified materials. [16]

Compostability Mark



Figure 8 - Home compostable mark (on the left) . Industrially compostable mark (on the right)

The compostability label is a certification mark that indicates a packaging product's ability to biologically decompose under controlled composting conditions, leaving no toxic residue and contributing to the production of quality compost. This label, widely recognized in Europe, assures that the material complies with established industrial compostability standards such as the European standard EN 13432 for packaging and EN 14995 for plastic products. To obtain the compostability label, the product must undergo rigorous testing to verify its chemical composition, biodegradation, disintegration during composting, and the quality of the resulting compost. The certification process is carried out by accredited independent bodies: TÜV Austria and DIN CERTCO. [15]

3.1.2 Type II labels – Recyclability labels

Recyclability labels are explicitly designed to guide consumers in appropriately handling the packaging after consumption. They primarily inform users about the materials used in packaging, providing clear instructions on disposal, recycling methods, or other necessary consumer actions aimed at reducing waste. To achieve this, various symbols are utilized to convey different information to the consumer:

- **Producer Symbols**

Mobius Loop 	The material can be recycled
Mobius Loop with percentage 	Indicate the percentages of recycled materials in the packaging
Tidyman	It encourages consumers to dispose of packaging properly to prevent littering.

	
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Table 16 - Generic Recycling Symbols in EU

- **Material specific**

Established in the Commission decision 97/1297EC, 28 January 1997. These symbols help recycling centers properly identify and sort different types of plastics, ensuring materials are recycled efficiently.

	Polyethylene Terephthalate	Plastic
	High-density polyethylene	
	Polyvinyl chloride	
	Low Density Polyethylene	
	Polypropylene	
	Polystyrene	
	Other kinds of plastic not defined by the previous groups	
	Corrugated fibreboard	Paper / Cardboard
	Non-corrugated fibreboard	
	Paper	

	Steel	Metal
	Aluminium	
	Wood	Wood
	Cork	
	Colourless glass	Glass
	Green glass	
	Brown glass	

Table 17 - EU material's composition codes

3.1.3 Type III labels – Environmental Declaration

Type III eco-labels represent environmental declarations based on quantitative data from life cycle assessments (LCAs), which determine the ecological footprint of a product throughout its entire lifecycle. LCAs systematically evaluate various environmental impacts such as energy consumption, greenhouse gas emissions, and resource depletion, presented clearly in tabular form alongside relevant explanatory details. Additionally, Type III eco-labels may include supplementary information, including specific ingredients or components, emissions during product use, or details regarding the product's end-of-life phase.

Carbon trust



Figure 9 - Carbon emissions reductions label from Carbon trust [15]

The Carbon Reduction Label signifies that a product has undergone a comprehensive life cycle assessment to quantify its carbon footprint. This footprint encompasses all life cycle stages, including production, use, and end-of-life disposal. Beyond simply disclosing the environmental impact, the label represents a formal commitment by the product owner to actively reduce this footprint within a two-year period, reinforcing accountability and continuous improvement in climate impact mitigation.

Per il clima



Figure 10 - Per il clima label

The Per il Clima label is a voluntary carbon footprint certification developed to inform consumers about the greenhouse gas emissions associated with a product or service throughout its life cycle or specific phases of it. The CO₂ equivalent value displayed on the label can be determined through two distinct approaches: either via a technical audit and data analysis conducted by trusted research institutes or by leveraging existing company data gathered for regulatory compliance purposes. In both cases, the declared emissions reflect either the full life cycle or defined stages, based on the specified spatial and temporal boundaries.

3.1.4 Recycling labels – State Specific

The use of recycling symbols is not optional in all countries. In some nations, companies are legally required to include specific labelling when placing packaging on the market.

- **Italy**

Since January 2023 through Decree No. 116, all packaging in Italy is required to carry mandatory environmental labelling. This regulation applies to both Business to Business (B2B) and Business to Client (B2C) packaging. Labels must clearly indicate the material composition and proper disposal method; an example of the label structure is reported in Figure 5.

For household packaging intended for end consumers, detailed disposal instructions are also mandatory. Moreover, all separable packaging components must be individually labelled to support effective recycling.



Figure 11 - Recycling Labelling in Italy [16]

- **Spain**

Royal Decree 1055/2022 mandates that all packaging must be clearly and legibly marked with a pictogram, as per figure 6, indicating the correct disposal container of the package.



Figure 12 - Spain Recycling pictograms [17]

- **France**

CITEO, the French member of Packaging Recovery Organisation (PRO) Europe, has introduced a standardized set of Sorting labels, called Info-tri in France, to encourage better packaging waste sorting by consumers. These labels are mandatory for household packaging and include the following four design elements:

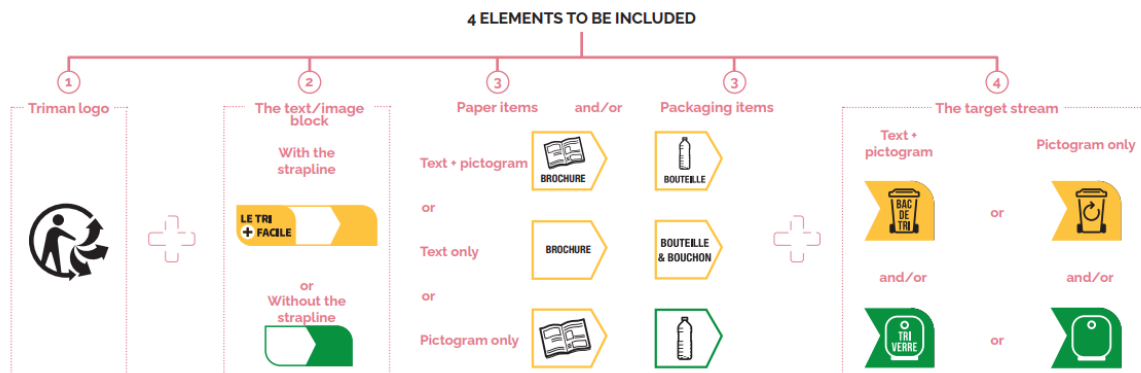


Figure 13 - France info-tri label [18]

4. Discussion

The introduction of Regulation (EU) 2025/40 (PPWR) represents a crucial step towards packaging sustainability within the European Union, presenting notable opportunities but also substantial challenges. The following discussion addresses two central aspects: the challenges associated with manufacturing compliant packaging according to Chapter II's sustainability requirements and the complexities in designing and implementing a harmonized labelling system under Chapter III.

4.1 Challenges in manufacturing under the new PPWR Regulations

The PPWR introduces rigorous sustainability standards with significant implications for packaging manufacturers. Foremost among these is the recyclability grading system, classifying packaging into grades A, B, and C. Achieving higher recyclability grades will require extensive redesign of packaging products, imposing substantial demands on manufacturers. This redesign not only involves the selection of recyclable materials but also reconsideration of secondary components such as labels, adhesives, and inks defined in Annex II, some improved design for these components are reported in Table 8.

These measures necessitate substantial technological innovation, supply-chain adjustments, and potentially increased costs due to higher-quality materials and advanced processing technologies.

Component	Original Design	Improved Design
Adhesive	solvent based/ pressure-sensitive/melt adhesive	washable adhesive self-adhesive non-glue structure
Label	PVC shrink label paper label multi-layer label	PET shrink label wood-based PE Peelable label No label label reduction Laser printing and embossing Electronic tag

Colour	green/blue white/black opaque	transparent unpigmented
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Table 18 - Application cases of design for extra-components in plastic packaging [19]

The recyclability of plastics, particularly plastic films and multilayer materials used in the food industry, presents additional complexities. Food packaging often requires specific barrier properties against gases, moisture, and contaminants, achieved by combining multiple polymers like polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET) and ethylene vinyl alcohol (EVOH), as well as barrier coatings such as aluminium oxide (AlOx) and silicon oxide (SiOx). [20]

Mechanical Stability	Oxygen Barrier	Moisture Barrier	Light Barrier	Tie Layer	Sealant
PO	EVOH	PO	Aluminium	PU	PO
PET	PVDC	EVA	Paper	PO	EVA
PS	PA	PVDC			PA
Paper	PET	Aluminium			PET
	SiOx				
	AlOx				
	PVOH				
	Aluminium				

Table 19 - Properties and materials in multilayer flexible food packaging. Abbreviations: PO (polyolefins: polyethylene, polypropylene), PET (polyethylene terephthalate), PS (polystyrene), EVOH (ethylene vinyl alcohol), PVDC (polyvinylidene dichloride), PA (polyamide), SiOx (silicon oxide), AlOx (aluminium oxide), PVOH (poly vinyl alcohol), EVA (ethylene vinyl acetate), PU (polyurethane). [20]

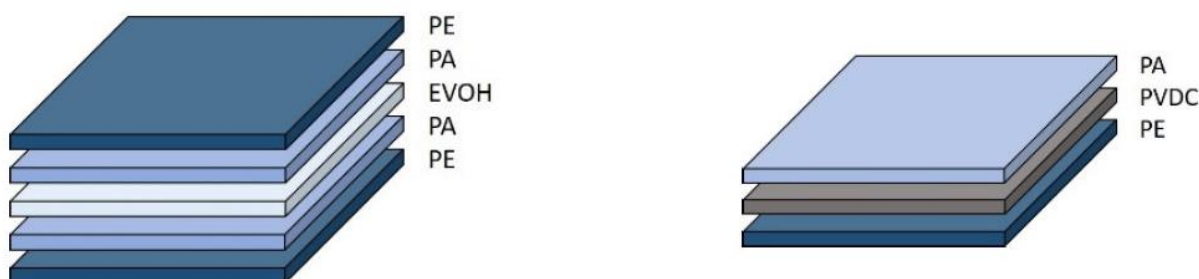


Figure 14 - Examples of multilayer solutions

These materials significantly enhance packaging performance but complicate recycling efforts due to polymer incompatibility, different melting points, and thermal stabilities. Consequently, traditional mechanical recycling technologies struggle with

multilayer films and heavily contaminated streams, often leading to decreased recyclability and lower quality recycled materials. Current recycling systems achieve varying recovery rates, 52% for hard plastics, 59% for plastic films, and up to 79% for rigid PVC, but these results highly depend on the purity and sorting efficiency of the collected materials. [21]

Polymer	Sorting potential	Reprocessing potential	Recycling potential
Hard plastic waste			
PP	86%	79%	68%
HDPE	84%	73%	61%
PVC	94%	56%	53%
PS	72%	79%	57%
PET	50%	80%	40%
High quality	83%	93%	77%
Medium quality	82%	76%	63%
Low quality	72%	70%	50%
Overall	69%	75%	52%
Plastic film waste			
Polyolefins	87%	71%	63%
High quality	87%	77%	66%
Medium quality	–	–	–
Low quality	86%	72%	62%
Overall	83%	71%	59%
PVC-container waste			
PVC	99%	96%	95%
High quality	–	–	–
Medium quality	–	–	–
Low quality	99%	96%	95%
Overall	82%	96%	79%

Figure 15 - Sorting, reprocessing and recycling potentials for individual polymers

To address these challenges, industry standards increasingly advocate for mono-material designs, minimizing the diversity of polymers and strictly controlling

impurities. Polyolefins (PE and PP) are favoured due to their higher compatibility with existing recycling infrastructures, especially when paired cautiously with minimal amounts of barrier layers like EVOH or oxide coatings. Advanced sorting technologies, such as near-infrared (NIR) spectroscopy, are also being optimized to improve material separation, thereby reducing contamination and enhancing overall recycling yields.

Additionally, the requirement for minimum recycled content in plastic packaging represents another critical challenge. Meeting prescribed thresholds will require significant advancements in recycling technologies and robust verification systems to ensure compliance. Securing adequate supplies of suitable recycled materials, maintaining their quality standards, and ensuring compliance documentation will impose notable logistical and administrative burdens on producers.

Stringent controls on substances of concern, including heavy metals and per- and polyfluoroalkyl substances (PFAS), introduce additional complexities in manufacturing processes. Manufacturers must rigorously audit and modify their supply chains, verifying compliance through sophisticated testing regimes, thus potentially increasing production complexity and costs. Strict limitations on substances like PFAS necessitate intensified material testing and potential investment in alternative materials.

The detection of PFAS, primarily employs liquid chromatography coupled with mass spectrometry (LC-MS). This method offers high sensitivity and specificity, suitable for trace-level detection in diverse matrices such as water, food packaging materials, and biological samples. Recent advancements in analytical technologies include nanoparticle-based sensors, which provide rapid, on-site detection capabilities. For instance, quantum dot nanoparticle-based biosensors have demonstrated potential for detecting trace levels of PFAS with high sensitivity and accuracy. [22]

Given environmental and health concerns surrounding PFAS, significant research and development efforts are being directed toward sustainable and bio-based alternatives. Promising advancements include materials derived from plant polysaccharides, proteins, waxes, and recycled or upcycled waste streams. For instance, cellulose nanofibers extracted from agricultural residues have demonstrated potential as effective, biodegradable alternatives offering robust barrier properties and mechanical strength. [23]

Lastly, the PPWR's emphasis on packaging minimisation and reusable packaging criteria requires profound shifts in product design and logistics. Meeting the demands of reusability mandates the creation of highly durable, easily cleanable, and refillable packaging systems, which implies substantial investments in product development, infrastructure, and consumer education.

Compliance sheet

Compliance aspect	Required Actions	Technical Documentation (Following Annex VII)
Recycled Content	Meet defined recycled content targets (see Table 3)	Specific recycled content calculations
Recyclability	Ensure packaging grade A, B or C (see Figure 3)	Recyclability assessments, conformity declarations
PFAS	≤25 ppb individual, ≤250 ppb total, ≤50 ppm polymeric	Risk analysis documentation, PFAS content test results
Compostability	Comply with compostability national standards if collected with bio-waste	Compostability proof, detailed packaging descriptions
Reusable Packaging	Design packaging explicitly for multiple rotations, ensuring durability, hygiene, and recyclability compliance.	Durability and hygiene assessments, recyclability assessment
Packaging Minimisation	Limit packaging materials to the strictly necessary	Technical specifications justifying compliance

Table 20 - Compliance sheet

In addition to the items listed in the technical documentation table, it is also mandatory to include a Declaration of Conformity, which must be retained for a period of between 5 to 10 years, along with a general description of the packaging and its intended use.

4.2 Challenges in designing a harmonized labelling system

The harmonized labelling requirements under the PPWR represent another complex facet, involving the reconciliation of EU-wide standardization with existing national frameworks. Countries such as Italy, Spain, and France already have detailed, mandatory labelling systems enforced by national law. Integrating these existing frameworks with a newly harmonized EU standard requires careful transitional arrangements to avoid market confusion and maintain compliance.

The creation and implementation of new universal pictograms pose significant challenges. Although the PPWR mandates clear and universally accessible pictograms to communicate packaging material composition, it remains unclear whether these symbols will follow or diverge from the established standards outlined in Commission Decision 97/129/EC. Regardless, new pictograms must carefully consider existing material identification symbols, such as those for plastics, paper, metals, and glass, which are already broadly recognized by European consumers. Retaining consistency with these established symbols can significantly reduce confusion and support quicker adoption among consumers.

The recent EU Interim Report on the development of harmonised waste sorting labels provides relevant insights into designing effective labelling solutions. This comprehensive study evaluated existing national schemes to propose an EU-wide label design. Findings emphasize that visual clarity, intuitive icons, and consistent use of colour are critical for effective consumer understanding. Particularly, textual information emerged as the most effective design element for improving sorting accuracy, especially when coupled with clear material identifiers and sorting instructions. These insights, reported in Figure 8, provide a robust foundation for further prototype refinement, emphasizing the importance of balancing visual appeal with informational clarity. [24]

Table 16 Synthesis of insights for the labelling system

Consistency	User-friendliness	Information	Choice and motivation	Integration with packaging
Unified Design: Consistent and minimalist design enhances clarity and familiarity Standardised Colours: Distinct, logical, and universally understood colours (e.g., yellow for plastic, green for organic) ensures immediate recognition; care to avoid overlaps (e.g., green for glass and organic, grey shades for metal and residual) Harmonisation Across Systems: Best possible alignment with existing practices towards standardisation	Simplicity is Key: Not too many labels or categories together, labels should focus on essential categories and avoid unnecessary granularity Clear Differentiation: Icons and colours must distinctly separate waste types to reduce confusion (e.g., organic vs. glass, soft vs. hard plastics). Adaptability for Different Contexts: Consideration of the diverse settings like household space, public waste collection ensuring practicality in diverse settings Complexity: Subcategories make the system harder to understand and use	Icon and Text Combination: Both icon and text should be universally understandable even across language barriers Guidance on Preparation: Labels should provide clear instructions on waste preparation (e.g., rinse cans, remove labels), either directly or via additional information (e.g., QR codes). Visibility: Large text and icons with high contrast for readability, for visually impaired users or low-light conditions Ambiguity in Icons: Some icons not immediately recognizable or intuitive, such	Educational Potential: Clear, engaging labels encourage and foster a habit of waste separation. Motivational Design: Appealing graphics and colours that align with eco-friendly themes Avoiding Overcomplication: A system that feels overly burdensome risks reducing user participation. Keeping it simple and intuitive is crucial to maintaining motivation. Unclear Benefits: Without understanding the environmental impact of proper sorting, users might not	Label Placement: Prominent placement on product packaging to ensure visibility and avoid confusion. Clear Alignment with Waste Bins: Packaging labels matching the corresponding bin in colour, iconography, and text Consideration for Complex Packaging: For multi-material packaging, labels should clearly indicate how to separate components or guide users toward specific bins (e.g., "dispose of cap separately") Insufficient Placement and Visibility: Labels on packaging are often too small, poorly placed, or hard to find.

Figure 16 - Synthesis of insights from the JRC141556 [24]

Regarding recyclability and recycled content, while the PPWR does not mandate recyclability grades or recycled content information unless voluntarily declared by the manufacturer, any such claims must adhere strictly to regulatory standards. Organizations like RecyClass are proactively developing third-party certified recyclability labels (Type III eco-labels) [25].



Figure 17 - Recyclability Marks by RecyClass

However, integrating voluntary labels and well-established ecolabels with the mandatory EU framework could create additional complexity. The use of excessive labels was found to distract users from core sorting messages [24], careful consideration in label design, placement, and consumer education will be necessary to preserve the clarity and effectiveness of all labelling information presented to consumers.

Moreover, implementing a harmonized colour label for deposit-return systems may face resistance and practical difficulties. Harmonizing colours across diverse national deposit systems must account for existing consumer habits and brand associations, risking temporary consumer confusion or misinterpretation.

Table 29. Colour associations with colour-coded material categories

Material Category	Associated Colours
Plastics	Yellow
Glass	Green
Compostable Materials	Brown, Dark Green
Paper	Dark Blue, Beige
Metals	Black, Grey
Residual Waste	Black, Grey
Textiles	No consistent association
Steel	No consistent association

Figure 18 - Example of colour association in EU [24]

Compliance sheet

Information	Compliance Requirements	Optional
Composition	all packaging must carry a harmonised label that clearly communicates its material composition	-
Compostability	Must bear a label for compostability	-
Deposit and return system	National label + Harmonised colour label	-
Substance of concern	Marked using standardise, open, digital-marking technologies	QR code or other digital data carrier
Reusability	Must be labelled as reusable + Information about collection point and reuse-system via a digital carrier	-
Open loop system without system operator	Must be labelled as reusable	-
Recycled content	-	✓
Biobased content	-	✓
EPR schemes	-	National digital data carrier
National Deposit and return system	-	National symbols

Table 21 - Compliance sheet for labelling

5. Conclusion

The challenges posed by the PPWR's sustainability and labelling requirements reflect a robust and ambitious policy aimed explicitly at accelerating the transition toward a circular economy and broader environmental stability. While significant in their complexity and impact, these regulations articulate a clear commitment to resource efficiency, reduced environmental impact, and improved recycling and recovery outcomes. Achieving these ambitious goals necessitates proactive cooperation among manufacturers, regulatory bodies, and consumers, supported by continued innovation, comprehensive education initiatives, and strategic investments in sustainable technologies.

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