GS1 in Europe

Packaging and Packaging Waste Regulation (PPWR) and GS1 Standards

White paper on how to use GS1 standards
to support recycling use cases

Disclaimer

This document was created by the group of GS1 experts under the GS1 in Europe Packaging Activity – Workstream 1 Identification and Data Model. Discussions and findings for topics regarding identification and data model for packaging are based on the prevailing circumstances until the publication date of this document.
It is important to note that delegated acts setting a common standard for the Packaging and Packaging Waste Regulation are still currently under development, and the position outlined herein reflect the current state of affairs, which are subject to change in the future. Therefore, stakeholders should exercise caution and stay updated with evolving regulations and practices related to the requirements mandated by the Packaging and Packaging Waste Regulation in their respective jurisdictions.

For up-to-date information or specific inquiries, individuals are encouraged to check for updates with local experts in the field of packaging or relevant local regulatory authorities.

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Document Summary

Document Item	Current Value
Document Name	Packaging and Packaging Waste Regulation (PPWR) and GS1 Standards - White paper on how to use GS1 standards to support recycling use cases
Document Date	June 2025
Document Version	1.0

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1. Management summary

The European Union's Packaging and Packaging Waste Regulation (PPWR), which came into force in February 2025, marks a significant shift towards a circular economy by setting ambitious targets for packaging reduction, recyclability, and transparency. To support industry stakeholders in navigating these complex requirements, GS1 in Europe focused on leveraging GS1 standards to facilitate compliance.

Who should read this document?

This document is intended for all stakeholders across the packaging value chain who are navigating current and upcoming regulatory requirements. Whether you are a packaging manufacturer, brand owner, retailer, logistics provider, or involved in waste management and recycling, this document offers insights into how standardisation can support compliance, improve data transparency, and drive circularity. It is also useful for sustainability experts and standards organisations involved in building a more consistent and sustainable approach to packaging.

Why do you need to be prepared?

The European Union's Packaging and Packaging Waste Regulation (PPWR), which came into force in February 2025, marks a significant shift toward a circular economy by setting ambitious targets for packaging reduction, recyclability, and transparency. By setting ambitious targets for transparency reducing packaging waste, enhancing recyclability, and improving data transparency, the PPWR is fundamentally reshaping how businesses across Europe are approaching packaging.

To support industry stakeholders in navigating these complex requirements, GS1 in Europe focused on a holistic approach that connects these three complex worlds - packaging, data, and sustainability. GS1 standards provide the foundation to facilitate compliance and help companies meet the requirements of the PPWR.

How can GS1 help you?

GS1 standards, as open and globally accepted standards, enable industry stakeholders to share transparent, reliable product and packaging data across the entire value chain. By using standardised identifiers, data carriers, and business processes, companies can ensure consistency, traceability, and interoperability—key requirements for regulatory compliance. This trusted data foundation helps businesses meet evolving legal obligations more efficiently while supporting circularity, safety, and sustainability goals.

This white paper explains how GS1 standards can already be used today for circular packaging. In addition, an overview of technology-agnostic data attributes and code lists is included to support companies on their way to compliance and efficiency according to the PPWR.

This current version of the white paper focuses exclusively on recycling-related use cases and reflects the known regulatory requirements as of the date of the publication (June 2025). Topics such as packaging reduction and reuse, while equally relevant under the PPWR, will not be addressed. The white paper will be iteratively updated to reflect evolving regulatory requirements e.g. adoption of delegated acts and stakeholder feedback.

2. Sustainability regulations in the European Union

Accelerating the transformation to a circular economy is one of the key priorities in the European Union (EU). The European Commission summarised this ambitious roadmap in 2019 within the framework of the European Green Deal (EGD). In line with this ambition, the Circular Economy Action Plan (CEAP) was published in March 2020. This action plan structures the measures and paves the way towards a transition from a linear to a circular economy. It includes actions to create a well-functioning market for secondary raw materials, for example develop further EU-wide end-of-waste criteria for certain waste streams and enhance the role of standardization.

In line with the EGD, the CEAP and the EU Plastics Strategy, in November 2022 the European Commission published a Packaging and Packaging Waste Regulation (PPWR) proposal. It addresses the entire life cycle of packaging materials. The PPWR aims to reduce pollution from packaging materials and promote a sustainable circular economy for packaging. Moreover, it will be binding for all EU countries without any further options for shaping it.

When it comes to plastic packaging, the Extended Producer Responsibility (EPR) principle is another important building block in the handling of packaging volume. The EPR is an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. EPR is typically understood to involve a shift in responsibility from governments or municipalities to producers as well as encouragement for producers to take environmental considerations into account during the design phases of product development. EPR schemes for packaging rely on a system of fees that are assigned to packaging based on material type (e.g., plastic, paper, metal) and weight. In this way, EPR enables the funding of the collection for recycling of packaging materials.

The Ecodesign for Sustainable Products Regulation (ESPR) is another key instrument to provide transparency along the whole life cycle of products. It sets requirements for product design to enhance durability, reusability, upgradability, and recyclability. It also aims to enable the objectives of EU industrial policy such as boosting the demand for sustainable goods and supporting sustainable production.
As an important instrument to achieve these ambitions, the regulation includes the concept of a Digital Product Passport (DPP). The DPP is a mandatory data structure that will simplify digital access to product-specific information related to sustainability and circularity, enabling B2B, B2C and B2G data exchange.

Although packaging is not a focus sector for ESPR, products that include packaging, such as detergents, fall within its scope. Moreover, both ESPR and PPWR request a unique identifier that can be unambiguously used in a cross-sectoral way among the multiple stakeholders. Product data needs to be shared in a standardized language. Transparency provides the possibility to increase the sustainability performance of products and packaging and to empower consumers in their purchasing decisions. To be more precise, according to the PPWR, a QR code or another type of standardised, open, digital data carrier must be placed on the packaging that contains various information, e.g. on its material composition, the destination of each separate component of the packaging in order to facilitate consumer sorting, on reusability, including the availability of a local, national or Union-wide reuse system and information on collection points, and on the share of recycled content.

Effective data exchange across company boundaries is essential for meeting PPWR requirements. GS1 standards offer a common language and framework for accurate and efficient data exchange along the supply chain. A key requirement is developing a shared understanding of methodology and communication to ensure data exchange is as efficient and accurate as possible. By adopting these standards, companies can enhance data accuracy, strengthen collaboration with partners, and meet the requirements of the PPWR.

This approach aligns with the vision and mission of GS1. GS1 believes in the transformative power of standards to change the way people work and live. The mission is to support the transition towards a legally compliant and resource-efficient packaging economy, with and for GS1 members. To achieve this, GS1 will provide a common language based on GS1 Standards for circular packaging.

To tackle upcoming challenges related to the PPWR, GS1 launched a European-level Packaging Activity. It began with defining business needs and identification, followed by the development of a data model. GS1 Member Organizations from Germany, France, Denmark, Sweden, the Netherlands, Austria, and BelgiLux collaborated as a core group in the workstream, focusing on packaging recycling. This position paper provides an overview of the activity and the outcomes of this collaborative effort.

3. Packaging and Packaging Waste Regulation (PPWR)

3.1 Overview

The current EU Packaging and Packaging Waste Directive was first adopted in 1994 and has been amended several times. In November 2022, the EU Commission published the PPWR proposal, aiming to replace the existing directive and update the current framework for packaging and packaging waste across the entire life cycle, towards a circular economy and a climate-neutral Europe. On 24 April 2024, the EU Parliament approved the PPWR proposal, and on 26 November, the final version of the PPWR was formally approved by the new EU Parliament. As the final step in the ordinary legislative procedure, the EU Council approved the regulation on 16 December 2024. On 22 January 2025, the PPWR was published in the Official Journal of the EU, and it officially came into force on 11 February 2025.

Although recycling rates are increasing in the EU, the amount of packaging waste remains high. In 2022, the EU generated 83.4 million tonnes of packaging waste. Additionally, each person in the EU produced nearly 186.5 kilograms of packaging waste, with plastic accounting for 19.4% of the total. To address this issue, the PPWR sets requirements for packaging, such as making all packaging reusable or recyclable by 2030. Furthermore, the PPWR states that each EU Member State must reduce packaging waste per person by 5% by 2030, by 10% by 2035, and by 15% by 2040 compared to packaging waste in 2018.

Still, creating transparency in the plastic packaging value network alone is not enough to tackle the multiple challenges of plastic pollution or climate change. It is crucial to consider the waste hierarchy (Reduce, Reuse, Recycling). Thus, the foundation is minimising the amount of packaging, starting with the reduction of packaging material and introducing reusable packaging wherever possible. For packaging that cannot be avoided, recycling at end-of-life is a critical solution to enable circular value networks. Therefore, the design for recycling of plastic packaging is a prerequisite for all subsequent steps in the value networks and should be treated with the highest priority by all stakeholders involved. In addition, the performance of recycling systems — from collection and sorting to the sale of recycled materials — needs to improve globally. It is important to unlock potential for more efficient recycling in order to boost quantities of recyclate of suitable quality.

3.2 Requirements

In general, the PPWR defines goals and requirements covering the entire lifecycle of packaging with the focus on reducing packaging waste and promoting a sustainable circular economy for packaging. Below are the main articles of the PPWR that were the focus of the GS1 Packaging activity.

Article 5: Requirements for substances in packaging

Packaging introduced to the market must be designed to contain no or only minimal amounts of harmful substances. This applies to both the packaging material itself and its components, including waste management processes such as secondary raw materials, ashes, or other waste products. To minimize the environmental impact of these harmful substances, specific requirements are set (18 months from the date of entry into force of the regulation). For example:

- The sum of concentration levels of lead, cadmium, mercury and hexavalent chromium resulting from substances present in packaging or packaging components shall not exceed 100 mg/kg
- From 12 August 2026, food-contact packaging shall not be placed on the market if it contains per- and polyfluorinated alkyl substances (PFAS) in a concentration equal to or above:

  . 25 ppb for any PFAS as measured with targeted PFAS analysis (polymeric PFAS excluded from quantification)

  . 250 ppb for the sum of PFAS measured as the sum of targeted PFAS analysis, where applicable with prior degradation of precursors (polymeric PFAS excluded from quantification)

  . 50 ppm for PFASs (including polymeric PFAS)

Article 6: Recyclable packaging

All packaging introduced to the market must be recyclable. The specific definitions of recyclability are still being clarified and will be detailed in the coming years. Generally, packaging is deemed recyclable if it fulfils two criteria. Firstly, it must be designed for material recycling, ensuring that the resulting secondary raw materials are of high enough quality to replace primary raw materials (apply from 1 January 2030 or 24 months from the date of entry into force of the delegated acts). Secondly, it should be capable of being collected separately and sorted into specific waste streams without affecting other streams (apply from 1 January 2035 or as regards the recycled-at-scale requirement, from 1 January 2035 or five years from the date of entry into force of the implementing acts).

Manufacturers must assess packaging recyclability, which will be expressed in recyclability performance grades A, B, or C as described in Table 1: Recyclability performance grades. By 1 January 2030, or 24 months after the date of entry into force of the delegated acts (whichever is the latest), packaging must achieve at least a grade C to be placed on the market. From 1 January 2038, packaging must meet the recyclability standards of grades A or B, as specified in Table 1: Recyclability performance grades, to be placed on the market.

2030		**2035**			**2038**		
Recyclability performance grade	Design for recycling (DIR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance grade (for DIR)	Design for recycling (DIR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance grade (for recycled-at-scale asscssucat)	Recyclability performance grade	Design for recycling (DIR) Assessment of recyclability per unit, in terms of weighting	Recyclability performance recycled-at-scale assessmicut)
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 C to 70 %	Grade C	higher or equal to 70%	Grade C Ras	Grade C CANNOT BE PLACED ON THE MARKET	higher or cqual to 70 %	Grade C Ras
TECHNICALLY NON-RECYCLABLE	lower than 70 %	TECHNICALLY NON-RECYCLABLE	lower than 70%	NOT RECYCLED AT SCALE (below thresh-olds of Article 3(1). point (39).	TECHNICALLY NON-RECYCLABLE	lower than 70 %	NOT RECYCLED AT SCALE (below thresholds of Article 3(1), point (39).

Table 1: Recyclability performance grades

Article 7:
Minimum recycled content in plastic packaging

Any plastic part of packaging introduced to the market must contain a minimum percentage of recycled content sourced from post-consumer plastic waste. This percentage is calculated as an average per manufacturing plant and year. The following minimum percentages of recycled content are required:

By 1 January 2030, or three years after the date of entry into force, whichever is the latest:

- (a) 30 % for contact sensitive packaging, except single use beverage bottles, made from polyethylene terephthalate (PET) as the major component
- (b) 10 % for contact sensitive packaging made from plastic materials other than PET, except single use plastic beverage bottles
- (c) 30 % for single use plastic beverage bottles
- (d) 35 % for plastic packaging other than those referred to in points (a), (b) and (c)

By 1 January 2040:

- (a) 50 % for contact sensitive packaging, except single use beverage bottles, made from polyethylene terephthalate (PET) as the major component
- (b) 25% for contact sensitive packaging made from plastic materials other than PET
- (c) 65 % for single use plastic beverage bottles
- (d) 65 % for plastic packaging other than those referred to in points (a), (b) and (c)

Article 9:
Compostable packaging

By 12 February 2028, the following packaging must comply with the standards for composting in industrially controlled conditions in bio-waste treatment facilities and when required by Member States, it must also meet home composting standards:

- A 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
- Sticky labels attached to fruit and vegetables

By 12 February 2028, all other packaging, including packaging made of biodegradable plastic polymers and other biodegradable materials, must be designed for recycling, without impacting the recyclability of other waste streams.

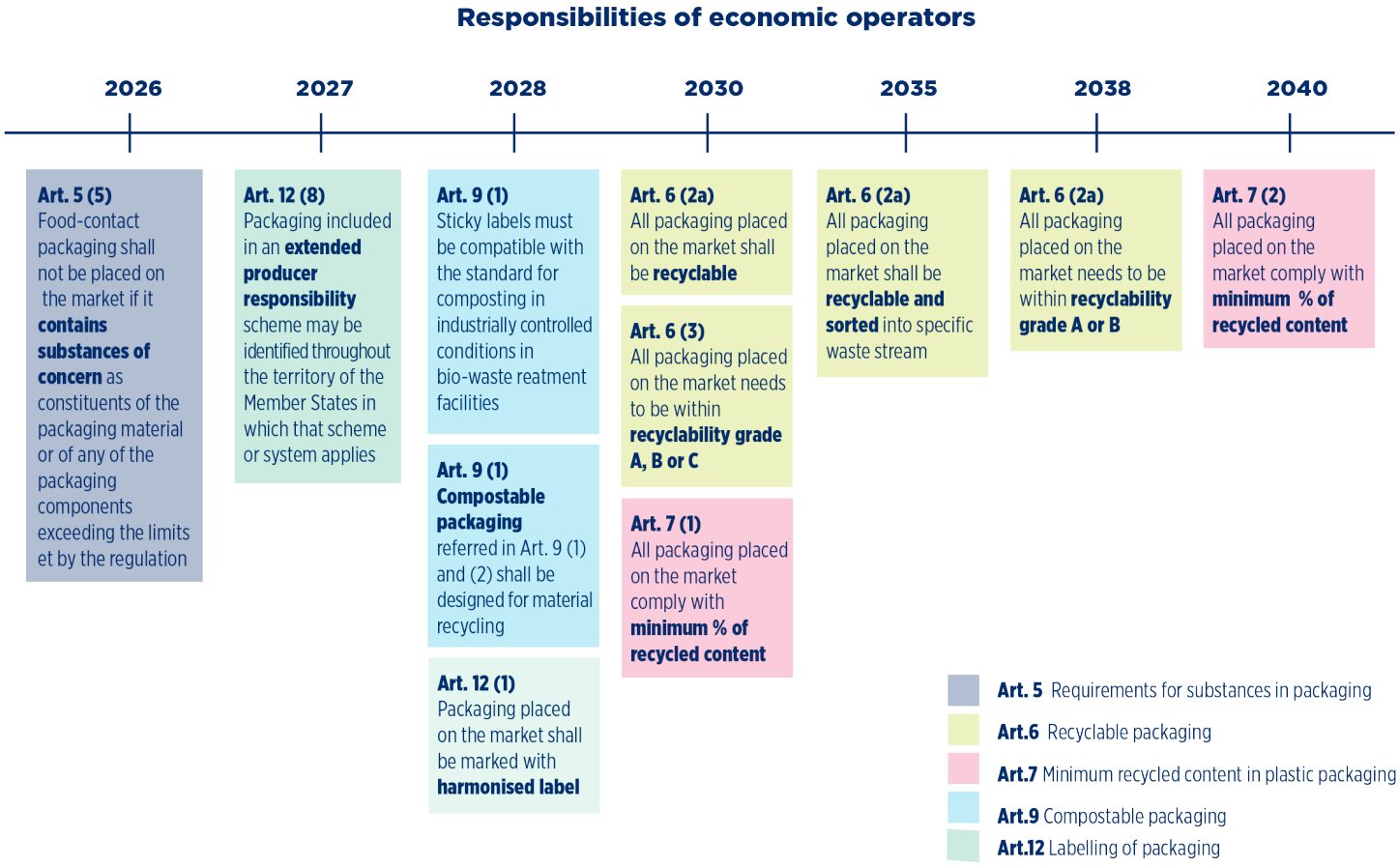
Article 12: Labelling of packaging

From 12 August 2028, or 24 months after the date of entry into force of the delegated acts (whichever is the latest), packaging placed on the market shall be marked with a harmonised label containing information on its material composition to facilitate consumer sorting. The label shall be based on pictograms and be easily understandable, including for persons with disabilities. In addition to the harmonised label referred to in this paragraph, economic operators may place a QR code or another type of standardised, open, digital data carrier on the packaging that contains information on the destination of each separate component of the packaging to facilitate consumer sorting.

Furthermore, it shall be affixed, printed, or engraved visibly, legibly, and firmly on the packaging, so that it cannot be easily erased. The information contained therein shall also be available to end users before the purchase of the product through online sales. Moreover, a single data carrier shall be used for providing the information required for the packaged product and the packaging, and both shall be easily distinguishable.

Labelling requirements are specified for the following packaging information (each with its own timeline): compostable packaging, packaging that is subject to deposit and return systems, reusable packaging, and packaging information on the share of recycled content and substances of concern.

The PPWR enters into force on 11 February 2025 and its general date of application is 18 months after that (12 August 2026). However, many relevant provisions will only take effect at a later date.
The following graph provides an overview of the implementation dates for the main articles in this working group.



Graph 1: Implementation Timeline Overview

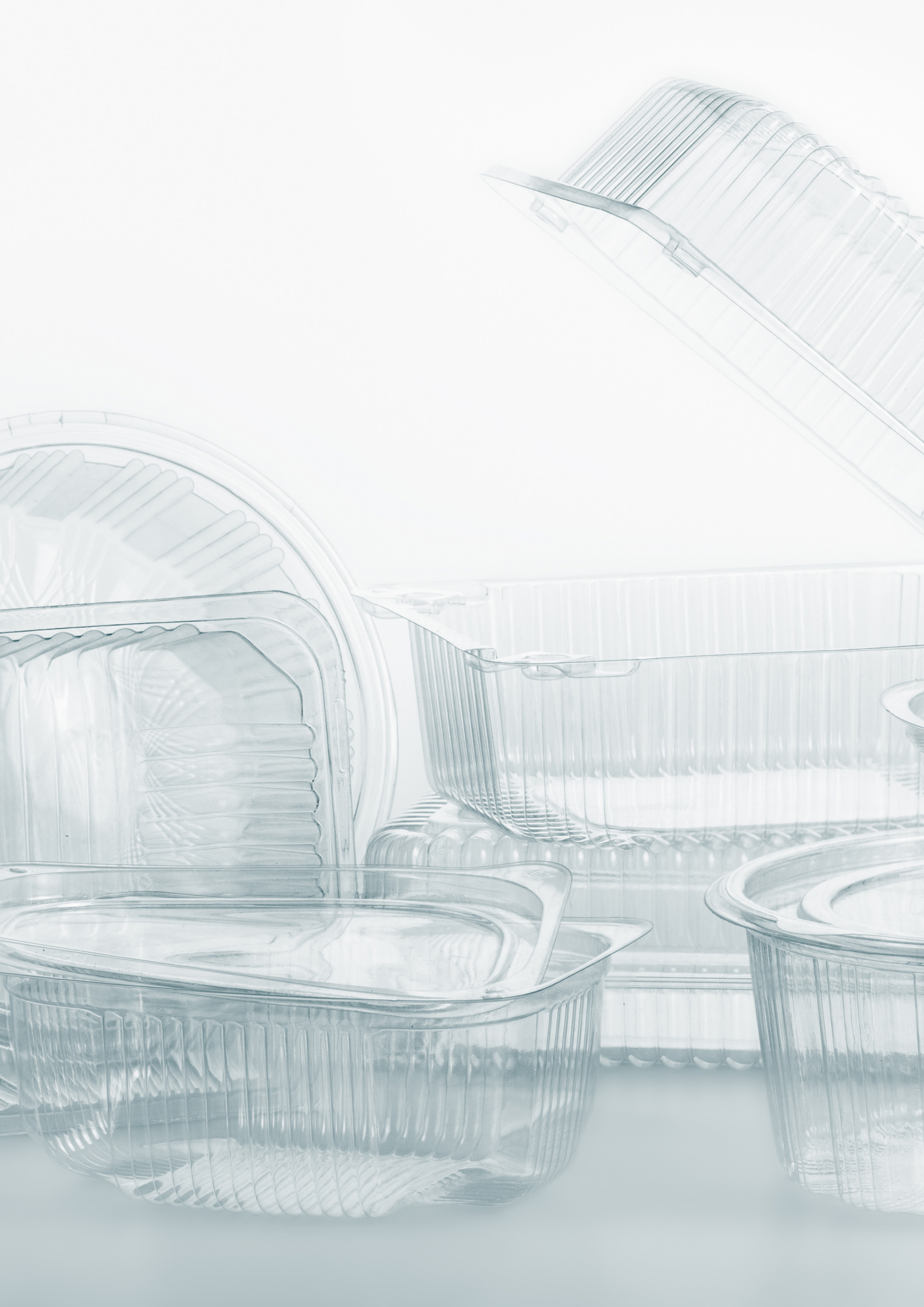
Source: Packaging and Packaging Waste Regulation (EU) 2025/40)

It is also important to note that delegated and implementing acts are essential for fully understanding the requirements outlined in the articles. However, as of June 2025, these acts have not yet been published and follow different timelines for release. As a result, the packaging activity group has been working with only the information currently available. Once the delegated and implementing acts are published, the specific requirements of the articles—and the corresponding datasets needed to meet them—will become clearer.

In summary, the conformity assessment integrates the requirements of these articles. Manufacturers can only place packaging on the EU market if it complies with Articles 5 to 12. Additionally, they must ensure compliance with Articles 24 and 26. Manufacturers are also required to provide a general description of the packaging and its intended use, along with designs and manufacturing drawings.
These requirements are defined in the technical documentation, which forms the basis of the conformity assessment.

The following figure illustrates the procedure. Before placing packaging on the market, manufacturers must conduct a conformity assessment based on the structure and elements outlined in the technical documentation. Once compliance is confirmed, they must issue a declaration of conformity.

Figure 1: Conformity assessment procedure



4. Circular Packaging and GS1 Standards

Plastic packaging often has a complex structure and is made of different materials. Currently, recycling-relevant information from plastics production processes is neither collected in a standardised way nor made available in a structured way. However, this information basis is needed, on the one hand, to fulfil legal requirements in the future and, on the other hand, to enable the transformation to a circular economy based on recycling for the recovery of high-quality recyclate:

- Treat packaging as a valuable resource
- Keep the value of packaging in the loop through circular economy
- Protect the environment from packaging pollution

Therefore, the goal is to create new packaging from old packaging, achieving a closed-loop system.

As the value network in the plastic packaging sector is very complex and many stakeholder groups are involved, cross-company collaboration is a prerequisite for the transition to a circular economy.
In this context, the role of standardisation becomes even more important. Only if information is structured and standardised it can be shared between all stakeholders in the value network, allowing interactions and cooperations. Standardised data help to optimise processes that extend the life cycle of materials and products. Using a common language is the only way to obtain the level of efficiency needed in the circular economy. And finally, because this data will mostly be processed by machines, interoperability of IT systems using a common language is crucial.

This common data framework enables all involved stakeholders to act in the interests of the circular economy, enabling product data to be shared among all entities with the focus on resource efficiency and the consideration of a low carbon footprint.

Figure 2: Circular packaging value chain shows the complex interactions of different stakeholders taking part in a circular packaging value chain. They have different roles, responsibilities and obligations in order to achieve and support circular processes for plastic packaging.

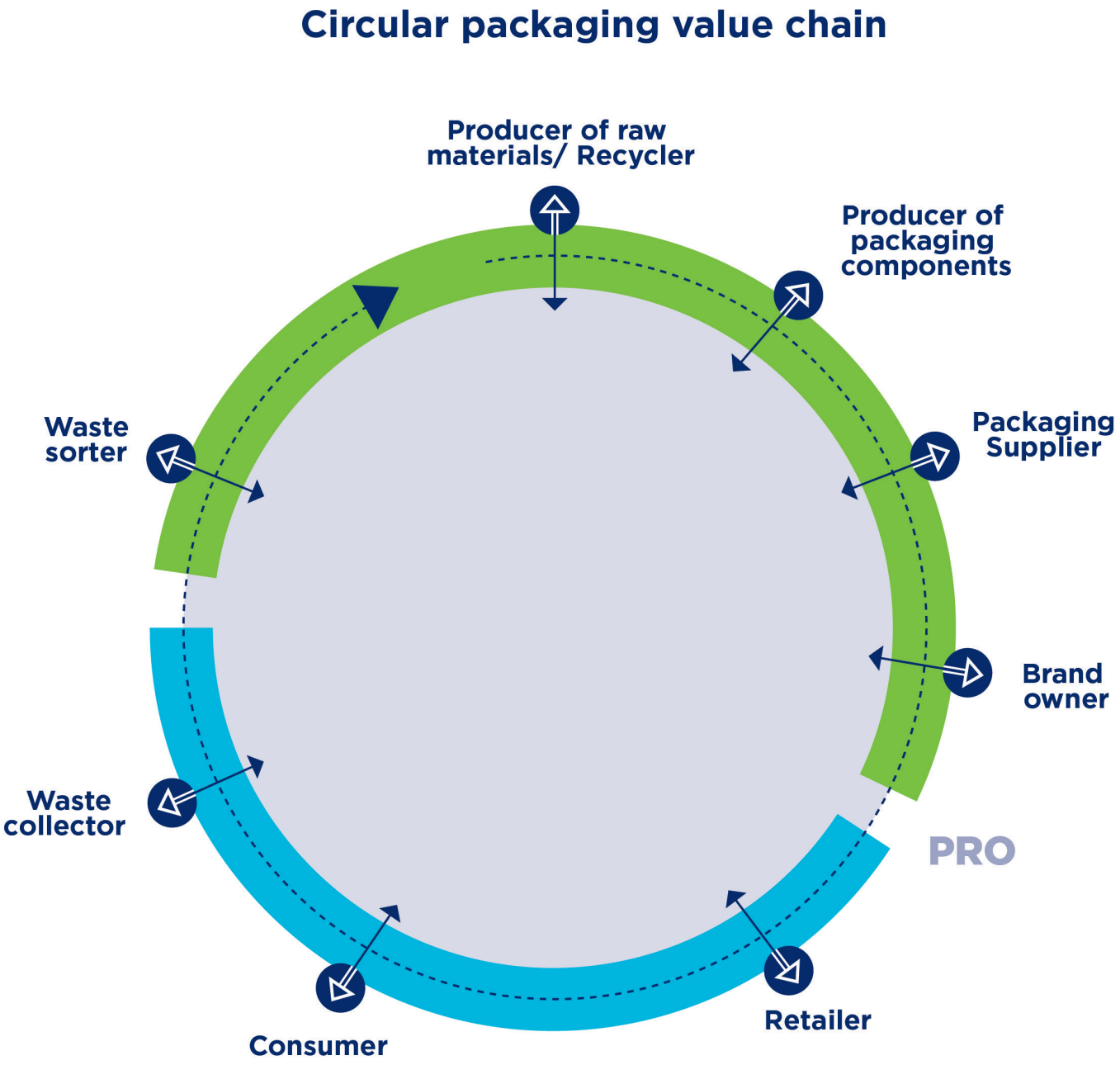


Figure 2: Circular packaging value chain

To meet the upcoming legal regulation in the context of PPWR in an efficient and digital manner, it is vital for all stakeholders along the circular packaging value chain to have the possibility to apply a common language for the data exchange. This goes far beyond the exchange of data between brand owner and retailer. An Economic operator, this could be e.g. a brand owner, is urged by legislation to provide more granular information described in chapter 3 coming from the upstream processes.

GS1 standards are the most widely used system of business standards in the world - categorised into three dimensions: Identify, Capture and Share. The three dimensions are illustrated in Figure 3: GS1 system of standards: Identify – Capture – Share.

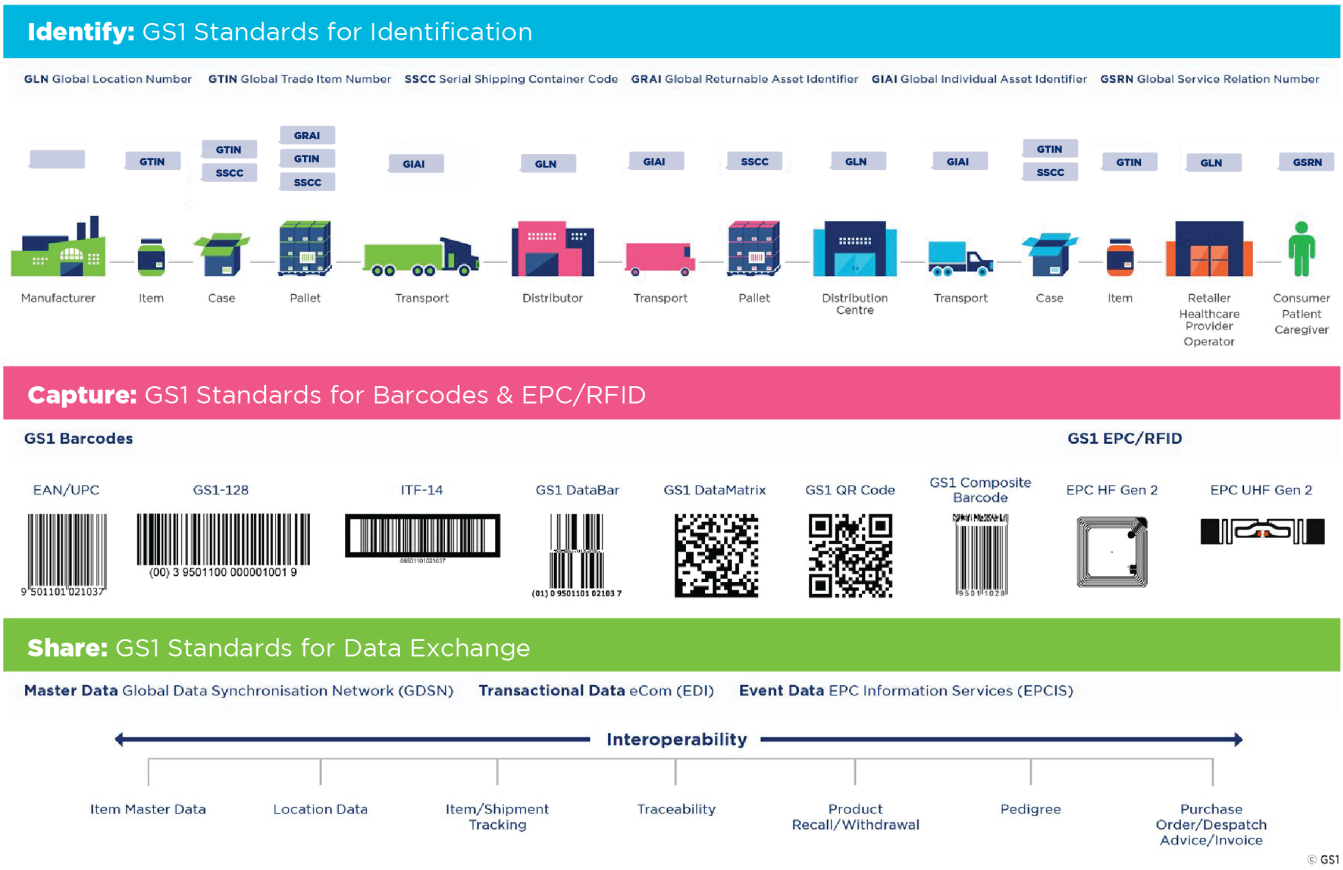


Figure 3: GS1 system of standards: Identify – Capture – Share

1 Identify:

GS1 ID keys enable organisations to assign standard identifiers to products, documents, physical locations and more. Because GS1 ID keys are globally unique, they can be shared between organisations, increasing supply chain visibility for trading partners. For instance, a company can use the Global Location Number (GLN) to identify its locations, and the Global Trade Item Number (GTIN) to uniquely identify its trade items. GS1 defines trade items as products or services that are priced, ordered or invoiced at any point in the supply chain. The GS1 Company Prefix (GCP) provides information about the company that assigns the GTIN.

- Upstream: From packaging supplier to brand owner
- In the upstream segment, each individual packaging component – be it a tray, carton, lid or film – receives its own GTIN, assigned by the packaging supplier. If multiple production locations are involved, they are identified via separate GLNs.
- Downstream: From brand owner to retail or PRO
- In the downstream segment, there are different item hierarchy levels. Each level of the hierarchy receives a unique GTIN and represents a specific unit, such as consumer unit, case, or pallet.
  In the responsibility of the brand owner, packaging GTINs from the upstream segment can be linked to the product's existing trade item hierarchy.
  This ensures ´at each hierarchy level' that the packaging in use can be clearly traced back to the responsible producer, and that the data can be reused for reporting purposes without reformatting or duplication.
- Downstream: From brand owner to sorting operator
- Using a combination of advanced intelligent sorting technologies, the waste sorter determines which types of packaging will be sorted out. With the packaging composition of each consumer unit linked to its GTIN, high-resolution cameras on the sorting lines can thus detect the (invisible) data carrier and retrieve the relevant packaging information.

2 Capture:

The GTIN can be represented in data carriers, such as 1D barcodes or 2D-Codes, to enable automatic data capture.

3 Share:

Electronic data exchange improves speed and accuracy when sharing master data, transaction data and visibility data.

- GDSN: The GS1 Global Data Synchronisation Network (GS1 GDSN) is the world's largest product data network. With GDSN, high quality product content is uploaded, maintained and shared automatically, ensuring trading partners have immediate access to the most current and complete information needed to exchange products on both local and global markets.
  The *GS1 in Europe GDSN Implementation Guide for Packaging*[1] describes the harmonized set of core attributes to exchange packaging information in GDSN in Europe. This core set is required in all European countries. Per country there can be additional requirements which are not included in this guideline. The GDSN implementation guideline will be updated based on the outcomes of this white paper to ensure a common European data exchange between brand owners and retailers.
- EANCOM® (DESADV): The EANCOM® Despatch Advice is a message specifying details for goods despatched or ready for despatch under agreed conditions.
- EPCIS: GS1's standard for supply chain visibility, including a ready-to-use data model for visibility events. It provides information about a specific GTIN with regard to on what happened (e. g. commissioning) where, when and in what condition.
- WebVoc On-Demand Data Retrieval: On-demand requests for files (often JSON-LD documents) applying the (GS1) Web Vocabulary, a method for describing trade items, companies, locations, and more using linked data concepts.

Technology agnostic, standardised data attributes and code lists are therefore an important foundation to interact between different actors, industry sectors, solutions and systems - upstream and downstream. However, packaging suppliers rarely use GDSN. This is the reason why the focus is on the recommendation of existing appropriate attributes, code values and message formats in a more technology-agnostic perspective for the overall circular packaging value chain.

Using GS1 Standards and combining identify, capture and share in the context of packaging bring different benefits in practice already today. The aim is to remain flexible in terms of technology (GDSN, EDI, Excel), while ensuring consistency and traceability on both sides of the supply chain:

- The GTIN and GLN combination enables a transparent connection to the original packaging producer.
- The data can be exchanged flexibly depending on the partner's system landscape – from structured spreadsheets to fully integrated systems.
- Above all, the GS1 standards ensure that relevant packaging information is consistently available, regardless of product type or hierarchy level.

[1] Link to GDSN packaging guideline

A large number of directives and regulations were introduced as part of the EU Green Deal. The information addressed in the PPWR is also relevant to other regulations, such as the ESPR. When it comes to the requirements of the ESPR and therefore the implementation of the Digital Product Passport (DPP) as an instrument to achieve more transparency and circularity for products, it becomes evident, that the digitally attached information will also cover packaging information and attributes, e.g. recycled content information for consumers on how to dispose packaging waste correctly.

The PPWR and ESPR require a QR code or another type of data carrier that is standardised, open, and digital, and that contains information about the packaging and its associated product to meet regulatory requirements. This is where the 2D Code, in combination with the GS1 Digital Link, comes into place.

The GS1 Digital Link Standard connects GS1 identifiers – such as a GTIN – with the web.

The GS1 Digital Link standard makes it possible to express any GS1 identifier such as a GTIN as a web URI, thus making them directly resolvable through the web. On this basis, GS1 Keys can act as a gateway to human- or machine-readable facts and assertions made about them. This leads to numerous positive effects, as illustrated in Figure 4: More space on the packaging with the help of a GS1 Digital Link:

- the linked information can be adapted at any time without having to renew the data carrier – such as a QR-Code – and its content.
- in combination with a GS1-compliant resolver service, GS1 Digital Link enables connections to different information. With that, different target groups may retrieve specific information. Consumers may receive information to increase the longevity of a product and recyclers detailed information on materials used to ensure better recycling processes.
- space on the packaging is saved, and additional barcodes can be omitted

Figure 4: More space on the packaging with the help of a GS1 Digital Link

The industry is moving towards 2D barcodes to encode more data and enhance consumer engagement. This shift meets growing demands for information, improves supply chain efficiency, supports new circular economies, and builds brand trust. Retailers, brands, solution providers, and GS1 have developed standards for 2D barcodes, including size, quality, placement, syntax, and human-readable text criteria.

There are different types of 2D codes, with three variants approved for open use at Point of Sale (POS) according to GS1 standards (illustrated in Figure 5: Types of 2D codes). Two of these are already in practice: the GS1 Data Matrix and the QR Code with GS1 Digital Link. The latter allows redirection to additional information on the internet. The third variant is a Data Matrix with GS1 Digital Link, for which no pilots are known to date.

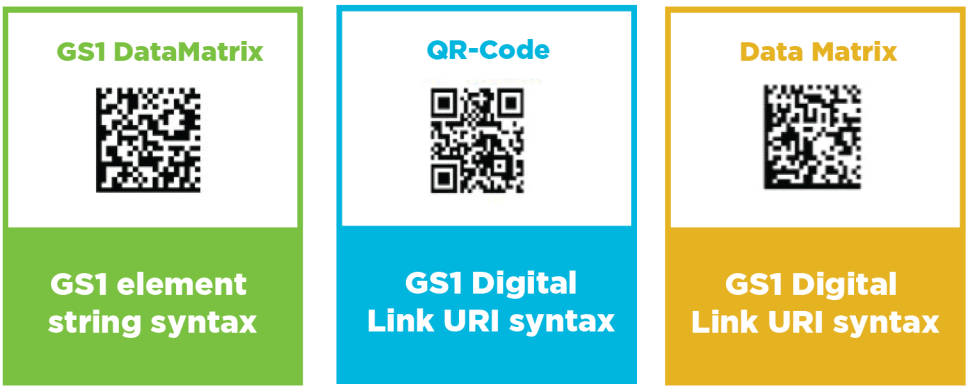


Figure 5: Types of 2D codes

While linear barcodes will remain, a transition period is needed for widespread adoption of 2D barcodes. The new standards and ambition 2027 allow time for planning and system evolution to support these capabilities by 2027.
With the 2D migration jointly initiated by GS1 and users, a standardised and interoperable solution is available:

- Business partners can exchange information without bilateral agreements and import it into their own systems.
- The number of data carriers on packaging at retail POS can be reduced, leading to fewer misreads and misunderstandings, and more space on the packaging for graphics and merchandising.
- Companies are supported in the introduction of more powerful data carriers.

Looking ahead to the future another crucial requirement for the future implementation of standardised data attributes and code lists is ensuring scalability and leveraging synergy effects between regulatory requirements. Beyond the PPWR, various regulations under the EU Green Deal umbrella require data to be exchanged across the value chain. GS1 Standards allow to comply with multiple regulations simultaneously. The advantage is that data is generated once in a standardizsed format, exchanged once for multiple purposes, and can be utilised for multiple regulations. Based on that interoperable approach it is possible for companies to maximise synergies and reduce excessive effort for companies that are subject to the reporting requirements.

The GS1 in Europe White Paper Corporate Sustainable Reporting Directive (CSRD)[2] and GS1 Standards takes up exactly this vision and refers amongst others to ESRS E5 Circular Economy data points in the context of packaging to demonstrate a collaborative approach to corporate ESG activities.

[2] Link on White Paper on GS1 Standards for CSRD

5. Technology-agnostic data attributes and code list for PPWR requirements

GS1 standards form the basis and help as a common language in the value chain. GS1 standards enable data exchange across company boundaries. Due to the large amount of data a high degree of digitalisation and automation is needed to support compliance and efficiency in value chains.

Effective data management is therefore crucial to fulfilling the requirements of the PPWR, and GS1 standards can significantly help in this process by providing a common language and framework for accurate and efficient data exchange across the circular packaging value chain:

GS1 standards are continuously maintained and developed in collaboration with industry stakeholders based on business requirements laid down by them. The GS1 standards are developed via the *GSMP (Global Standards Management Process)*, which is a community-based forum for businesses facing similar problems to work together and develop standards-based solutions. New developments with focus on identification have already been initiated due to the new PPWR requirements. As an example, the working group in charge of the topic 'circularity and digital product passport (DPP)', recently published the change notification called 'Work Request 23-103', which proposes a few modifications to the GS1 Standards. For example:

- The extension of the 'extended packaging applications' (described in chapter 2.1.13 of the General Specifications document).
- This application describes the usage of QR Codes and links to webpages on packaging. According to the change notification, this application should not only apply to products scanned at the point of sale, but also for products sold from business to business. Also, it should not only allow QR Codes and links on the packaging, but product documents and direct marking on the product itself as well.
- The extension and the renaming of the Consumer Product Variant (application identifier 22).
- According to the change notification, this application should be renamed to GTIN Version Number, and it should be used to communicate to any party (consumer, regulator, trading partner, ...) that minor changes occurred to the product which didn't require a GTIN change.

These change propositions, as well as many others, are still being discussed in different working groups and have, at the time of writing, not been finalised.

Aligning business concepts with various technological representations based on an agnostic model ensures flexibility and interoperability. By defining business concepts independently from specific technologies (e.g., XML GDSN, Web vocabulary), organisations can align data with real business needs, improve consistency across systems, and future-proof their models. This approach facilitates seamless integration, enhances data governance, and allows for scalability as business and regulatory requirements evolve. It ultimately ensures that data remains actionable, standardised, and technology independent.

To implement this approach, the core group of the European-level Packaging Activity — consisting of GS1 Member Organisations from Germany, France, Denmark, Sweden, the Netherlands, Austria, and BelgiLux — identified relevant data attributes and code lists either already standardised or available via GSMP work request as a proposal for further standardisation that will be necessary to meet future PPWR requirements. It should be mentioned that the group followed a technology-agnostic approach. This means that data attributes were collected independently of specific technologies. These data attributes and code lists, serve as a common language for cross-company collaboration within the circular packaging value chain.

The collected data points are compiled in a dataset overview, available in a separate Excel file (see link). The dataset demonstrates how GS1 standards can support recycling use cases according to PPWR requirements. However, it does not yet include all data points needed for full compliance. At this stage, creating a complete dataset is not possible, as the detailed requirements for various recycling-related use cases, such as recyclability assessments and the associated transparency on required attributes and code values, will only become clear with the publication of the Delegated Acts. This will result in a need for further development of datapoints and a standardisation within the framework of the GSMP.

The data attributes and code lists can be expanded by this working group, other GS1 groups (GS1 in Europe or GS1 member organisations), or related initiatives. This provides a valuable basis for fulfilling the requirements of the PPWR in the future on the basis of existing, open standards. Moreover, the structured data collection supports companies in the future-proof documentation of their packaging data and enables digital applications such as recyclability analyses.

The following table presents an excerpt from the dataset in the Excel file[3], showing only a few columns due to space limitations in this document.

Business-Friendly Name	Definition	GDSN (GS1 XML name)	Web Vocabulary
Packaging Type	The dominant means used to transport, store, handle or display the trade item as defined by the data source. This packaging is not used to describe any manufacturing process. Data recipients can use this data for: o Space Planning o Data Accuracy (Tolerances) o Supply Chain processes o Recycling process (In combination with packaging materials) o Product buying/procurement decisions o Tax calculations/fees/duties calculation.	packaging TypeCode	gs1:packagingType
Packaging Material Type	The materials used for the packaging of the trade item for example glass or plastic. This material information can be used by data recipients for: o Tax calculations/fees/duties calculation o Carbon footprint calculations/ estimations (resource optimisation) o to determine the material used.	packaging Material TypeCode	gs1:Packaging MaterialTypeCode
Recycled Material Type	The code describing the type of raw or recycled material the product packaging material is made from.	packaging RawMaterialCode	
Percentage of Recycled Material	The percentage of the type of raw or recycled material the product packaging material is made from, as specified by the Packaging Raw Material Code.	packaging RawMaterial ContentPercentage	
Packaging Element	The code that describes the part or element of the packaging of the product associated to a material or composite material.	packaging MaterialElementCode	
...	...	...	...

Table 2: Dataset excerpt

Way forward

The implementation of the PPWR, which officially entered into force in February 2025, will be further detailed through a series of Delegated Acts and Implementing Acts issued by the European Commission. Delegated Acts are expected to specify technical and procedural requirements that will be critical for ensuring compliance across the circular packaging value chain. Implementing Acts, on the other hand, will establish the uniform application of these requirements across all Member States. Together, these acts will shape the practical execution of the PPWR by providing detailed guidance for stakeholders. In alignment with these evolving requirements, GS1 in Europe is committed to iteratively developing and updating this white paper in close collaboration with the GSMP framework to ensure it remains a reliable reference for stakeholders.

A key focus topic in the upcoming year is the integration of a PPWR conformity assessment framework, which will help stakeholders evaluate and demonstrate compliance using standardised, interoperable data models and identifiers. This approach aims to streamline reporting, enhance traceability, and support sustainable packaging practices in line with EU objectives.

[3] Link to Excel file

6. Industry examples

GS1 Austria - Industry Example: Structured Packaging Data Using GTINs.

A food manufacturer producing sliced ham for the retail sector set out to improve how packaging information is handled and shared. The product is sold in vacum-formed trays with a top sealing film, presented in a transparent setup at the deli counter.

While all product master data is already provided to retail partners via GDSN, the packaging information – including material types, component weights and recyclability – was previously only available in unstructured form. Declarations of conformity, technical datasheets or PDFs were used, but these formats did not support integration into systems or compliance reporting under the Packaging and Packaging Waste Regulation (PPWR).

To address this, the producer launched a targeted initiative to standardise its packaging data. Each component – tray, top film, and the stretch wrap used to group ten base units – was assigned a dedicated GTIN. These GTINs were populated with attributes based on GS1 guidance for packaging data, including material coding, recycled content, and recyclability indicators.

Rather than embedding this information directly into the GDSN data feed, the company supplied it in a structured Excel format aligned with a shared attribute model. This made it easier to link the packaging GTINs to the product hierarchy levels (base unit, grouped unit, pallet) and enabled downstream use in logistics, documentation and sustainability reporting.

The project helped ensure that packaging data is consistently available, traceable to the original supplier via the GTIN/GLN structure, and ready for future reporting needs under the PPWR.
This approach can now be transferred to other product categories and supplier relationships. It also provides a foundation for automated compliance and sustainability reporting across different data exchange systems.

GS1 Denmark & GS1 Netherlands - Industry Example: GS1Trade Packaging

The EPR project is a collaboration between the member organisations of Denmark and Netherlands. The purpose is to help the industry to efficiently comply with the EPR regulation through GS1 GDSN standardised and secure processes for data collection, sharing and declaration.

A new GS1 Data service has been designed to provide maximum flexibility and scalability in the data management process. The tool handles packaging as a unique object in the platform (with its own GTIN when industry adopts) which moves the MDM creation and ECO-modulation backwards in the value chain where it is best handled. Packaging components can be linked to multiple GTINs which is a key driver for efficiency, both initially but also when the packaging is optimised. The platform offers full traceability of changes made allowing for precision in declaration as inventory shift from old to new packaging. Country-specific legal classification criteria is maintained in the platform, ensuring compliance with the local EPR requirements.

GS1Trade Packaging launched in Denmark late 2024, initially with the master data module allowing users to collect and structure data. Since then, additional features have been added, and a strong roadmap is ahead with declaration as the next significant milestone. 500 companies are already utilising GS1Trade Packaging in Denmark and more is on their way.

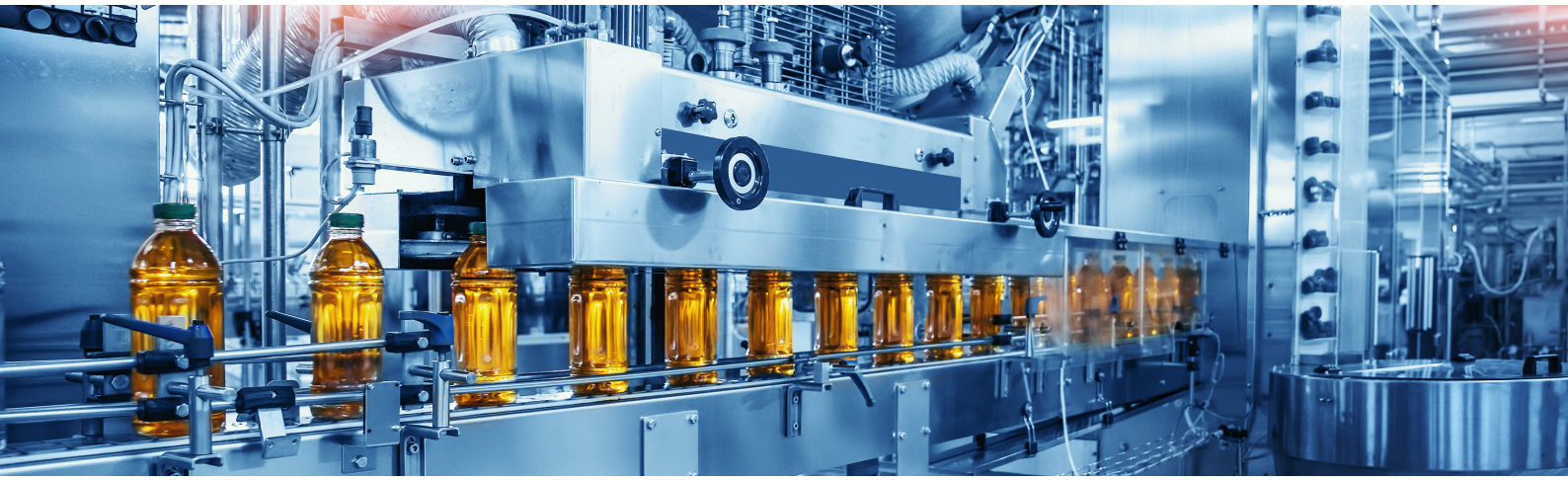
GS1Trade Packaging currently runs as a pilot with select members in Netherlands and a plan for further roll-out is under way. The ambition is to make GS1Trade Packaging available through other GS1 member organisations in Europe as the EPR and PPWR affects industries in all EU countries.

GS1 Germany - Industry Example: structured packaging data using GDSN, EPCIS and GS1 web vocabulary

On the way towards a circular economy, GS1 Germany supports actively cross-industry initiatives that drives further development of GS1 standards forward. There are already multiple solutions in place that enables standardised, interoperable data exchange across the circular packaging value chain. It is already possible to exchange standardised information on the recyclability and recyclate content of packaging between brand owner and retail. This data exchange via GDSN not only serves efficient B2B communication but also creates transparency for end consumers and EPR institutions.

One of the key innovations emerging from cross-company collaboration is the automated digital assessment of packaging recyclability. By leveraging GS1 standards, packaging data—such as material composition, additives and adhesives — can be structured and shared in a machine-readable format. This enables an automated evaluation of a packaging's recyclability based on current design-for-recycling guidelines. The result is a scalable solution that supports both regulatory compliance and sustainability goals.

Next to that GS1 Germany also supports data-driven recycling and production processes[4] with the help of EPCIS and GS1 web vocabulary. The focus here is on collecting structured information through data capturing points in machines used in the production and recycling processes of plastic packaging. This is a foundation of valuable primary life cycle data needed for subsequent business processes and trading partners. EPCIS, along with its accompanying data standard, the Core Business Vocabulary (CBV), is GS1's core standard to enhance visibility in companies or value networks. In simple terms, it provides a common language to capture and share what are known as EPCIS events, providing organisations with the ´what, when, where, why and how´ of objects traversing through business processes.



[4] Link to CPT guideline

References

Packaging waste statistics, Eurostat (2025):
https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Packaging_waste_statistics

Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC (2025):
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202500040

Appendix

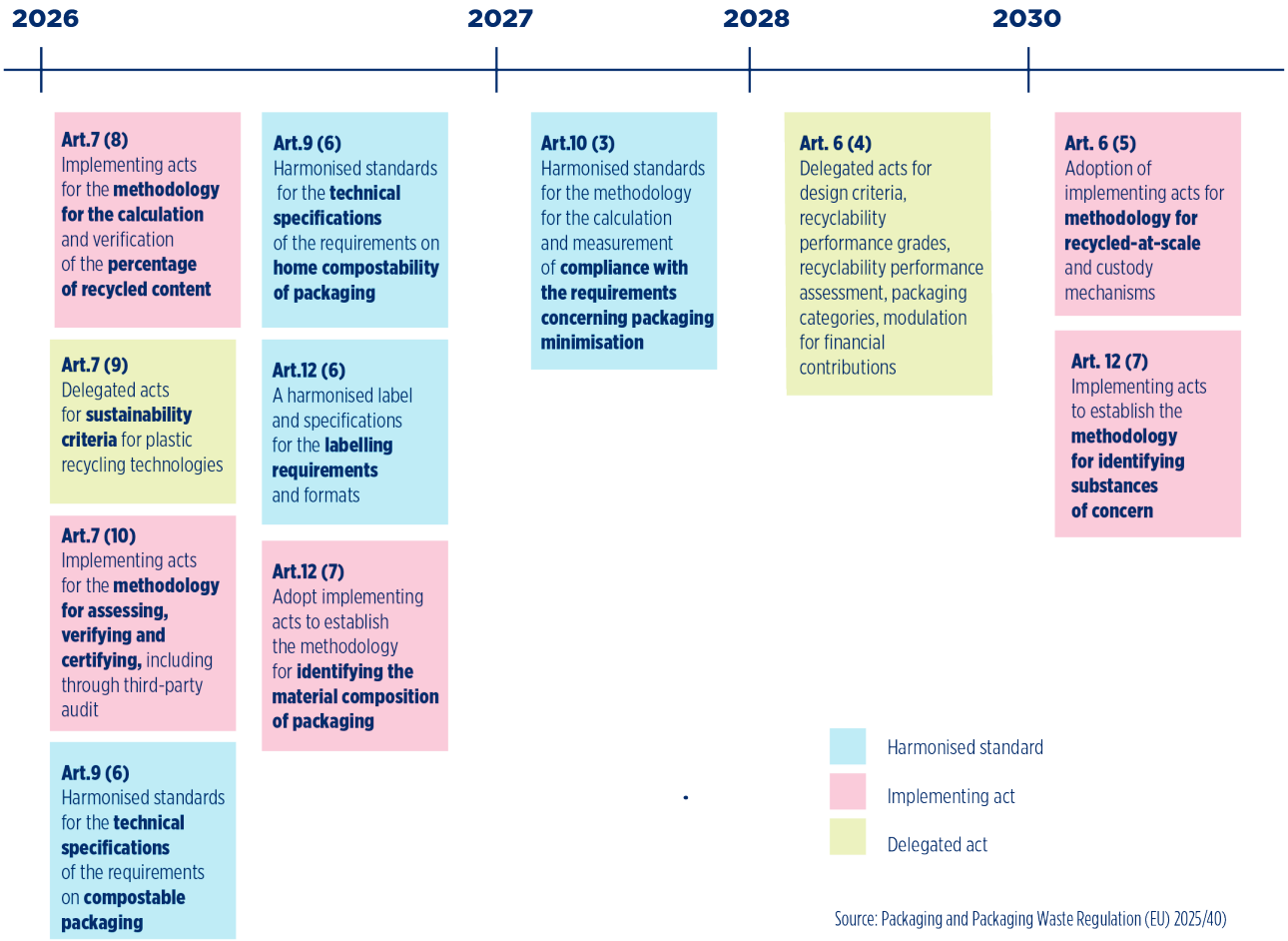
1. Timeline for upcoming requirements from the PPWR

Article	Description	Date
5 - Requirements for substances in packaging (5)	Food-contact packaging shall not be placed on the market if it contains per- and polyfluorinated alkyl substances (PFAS) in a concentration equal to or above the following limit values to the extent that the placing on the market of packaging containing such a concentration of PFAS is not prohibited pursuant to another Union legal act	From 12 August 2026
5 - Requirements for substances in packaging (5)	Without prejudice to the restrictions on chemicals set out in Annex XVII to Regulation (EC) No 1907/2006 or, where applicable, to the restrictions and specific measures on food-contact materials and articles in Regulation (EC) No 1935/2004, the sum of the concentrations of lead, cadmium, mercury and hexavalent chromium resulting from substances present in packaging or packaging components shall not exceed 100 mg/kg.	
6 – Recyclable packaging (2a)	All packaging placed on the market shall be recyclable – packaging is it is designed for material recycling	1 January 2030 or 24 months from the date of entry into force of the delegated acts adopted
6 – Recyclable packaging (2b)	All packaging placed on the market shall be recyclable - when packaging becomes waste, it can be collected separately sorted into specific waste streams without affecting the recyclability of other waste streams and recycled at scale	1 January 2035 or, or five years from the date of entry into force of the implementing acts
6 – Recyclable packaging (3)	Packaging shall not be placed on the market unless it is recyclable within grades A, B or C as described in Table 3 of Annex II	1 January 2030 or 24 months from the entry into force of the delegated acts
6 – Recyclable packaging (3)	Packaging shall not be placed on the market unless it is recyclable within grades A or B as described in Table 3 of Annex II	from 1 January 2038
6 – Recyclable packaging	Economic operators shall comply with new or updated design for recycling criteria	within 3 years of the date of entry into force of the relevant delegated act
6 – Recyclable packaging (4)	conomic operators shall comply with new or updated design for recycling criteria	within 3 years of the date of entry into force of the relevant delegated act

Article	Description	Date
7 - Minimum recycled content in plastic packaging (1) (2)	Any plastic part of packaging placed on the market shall contain the following minimum percentage of recycled content recovered from post-consumer plastic waste, per packaging type and format as referred to in Table 1 of Annex II, calculated as an average per manufacturing plant and year	2 phases for the targets (see targets in section 2.2): By 1 January 2030 or 3 years from the date of entry into force of the implementing By 1 January 2040
7 - Minimum recycled content in plastic packaging (11)	The calculation and verification of the percentage of recycled content contained in packaging under paragraph 1 shall comply with the rules laid down in the implementing act adopted pursuant to paragraph 8.	By 1 January 2029 or 24 months from the date of entry into force of the implementing act referred to in paragraph 8, whichever is the latest
9 – Compostable packaging (1)	Where packaging referred to in Article 3(1), point (1)(f), and sticky labels affixed to fruit and vegetables are placed on the market, that packaging and sticky labels shall be compatible with the standard for composting in industrially controlled conditions in bio-waste treatment facilities and shall be compatible, where required by the Member States, with the home-composting standards referred to in paragraph 6 of this Article.	12 February 2028
9 – Compostable packaging (3)	Packaging other than that referred to in paragraphs 1 and 2, including packaging made of biodegradable plastic polymers and other biodegradable materials, shall be designed for material recycling in accordance with Article 6 without affecting the recyclability of other waste streams	By 12 February 2028
12 – Labelling of packaging (1)	Packaging placed on the market shall be marked with a harmonised label containing information on its material composition in order to facilitate consumer sorting The packaging placed on the market containing substances of concern shall be marked by means of standardised, open, digital-marking technologies in accordance with the methodology referred to in paragraph 7, second subparagraph In addition to the harmonised label referred to in this paragraph, economic operators may place a QR code or other type of standardised, open, digital data carrier on the packaging that contains information on the destination of each separate component of the packaging in order to facilitate consumer sorting.	From 12 August 2028 or 24 months from the date of entry into force of the implementing acts adopted pursuant to paragraphs 6 or 7 of this Article
12 – Labelling of packaging (8)	Packaging included in an extended producer responsibility scheme may be identified throughout the territory of the Member States in which that scheme or system applies.	By 12 February 2027

2. Expected timeline of delegated and implementing acts:

Timeline for delegated acts and implementing acts



Source: Packaging and Packaging Waste Regulation (EU) 2025/40)

Article	Description	Date
5 - Requirements for substances in packaging (2)	The Commission, assisted by the European Chemicals Agency, shall prepare a report on the presence of substances of concern in packaging and packaging components, to determine the extent to which they negatively affect the re-use and recycling of materials or impact chemical safety.	By 31 December 2026
5 - Requirements for substances in packaging (5)	The Commission shall carry out an evaluation to assess the need to amend or repeal this paragraph in order to avoid overlaps with restrictions or prohibitions on the use of PFAS laid down in accordance with Regulations (EC) No 1935/2004, (EC) No 1907/2006, or (EU) 2019/1021	By 12 August 2030
5 - Requirements for substances in packaging (9)	The Commission shall carry out an evaluation to assess whether this Article and the design for recycling criteria set out in accordance with Article 6(4) have contributed sufficiently to minimising the presence and concentration of substances of concern as constituents of packaging materials.	By 12 August 2033

Article	Description	Date
6 – Recyclable packaging (4)	Commission shall, after taking into consideration standards developed by the European standardisation organisations, adopt delegated acts for: • design for recycling criteria • recyclability performance grades • how to perform recyclability performance assessment and express its result • a description, for each packaging category • • a framework concerning the modulation of financial contributions to be paid by producers	By 1 January 2028
6 – Recyclable packaging (5)	the Commission shall adopt implementing acts for: • the methodology for the recycled-at-scale assessment per packaging category • the chain of custody mechanism ensuring that packaging is recycled at scale.	By 1 January 2030
7 - Minimum recycled content in plastic packaging (8)	The Commission shall adopt implementing acts establishing the methodology for the calculation and verification of the percentage of recycled content recovered from post-consumer plastic waste recycled and collected within the Union	By 31 December 2026
7 - Minimum recycled content in plastic packaging (9)	The Commission shall adopt delegated acts in to supplement this Regulation with sustainability criteria for plastic recycling technologies	By 31 December 2026
7 - Minimum recycled content in plastic packaging (10)	The Commission shall adopt implementing acts establishing the methodology for assessing, verifying and certifying, including through third-party audit, the equivalence of the rules applied in cases where the recycled content recovered from post-consumer plastic waste is recycled or collected in a third country	By 31 December 2026
9 – Compostable packaging (6)	The Commission shall request the European standardisation organisations to prepare or update harmonised standards laying down the detailed technical specifications of the requirements on compostable packaging	By 12 February 2026
9 – Compostable packaging (6)	The Commission shall also request the European standardisation organisations to prepare harmonised standards laying down the detailed technical specifications of the requirexments on home compostability of packaging referred to in paragraph	By 12 February 2026
12 – Labelling of packaging (6)	The Commission shall adopt implementing acts to establish a harmonised label and specifications for the labelling requirements and formats, including where provided through digital means, for the labelling of packaging referred to in paragraphs 1, 2 and 4 of this Article.	By 12 August 2026
12 – Labelling of packaging (7)	the Commission shall adopt implementing acts to establish the methodology for identifying the material composition of packaging referred to in paragraph 1 by means of standardised, open, digital-marking technologies, including for composite packaging and integrated or separate components of packaging	By 12 August 2026
12 – Labelling of packaging (7)	The Commission shall also adopt implementing acts to establish the methodology for identifying substances of concern by means of standardised, open, digital-marking technologies.	By 1 January 2030

About GS1 in Europe

GS1 in Europe is a non-profit organisation uniting 49 member countries and representing over 500,000 companies across Europe. As part of the global GS1 network, we provide a system of internationally recognised standards that enable seamless identification of products, locations, entities, and assets. Our mission is to create a common language for business, fostering efficiency, transparency, and innovation across industries. Together, we drive collaboration and support businesses in Europe.

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