GS1 New Zealand

Digital Product Passports - Feasibility Study Report

Evaluation of a datahub to collect and share plastic packaging information in the retail sector

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About GS1

GS1 is a global, not-for-profit organisation that develops and maintains standards for business communication. These standards are widely adopted across industries such as retail, healthcare, and construction, and are increasingly vital for sustainability efforts, particularly in the plastic packaging supply chain. GS1 operates as a global federation, with country-specific Member Organisations that support local industry needs. These organisations act as neutral enablers, helping businesses, councils, and government agencies implement GS1 standards to improve data sharing, traceability, and regulatory compliance.

GS1 New Zealand is not-for-profit; our Board members are voluntary and nominated by the industry bodies they represent including food and grocery, primary sector, healthcare and hardware products. Our identification standard underpins the New Zealand Business Number (NZBN) for the Government, which is mandated for use by government departments (see Appendix 1 for a summary of relevant GS1 standards and services).

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Contents

Glossary of Terms 5

Acknowledgements 7

Executive Summary 8

1 Introduction 11

1.1 Purpose 11

1.2 Objectives and Scope 11

1.3 Context: Digital Product Passports 11

1.4 Methodology 12

2 Data Sharing foundations 13

2.1 Unique Identification – an information access 'key' 15

2.2 Data Capture – access to digital information 15

2.3 Data Sharing – using existing infrastructure 16

2.4 How does a DPP support data sharing? 19

3 Current State – existing plastic packaging data & data sharing 20

3.1 What is the problem with plastic packaging in New Zealand? 20

3.2 New Zealand and Australia – retail data sharing system 22

4 Future Data Needs 24

4.1 Plastic Packaging Products – data for scheme implementation 26

4.2 Beverage Container Return Scheme – data for automation 27

4.3 Agrecovery Rural Recycling – data for scheme refinement 28

4.4 Resource & Waste Monitoring – data for accurate reporting 30

4.5 Industry Standards and Guidelines – data for certification 31

4.6 Overseas Packaging Regulations – data for compliance 32

4.7 Materials Recovery Facilities – data to enhance sorting 33

4.8 Where DPPs could help 33

5 Sample Dataset – plastic packaging in retail 35

5.1 Summary 35

5.2 Collection Objectives and Scope 35

5.3 Collection Methodology 36

5.4 Data sample – key insights 37

5.5 Data Validation – EIC Testing and Findings 40

5.6 Collection insights and analysis 40

6 Roadmap 41

6.1 Proposed Solution - Summary 41

6.2 Data Sharing Ecosystem – Concept Design 41

6.3 Recommended Implementation Phases – for any scheme 45

6.4 Plastic Packaging Product Stewardship – Recommended Approach 45

6.5 Agrecovery Rural Recycling Scheme – Recommended Approach 48

6.6 What is Needed to Drive Change 50
6.7 Proposed Ecosystem – Systems Upgrades 50
6.8 Recommended Next Steps 51

7 References/Bibliography 52

Appendices

Appendix 1: Key GS1 standards and services 55
Appendix 2: Data needs of different ecosystem participants 57
Appendix 3: Data collection scope 59
Appendix 4: Key packaging attributes 63
Appendix 5: Collection methodology 66
Appendix 6: GS1 Packaging related data attributes and code lists 69
Appendix 7: Packaging Code Lists (GS1 National Product Catalogue - NPC) 71

Figures

Figure 1: Representation of centralised, distributed and federated database systems. 13
Figure 2: Data Sharing Elements 14
Figure 3: The use of a GS1 Next Generation barcode to capture data 15
Figure 4: Digital Product Passport (DPP) GS1 version 16
Figure 5: Global Discovery Services – GS1 Global Registry Platform 17
Figure 6: Next Generation Barcode Uses 19
Figure 7: The National Product Catalogue Data Flow 22
Figure 8: NPC Product Record and Attributes – Bottle of Soft Drink 23
Figure 9: Example of Separate Component Level Packaging 23
Figure 10: Packaging Material Data Sharing 25
Figure 11: Data and cash flows for the Rural Recycling Scheme 29
Figure 12: Australian Recycling Label (ARL) 31
Figure 13: Summary of Data Needs for EU Packaging Regulation 32
Figure 14: Areas where DPPs and a national aggregated dataset would be useful 34
Figure 15: Packaging Origins Collection Distribution 37
Figure 16: Products Recorded by Stewardship Scheme 38
Figure 17: Product Labels – Recorded Claims 38
Figure 18: Packaging Components 39
Figure 19: Using the DPP Concept to Create a National Dataset 43
Figure 20: Data Sharing Ecosystem 44
Figure 21: How global standards can be used to share data across the supply chain 47

Tables

Table 1: Leveraging Data to Improve Waste Minimisation Outcomes 21
Table 2: Key packaging relevant to plastic packaging stewardship 27
Table 3: Data Sharing Ecosystem: Stakeholder Roles 44
Table 4: Plastic Packaging Origin within Collection Scope 59
Table 5: Data Collection Scope Compared to Stewardship Scheme Scope 61

Glossary of Terms

Term	Definition
API (Application Programming Interface)	A software interface that enables systems to exchange data automatically in a structured, machine-readable format.
ARL (Australasian Recycling Label)	A standardised on-pack label used in Australia and New Zealand that provides evidence-based recycling instructions for consumers.
Barcode (1D / 2D)	A machine-readable symbol used to encode product identifiers. 1D encodes GTINs for Point of Sale (POS) machines; Next Generation (2D) barcodes hold more data and support GS1 Digital Link.
Beverage Container Return Scheme (CRS/DRS)	A system where consumers pay a deposit on eligible drink containers and receive a refund when the container is returned for recycling.
Circular Economy	An economic model that maximises resource efficiency by designing out waste, keeping materials in use, and regenerating natural systems.
Component-Level Data	Data describing each separable part of packaging (e.g., bottle, lid, label), enabling accurate reporting of material types and recyclability.
Data Aggregator / Data Pool	An organisation or system that collects and harmonises data from multiple suppliers and shares it with authorised users (e.g., GDSN data pools, NPC).
Data Carrier	A technology used to store or link to digital information on a physical product, such as barcodes, RFID, NFC tags, or digital watermarks.
Data Space (Federated Data System)	A distributed data-sharing environment where participants keep control of their own data, enabled through shared standards, governance, and identity.
Digital Link (GS1 Digital Link)	A GS1 standard, adopted by ISO, the International Standards Organisation, that turns a product QR Code into a web-addressable identifier, enabling access to verified product information via a web address.
Digital Product Passport (DPP)	A structured digital record linked to a unique product identifier (e.g., GTIN) that provides verified information about a product's composition, sustainability, and lifecycle.
Digital Watermark	An invisible code printed on packaging that enables advanced scanning and sorting technologies to identify materials and recycling requirements.
EIC (Environmental Innovation Centre)	A materials testing laboratory that validates packaging attributes such as polymer type using spectroscopy (e.g., FTIR).
EPR (Extended Producer Responsibility)	A regulatory framework requiring producers to take responsibility for the environmental impacts of their products and packaging, including funding collection and recycling.
FTIR (Fourier Transform Infrared Spectroscopy)	A scientific technique used to determine polymer type and material composition.
GDSN (Global Data Synchronisation Network)	A global network of interoperable data pools that synchronise validated product master data between suppliers and recipients using GS1 standards.

GLN (Global Location Number)	A globally unique identifier for business entities, facilities, and legal or physical locations.
GTIN (Global Trade Item Number)	A globally unique product identifier encoded in barcodes, enabling traceability and data sharing across supply chains.
GS1	A global, not-for-profit standards organisation that develops data standards for product identification, data capture, and data sharing across supply chains.
Master Data	Authoritative, foundational data about a product (e.g., brand, description, packaging details) that remains consistent across systems and is shared between trading partners.
MRF (Materials Recovery Facility)	A facility that sorts and processes recyclable materials into streams that can be sold to recyclers or manufacturers.
National Product Catalogue (NPC)	A GS1-operated data aggregation service for Australia and New Zealand that synchronises product master data, including packaging attributes.
Next Generation Barcode	A data-rich 2D barcode such as GS1 DataMatrix or a GS1 QR Code with Digital Link that can carry significantly more information than traditional 1D barcodes, enabling enhanced product identification, traceability, regulatory compliance, and consumer engagement across the value chain.
NFC chips	Small Near Field Communication microchips that enable secure, very short-range wireless data exchange such as tapping a product with a smartphone to access digital information.
Packaging Component	Any distinct, separable part of packaging (e.g., bottle, pump, cap, shrink sleeve, label).
Product Stewardship	A scheme requiring producers, importers, and brand owners to manage the environmental impacts of their products across their lifecycle.
Recyclability Claim	A statement about whether packaging is recyclable, conditionally recyclable, or not recyclable, often requiring evidence (e.g., PREP results).
Resin Type	The polymer category used in packaging (e.g., PET, HDPE, PP), typically represented by the resin identification code (RIC).
Resolver (Digital Link Resolver)	A service that redirects a Digital Link URL to appropriate product information based on user, device, or purpose.
RFID (Radio Frequency Identification)	A data carrier that uses radio waves to transmit product identity information, typically used in logistics and automated sorting.
Serialised Identifier	A unique, item-level identifier (e.g., GS1 Digital Link with serial number) used for tracking individual units crucial for digital DRS and anti-fraud systems.
Sunrise 2027	A GS1-led global industry initiative to enable use of Next Generation Barcodes, such as GS1 DataMatrix and GS1 QR Codes, by 2027. It represents a worldwide commitment across retail, manufacturing, and supply-chain partners to ensure systems, packaging, and processes are ready to scan and use 2D barcodes at point-of-sale and throughout the product lifecycle - supporting the evolution from 1D (traditional) to 2D (data-rich) barcodes.

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Engagement included broad discussions with members of The Packaging Forum and WasteMINZ through conference participation and targeted group sessions. We also benefited from the perspectives provided by the New Zealand Food and Grocery Council, Plastics NZ, and Re.Group through their involvement on the Steering Group and drew on our experience supporting thousands of brand owner members.

Input from plastic packaging manufacturers was gathered via Plastics NZ and in direct conversations at trade fairs and industry conferences. We were informed by specific meetings with retailers and by our long-standing engagement across the food, grocery, and farm retail sectors. Brand owners contributed through direct email exchanges, participation in forums, and conference engagement.

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Executive Summary

As New Zealand moves towards more regulated approaches to minimising packaging waste and improving resource efficiency – including expanded product stewardship – accurate, standardised packaging data becomes a prerequisite for workable, low-burden compliance and credible performance measurement.

This feasibility study investigates how New Zealand can build a scalable, interoperable system for collecting and sharing plastic packaging data across supply chains. It evaluates the role of Digital Product Passports (DPPs) and a national dataspace to support product stewardship, regulatory compliance, circular economy decision making, and improved transparency across supply chains.

In this study, "plastic packaging data" refers primarily to standardised, component-level packaging attributes (e.g., resin type, weights, format/componentry, recycled content, and recyclability), linked to products via global identifiers.

A central challenge is the absence of a consistent, national level dataset for plastic packaging. This gap limits the government's ability to design effective regulations, constrains stewardship scheme performance, and prevents industry from accessing reliable data for reporting, sustainability claims, investment decisions, and operational optimisation.

The study does not propose a single new central database; instead, it focuses on leveraging existing standards and data systems and identifying the minimum viable foundations for a national approach.

Why better packaging data is needed

Leading markets (EU, China, Vietnam, South Korea) already recognise DPPs as core digital infrastructure for sharing detailed product and packaging information. A Digital Product Passport links a product's unique global identifier such as a GS1 Global Trade Item Number (GTIN) to verified, structured information about its composition, packaging, sustainability attributes, and where relevant - lifecycle events. Verification can be risk-based, combining supplier declarations with targeted audit/assurance for higher-risk attributes (for example recycled-content and regulated claims), supported by registry checks where available.

Accessed through **Next Generation Barcodes** or Application Programming Interface (APIs), DPPs provide:

- **Transparency for consumers**, recyclers, regulators and supply chain actors
- **Machine readable, scalable data exchange**
- **Verification and interoperability** across distributed data sources
- **Reduced manual reporting burden**, with "enter once, use many times"

This study describes the foundations for a nationwide ecosystem, explains the data sharing systems already in place, and outlines key areas needing plastic packaging data, now or in the near future. The study concludes that **New Zealand can rapidly accelerate packaging data quality by building on existing systems that use GS1 global standards** - already widely used across the food & grocery, hardware, agriculture, and retail sectors.

Building blocks already in place

1. **Unique Identification** – GTINs and Global Location Numbers (GLNs) are universal "access keys" for linking packaging attributes without centralising all data.
2. **Data Capture Tools** – Next Generation Barcodes and RFID enable component level packaging data to be digitised at source.
3. **Discovery and Verification Services** – The GS1 Global Registry Platform (GRP) supports product verification and access to a core set of product attributes. It enables more consistent information discovery across markets.
4. **Data Aggregation Systems** – The National Product Catalogue (NPC), linked to the Global Data Synchronisation Network (GDSN), already manages millions of product records and can extend to include detailed packaging component data.
5. **Interoperable Data Standards** – Open, globally harmonised data taxonomies (e.g., resin types, recycling instructions, sustainability claims) support cross-border compliance and automation.

These elements collectively support a federated "dataspace" architecture, where data remains distributed but interoperable—ideal for a national scale system.

Current State: New Zealand's plastic packaging landscape

Data challenges

- No national dataset capturing packaging materials, weights, componentry, resin types or recyclability
- Inconsistent and incomplete packaging data in existing business systems (e.g., only primary components recorded)
- Limited visibility into agricultural/farm plastics despite growing regulatory focus
- Difficulty meeting emerging global reporting requirements (e.g., EU Packaging & Packaging Waste Regulation, recycled content mandates, harmonised labels).

Future data needs

Stewardship schemes and emerging regulations require the following data at a national scale:

- Accurate material type and component level weights
- Resin composition and recyclability
- Recycled content
- Packaging origin (imported, locally packed, marketplace, agriculture)
- Eligibility flags for Container Return Schemes
- Aggregated national reporting (volumes placed on market, collected, recycled, exported, landfilled)

This data underpins Extended Producer Responsibility (EPR) fee setting, eco modulation, infrastructure planning, contamination reduction, compliance monitoring, sustainability reporting, and alignment with global regulatory frameworks.

Illustrative dataset (2,000 products)

This study created an illustrative dataset covering:

- Rigid plastics, soft plastics, composite packaging
- Most items collected were consumer retail packaging; and some farm plastics
- Component level data (colour, resin type, weight, and recyclability, sustainability claims supplied)

Key insights

- Significant diversity in materials and multicomponent packaging, increasing complexity for accurate reporting and recyclability evaluation
- Over half of items carried no sustainability or recyclability claims
- Validation testing identified very few discrepancies between stated on pack plastic type and actual material properties – though some did exist

Recommended system design: A national packaging data space

The study proposes a hybrid, federated model using global open standards:

Core principles:

- **Not reinventing the wheel:** leverage GS1 standards, existing data pools, registries, and corporate systems
- **Share once, use many:** minimise double entry by linking DPP data directly to supply chain identifiers
- **Interoperable, not centralised:** allow multiple stewardship schemes, data providers and aggregators to coexist
- **Scalable and future-proof:** compatible with international regulations and other resource streams (textiles, construction materials, food waste)

Three-phase implementation pathway:

Phase 1 – Standardise and structure packaging data

Define mandatory attributes; adopt global classifications; ensure suppliers provide packaging component data as part of master data.

Phase 2 – Deploy Next Generation Barcodes

Enable direct access to packaging data for consumers, retailers, recyclers and collection sites, to support digital deposit return schemes and intelligent sorting technologies.

Phase 3 – Automate dataflows

Use APIs, Digital Link resolvers, and data pools to automate reporting to stewardship schemes, regulators, and international markets.

Sector specific opportunities

Plastic Packaging Product Stewardship

DPPs support automated eligibility checks, fee calculation, collection verification, and fair eco modulation. Barcode-based scan back systems reduce errors and increase data reliability.

Beverage Container Return Schemes

Next Generation Barcodes enable automated reverse vending machine validation, digital DRS models, and real time tracking of returned containers.

Agrecovery Rural Recycling Scheme

Component level data enhances accuracy of fee setting and recyclability assessments. Digital labelling could drive behaviour change and increase recovery rates.

MRFs and Waste Infrastructure

Access to trusted, packaging data enhances optical sorting, purity improvements, investment planning, and reduced contamination.

Recommended next steps

1. **Agree a core dataset** for plastic packaging using globally aligned definitions to ensure everyone is reporting the same thing, once, instead of rebuilding templates scheme-by-scheme.
2. **Mandate structured data** within stewardship frameworks to drive supplier adoption and lift data quality at scale in a way that is auditable and enforceable.
3. **Incentivise digital labelling** with Next Generation barcodes to make packaging data accessible at scale across manufacturing, retail, recovery, and compliance settings, not just in back-office systems.
4. **Use existing infrastructure first** (NPC, GS1 registries, Digital Link) before building new systems — to reduce cost, shorten delivery time, and avoid duplicating capability already in-market.
5. **Govern as a dataspace**, ensuring interoperability across multiple stewardship schemes and data services to prevent fragmentation and future rework as new schemes and requirements emerge.
6. **Run targeted pilots** to prove practicality, cost and value quickly and de-risk wider rollout. For example:

    - **a core dataset pilot** with a defined subset of suppliers and product categories
    - **a Next Generation Barcode/Digital Link pilot** for consumer-facing recycling guidance and scheme interactions
    - **an export-readiness pilot** focused on traceability fields relevant to packaging regulations in major export markets

Impacts

For businesses, a shared, standardised approach reduces duplicated reporting and improves the credibility of sustainability and recycled-content claims. This is increasingly important as major markets tighten rules and expectations. For communities and the waste system, better packaging attributes improve recycling guidance, sorting outcomes, and investment planning, supporting reduced contamination and improved material recovery.

Conclusion

New Zealand is well positioned to implement a national, interoperable packaging data ecosystem grounded in Digital Product Passports and global open standards. With modest enhancements to existing systems, aligned regulatory signals, and early pilots to prove feasibility, the country can unlock automated reporting, improved compliance, reduced waste, enhanced material recovery, and stronger participation in global circular economy frameworks.

This approach strengthens national environmental data, supports both industry and regulators, reduces manual burden, and helps protect New Zealand's economic interests in export markets where traceability, recycled content substantiation, and credible green claims are increasingly a prerequisite.

1. Introduction

1.1. Purpose

This study evaluated how product packaging data can be captured and shared using Digital Product Passports and datahubs to provide packaging information at scale, to support circular economy decision-making in New Zealand and maintain export readiness as international packaging requirements tighten.

Siloed information, or a lack of enriched data about products and their packaging is affecting decision-making, policies, and processes along the supply chain – from packaging production to post-consumer resource management and reprocessing. This gap has numerous adverse effects on recycling and end-of-life management. More consistent and enriched packaging information would enable more informed decision-making.

The study also assessed a packaging data sharing system for New Zealand that builds on existing infrastructure and collected a sample of plastic packaging to build a picture of plastic packaging currently available in retail, assess recyclability indicators, and understand the range of information that could realistically be shared.

1.2. Objectives and Scope

The key focus was the data requirements for plastic packaging within product stewardship schemes. This included retail packaging and selected packaging relevant to farm plastics declared priority products under the Waste Minimisation Act.

To evaluate datasharing concepts, the study:

- **Collected** a sample dataset of 2,000 plastic packaging products aligned with two priority product categories (retail plastic packaging and on-farm plastics packaging)
- **Evaluated** system architecture options to determine the most efficient and scalable approach for digital data exchange
- **Assessed** the feasibility and investment requirements of a potential national "datahub" to provide packaging information, supporting circular economy and stewardship related decision making for regulators, scheme operators, retailers, brand-owners and other stakeholders

1.3. Context: Digital Product Passports

Digital Product Passports (DPPs) are emerging globally as a mechanism to enhance transparency, traceability, and sustainability across product lifecycles. A DPP provides structured, verified digital information about a product and its packaging. This information is accessed via technologies such as Next Generation Barcodes, RFID tags, or other data carriers that link physical items to their digital records, or via system-to-system interfaces (APIs).

DPPs serve multiple stakeholders. Manufacturers and suppliers can share verified product attributes; regulators and customs authorities can access compliance information; consumers and recyclers can obtain accurate sustainability details; and investors and auditors can evaluate environmental, social, and governance (ESG) performance.

International regulatory approaches are evolving rapidly. The European Union will mandate DPPs for product categories such as textiles, batteries, and building materials from 2027. The EU model integrates product data across customs, chemical, sustainability, and waste regulatory systems, allowing data to flow across domains without duplication. Globally unique identifiers and interoperable open standards enable this integration.

Other markets are following a similar trajectory. Vietnam is progressing policy settings that include DPP-style requirements for certain products deemed "high-risk" under amendments to its Law on Product and Goods Quality from January 2026. South Korea has signalled interest in "data space" approaches to improve data sharing across systems without requiring a centralised database. China is piloting DPP systems in sectors such as textiles and batteries to support industrial digitalisation, Environmental, Social and Governance (ESG) reporting, and trade compliance. Indications are that information will increasingly be made available via next generation barcodes – China's new labelling law for packaged food, which comes into effect in 2027, encourages the use of digital labels.

These developments are increasingly relevant to New Zealand exporters as overseas markets increase their use of digital labels and tighten packaging related regulations.

Although regulatory designs differ, the essential principle is consistent: DPPs enable structured, interoperable data exchange. Assurance can be proportionate and risk-based, combining supplier

declarations with targeted certification requirements where third-party assessments are necessary (for example, recycled-content claims). This study examines the relevance of these developments for New Zealand's packaging data needs and identifies the foundational building blocks required to support DPP enabled data sharing.

1.4. Methodology

The study was designed to provide a national level overview of stakeholder needs, global best practice, and investment considerations for packaging data sharing. It comprised six phases:

Stakeholder Engagement

- Tested core assumptions and proposed approach.
- Identified key stakeholders across the plastic packaging value chain.
- Established a Steering Group to guide and validate the study direction.

Desktop Research

- Reviewed existing information to understand stakeholder expectations, current data availability, and existing datasharing systems.

Global Research

- Assessed international packaging data sharing approaches, standards, and regulatory models to inform a New Zealand appropriate system design.

Sample Data Collection

- Collected a dataset of 2,000 plastic packaging products aligned with two stewardship schemes.
- Tested independent data capture, validation, and documentation methodologies.
- Identified information gaps and opportunities for system improvement.

Recommendations Development

- Developed strategic options for scaling data sharing and enabling interoperability across sectors.
- Assessed the core foundational requirements for a national datahub.

Validation and Testing

- Conducted additional stakeholder engagement through business discussions and industry forums to confirm assumptions, identify constraints, and refine the recommended roadmap.

2. Data Sharing foundations

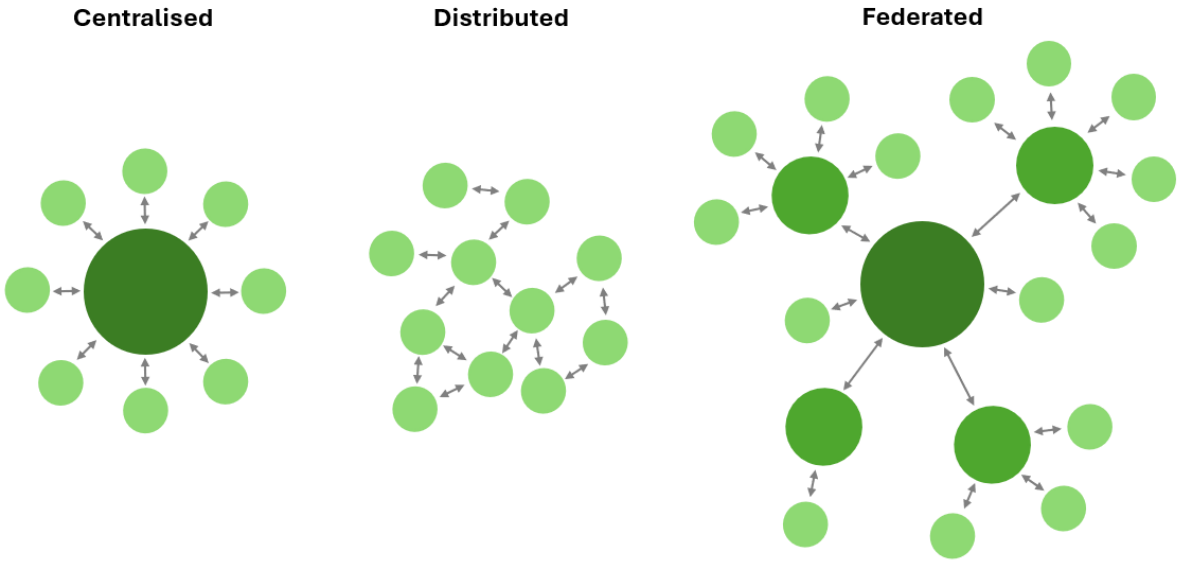
This study examines the requirements for establishing a nationwide ecosystem to enable businesses and other stakeholders to digitally share plastic and other packaging information with each other and data aggregation services in an interoperable, scalable way. The goal being to develop a national dataset that can inform investment, policy development, and decision making. It would also strengthen New Zealand's export readiness to meet overseas markets increasing requirements for traceability and substantiation of packaging, recycled content, and environmental claims. Once core foundational elements are in place, the system will provide users with reliable access to the packaging information they need.

Datasharing systems fall within three main categories: **centralised, distributed, and federated.**

- In a **centralised** model, all data sources feed into a single platform that stores and manages the data. This creates efficiency through a single point of control but also introduces a single point of dependency and potential bottleneck.
- A **distributed** model removes the central hub, allowing data sources to exchange information directly in a peer-to-peer network. While this maximises autonomy, it can result in fragmented governance and inconsistent data structures.
- A **federated** model blends the strengths of both: data remains with each participant, but a shared coordinating layer provides common standards, identity management, and interoperability. This allows distributed data sources to function as part of a coherent ecosystem.

The diagram below illustrates the distinctions between these models. Data system structures can be grouped into three broad categories: centralised, distributed and federated (Figure 1).

Figure 1: Representation of centralised, distributed and federated database systems.[1]



A federated data ecosystem that enables multiple participants to securely share, exchange, and use data based on common standards, governance rules and interoperability frameworks - while each participant retains control over their own data - is known as a "Data Space" architecture. This type of data sharing system enables collaboration and consistency without requiring centralisation, making it particularly suited for a nation-wide approach that draws on data from a wide range of sources (including global), where data interoperability and scalability are critical.

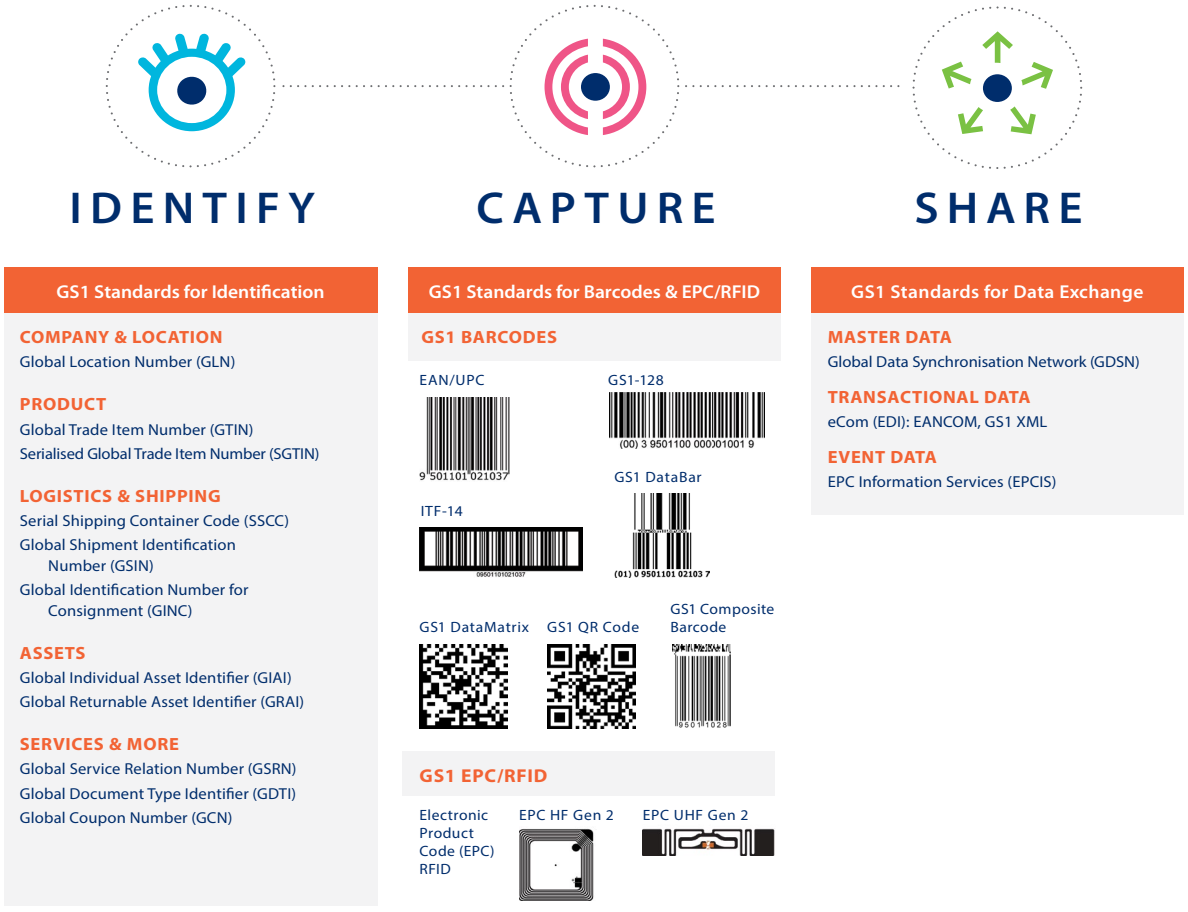
The International Data Spaces (IDS) framework integrates technical, organisational, and legal safeguards that cater to the needs of both the research community and private sector partners. The European Union's data strategy sets a goal of creating data spaces in several sectors including the Green Deal[2].

The **International Data Spaces Association (IDSA)** advocates the following guiding principles[3] which naturally align with the approach taken for this study:

- **Not reinventing the wheel**: use proven technologies
- **Integrate existing systems**: integrate data spaces into existing systems to the extent possible
- **Integrate or use existing standards**: align national and international specifications, technical standards, and established processes
- **Industry and domain independent**: make data spaces applicable as a concept as a horizontal standard
- **Easy to use**: low deployment threshold for companies and initiatives with a focus on portability and replicability.

A data sharing system requires three elements: identify, capture, and share. Figure 2 illustrates these three elements and the following sections provide a detailed explanation.

Figure 2: Data Sharing Elements



2.1. Unique Identification – an information access 'key'

Unique identification is a foundational enabler for data sharing because it provides the mechanism to reliably link packaging data across multiple highly distributed data sources without requiring centralisation of all packaging information in a single location.

Data can remain distributed across different organisations, systems, and jurisdictions, with each data user accessing only the information they need. Unique identifiers—or persistent digital IDs—allow each product, and information about it and its packaging, to be referenced consistently across different networks. This ensures data can be accurately aggregated and validated, reducing duplication and errors. Anchoring data exchange to a common identity layer, allows different stakeholders (including businesses and Extended Producer Responsibility/stewardship scheme managers) to maintain autonomy over their datasets while still contributing to a shared ecosystem, enabling transparency, compliance, and circularity/resource efficiency goals at scale.

2.2. Data Capture – access to digital information

Automated data capture tools are a core component of any data sharing system because they provide a bridge between a product and its digital information, allowing information access for different supply chain participants. Data carriers (such as barcodes, NFC chips and RFID tags) enable product and packaging information to be captured and linked digitally, minimising errors caused by manual data entry (as the data would only need to be entered once and then passed on by computer systems after that). This capability not only improves traceability and compliance but also improves productivity by reducing manual intervention and enabling scalability and trust in the system.

In short, data capture is one of the key building blocks to form a solid data sharing foundation. Standards for data capture allow for digital access to information relevant to packaging. New technologies such as the **GS1 Digital Link and Next Generation barcodes** allow more information to be carried than the current linear barcodes, enabling packaging data and recycling information to be accessible to businesses, supply chain partners, and consumers. Full transition to this new barcode is expected to happen over the next 5-10 years. The global retail industry is advocating a roll-out and has set itself a target of 2027 as the date when all retail Point of Sale machines globally will be able to read/scan Next Generation barcodes (referred to by the industry as "Sunrise 2027").

Figure 3: The use of a GS1 Next Generation barcode to capture data[4]

2.3. Data Sharing – using existing infrastructure

In a scalable and interoperable data sharing ecosystem, verification and validation systems ensure the integrity, accuracy, and compliance of data before it enters the network, establishing trust among participants. Data aggregators act as intermediaries that consolidate data from multiple sources, harmonising formats and applying standardisation protocols to enable consistent interpretation across diverse systems. To streamline and secure the flow of information, automating data exchange through APIs and Digital Link Standards provides machine-readable, standardised interfaces that facilitate real-time connectivity and interoperability between platforms.

Together, these components create a robust framework where data can be reliably verified, aggregated, and exchanged seamlessly, supporting scalability, reducing manual intervention, and enabling cross-sector collaboration in a trusted and efficient manner.

These building blocks are in place now and the use of open standards ensures that new players can emerge. The following sections provide examples of existing infrastructure and outline how it works.

Verification and Validation Systems

Global registry platforms and discovery services are a core enabler of data sharing systems because they provide the trusted infrastructure for verifying product identity at scale. In a distributed or federated ecosystem, participants need a common reference point to ensure that data exchanged about a product is accurate and authoritative.

The **GS1 Registry Platform (GRP)** fulfils this role for core product data in global supply chains. It acts as a central data verification and discovery hub by maintaining standardised identifiers like Global Trade Item Numbers (GTINs) and linking them to core product attributes. As the data is updated by the supplier, core product data is kept updated across trading partners, enabling the verification and discovery of product data across borders and industries at scale. This capability underpins interoperability, reduces duplication, and prevents fraud or misrepresentation.

Using the globally unique identifier, anyone can look up the registry to identify seven core data points about products – including a product description, brand owner, product classification/function, target market, and an image – to verify its identity and get key information. The following illustration shows the core product data included in the GRP. This digital product record can be considered a foundational DPP building block that can be shared and accessed globally. The core data does not include packaging data – this is added by data aggregation services. The role of the core data is to verify the uniqueness of the digital record.

Figure 4: Digital Product Passport (DPP): Core Data

The GRP acts as a large global directory or index – currently contains over 200 million individual products contributed by brand owners and manufacturers worldwide and supports queries across more than 1 million GS1 member companies in over 110 countries. It provides a **'single source of truth'** globally about the key features (the seven core attributes) of each uniquely identified product.

The GRP enables a service called **Verified by GS1** – a global lookup of core product data to confirm product and company identity and allow trusted access to standardised data. The GRP checks that the digital product record is uniquely registered, that the data meets GS1's standard validation rules, and does a check of trading partner information to enable item and price data exchange. This is useful for businesses and regulators that need consistent, verified core product data across borders and supply chains.

Data Aggregators

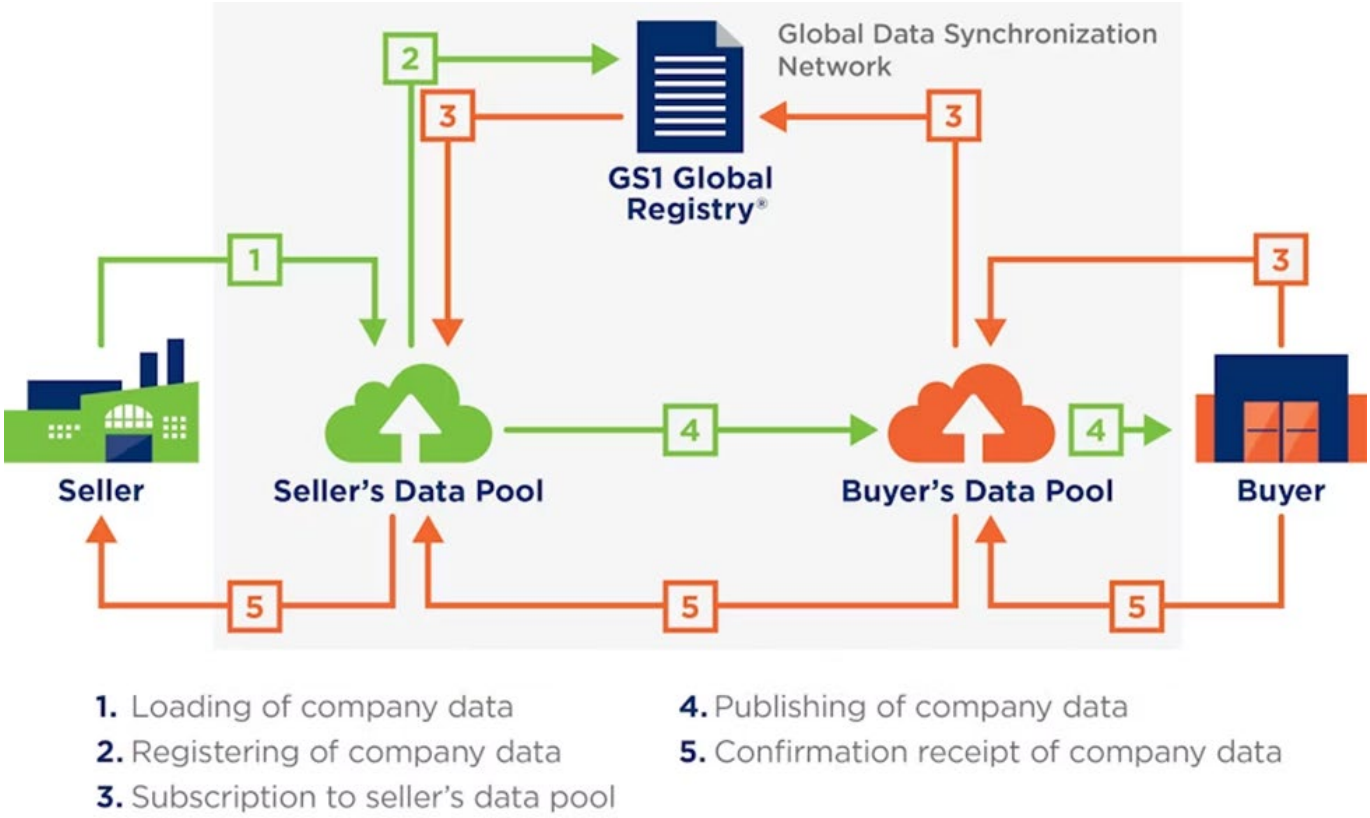
The Global Data Synchronisation Network (GDSN) is a network of 50 separate data pools run by GS1 Member Organisations that enriches core product data with additional attributes – including packaging information – using the same standards to enable data sharing at a global scale. Over 70,000 companies participate in the GDSN.

In addition to GS1 Member Organisations, other data service providers also make use of global discovery services, extending core product information with their own data. Data aggregators play a critical role in a data sharing system by acting as intermediaries that consolidate, normalise, and enrich data from multiple sources into a usable format.

In a federated ecosystem, data often originates from diverse systems with varying standards, structures, and levels of completeness. Aggregators bridge these gaps by harmonising datasets, applying classification frameworks, and validating identifiers against global registries. This process ensures that downstream users receive consistent, high-quality information without needing to query every source individually. Aggregators also add value by linking related datasets, providing analytics, and enabling discovery services that enhance transparency and decision-making. By reducing complexity and improving data integrity, aggregators make large-scale collaboration feasible across fragmented supply chains.

There are many independent data pools and data services operating globally, all competing. However, they all operate using globally unique, standardised identification. This standardisation enables commerce in a pro-competitive way by ensuring that there is a common understanding about the information being shared.

Figure 5: Global Discovery Services – GS1 Global Registry Platform



Automating Data Exchange through APIs and Digital Link Standards

Within a data sharing ecosystem, data aggregators serve as critical nodes that enable machine-to-machine (M2M) interoperability by consolidating and harmonising data from multiple sources. They leverage APIs provided by global registries—such as GS1's Verified by GS1 and Digital Link standards—to automatically validate identifiers and retrieve authoritative product information in real time. This API-driven approach eliminates manual data exchange, allowing systems to communicate seamlessly and maintain accuracy at scale. Aggregators also enrich datasets for analytics, compliance, and reporting. Furthermore, by using a tool that links to a product's digital information (Digital Link technology), aggregators can embed web addresses into identifiers, enabling access to authoritative data directly via the web. This combination of unique identification, structured classification, and linked data access creates a robust foundation for automated data exchange, ensuring accuracy, trust, and interoperability across diverse systems. This capability can transform packaging into a digitally discoverable asset, supporting automated workflows across supply chains and enables trust.

Summary – what makes a scalable data sharing system

Together, these data sharing elements form a distributed but interoperable data sharing network. Unique identification is the foundation, ensuring every packaging item can be referenced consistently across systems and throughout its lifecycle. Data capture tools—such as RFID or Next Generation barcodes embedded with Digital Link technology—transform physical packaging into a digital gateway, enabling machines and humans to access authoritative product data instantly. The Registry Platform acts as the anchor point, allowing users and systems to discover and trust product information regardless of where it is stored or who manages it. APIs and machine-to-machine protocols automate this data exchange. Data aggregators further strengthen the ecosystem by adding inputs from multiple sources and linking them to global registries, reducing complexity and enabling scalable collaboration. This integrated approach creates the backbone for Digital Product Passports—connected packaging that carries its own verified, actionable data—supporting transparency, regulatory compliance, and accelerating the transition to a improved resource efficiency.

2.4. How does a DPP support data sharing?

A Digital Product Passport (DPP) is a structured digital record that contains information about a product's materials, components, origin, environmental impact, and end-of-life instructions (including its packaging). A DPP could include packaging information such as polymer type, recyclability, recycled content, additives, and producer details. Information is typically accessible via a Next Generation Barcode or digital tag on the product (RFID). The product's unique identification number is a "key" that can access the product's data, enabling real-time access. DPPs can operate within centralised, distributed, or federated architectures. Below provides examples of different uses of DPPs accessed via a next generation barcode.

The technological infrastructure of DPPs is built on unique product identifiers, such as the Global Trade Item Number (GTIN), which ensure precise and consistent identification of products across systems. The unique identification number is an access key providing the recipient with access to the core product data (made available for free by global discovery services) and to product master data (available from data aggregation services).

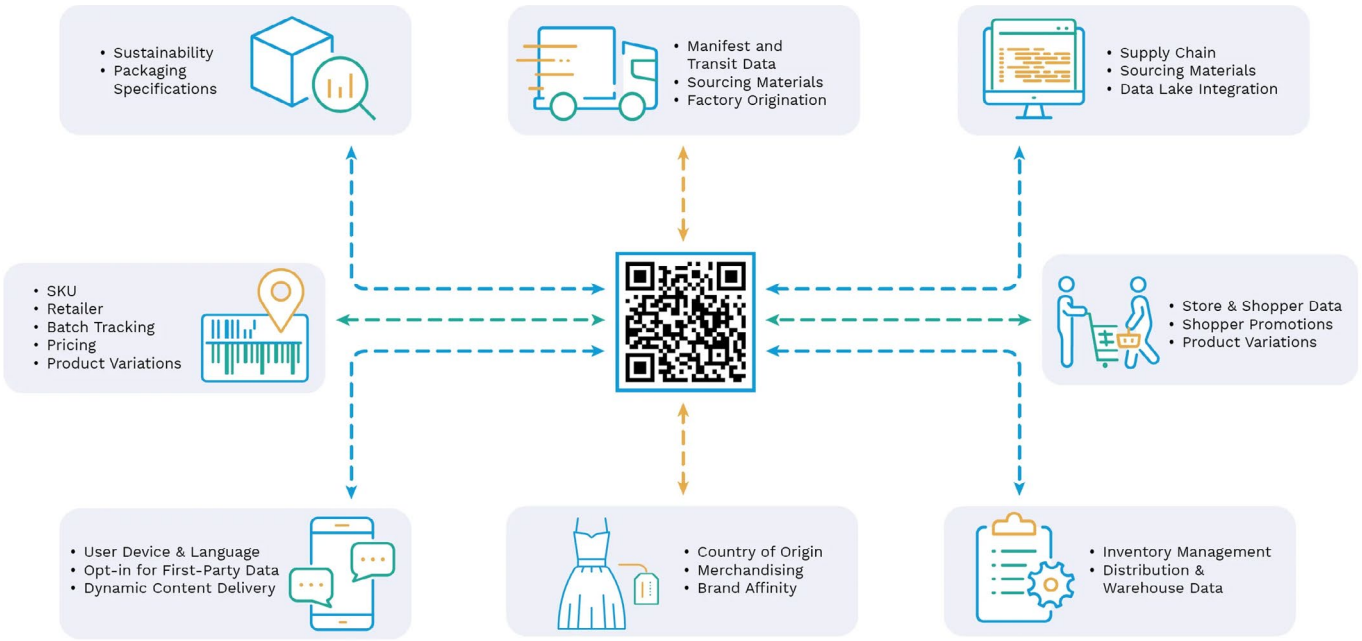
By leveraging open data standards DPPs enable structured and interoperable data exchange. This creates interoperable platforms using Application Programming Interfaces (APIs), allowing seamless integration with existing enterprise systems and regulatory databases and data sharing across diverse systems.

Globally agreed classification systems enable searchability meaning everyone can understand the information being provided, and similar products can be compared. Common data elements relevant to packaging include:

- Material composition and weight
- Recycled content
- Compliance documentation
- Sustainability claims
- Recycling and waste disposal instructions

Globally agreed data classifications ensure that all actors in the supply chain—from manufacturers to recyclers—can access standardised and actionable information.

Figure 6: Next Generation Barcode Uses



Credit: BL.INK: GS1 Digital Link - GS1 Sunrise 2027 2D barcodes fastest solution

3. Current State – existing plastic packaging data & data sharing

3.1. What is the problem with plastic packaging in New Zealand?

New Zealand currently lacks a coordinated and standardised approach to collecting and reporting data on plastic packaging. The *Rethinking Plastics in Aotearoa New Zealand report*[5] highlighted significant gaps in the evidence base needed to guide systems change, noting that there is no consistent method for measuring plastic use and disposal by material type across the country. This data gap hampers the ability to monitor progress, evaluate interventions, and design effective policies. Without reliable and granular data, it is difficult to understand the full scope of plastic packaging flows, identify priority areas for action, or benchmark against international best practice.

The Proposed Scheme Design for a Plastic Packaging Product Stewardship Scheme[6] reinforces these concerns, identifying the absence of data as a key barrier to implementing an effective Extended Producer Responsibility (EPR) framework. The report outlines that current state analyses and mass balance studies have been limited by fragmented and inconsistent data sources, which restrict the ability to model packaging flows accurately or assess the environmental impact of different packaging types. This lack of robust data also complicates the establishment of fair and effective levy systems, eco-modulation strategies, and performance targets for producers.

The lack of robust packaging data is also becoming an economic risk. Major export markets are strengthening packaging-related requirements (including traceability, recycled content substantiation, and the credibility of environmental claims). Without access to structured, comparable data, New Zealand businesses may face higher compliance costs and reduced ability to demonstrate conformity with overseas requirements.

Improving data sharing and transparency is essential to support efficient packaging use and waste reduction. Both reports call for the development of a national plastics data infrastructure that enables consistent reporting, facilitates stakeholder collaboration, and supports evidence-based decision-making.

This is not solely a New Zealand issue. APCO (the Australian Packaging Covenant Organisation) notes that “across Australia and globally, packaging regulation is shifting to rely on verified, comparable and auditable data” and that “businesses will increasingly need high-quality information to make decisions, model cost impacts, demonstrate readiness and participate in stewardship systems.”[7]

The following table summarises the benefits that could be achieved from improving data quality and accessibility.

Table 1: Leveraging Data to Improve Waste Minimisation Outcomes

Key Use Area	How can better data help
Policy and Regulation Development	• Policy and regulation: supporting government policy and implementation on waste minimisation, extended producer responsibility (EPR) schemes (e.g. product stewardship and container return schemes) and sustainability targets (e.g. emissions reductions commitments, the Global Plastics Treaty). • Monitoring compliance: Ensuring adherence to reporting requirements and (if regulated) participation in stewardship schemes.
Strategic Planning and Decision-Making	• Infrastructure and Investment: Guiding investment in sorting facilities, recycling equipment, reusable container assets, higher recycling content packaging, and other waste management or waste reduction systems. • Resource allocation: Prioritising funds and efforts to meet New Zealand's Waste and Resource Efficiency Strategy outcomes.
Transparency and Accountability	• Tracking progress: Measuring against national, local, business, or stewardship scheme sustainability targets. • Market requirements: reliable data is needed for those setting, meeting, and assessing certification or labelling standards (e.g. EU recycled content rules, EcoChoice standards, accurate packaging claims). • Research and public awareness: Providing transparent insights into packaging waste to foster informed choices and public trust.
Innovation and Design	• Sustainable packaging: Facilitating the development of recyclable, reusable, or alternative materials. • Circular economy initiatives: Enabling a transition from a linear to a circular economy.
Advocacy and Education	• Raising awareness: Informing campaigns for reducing packaging waste and promoting recycling. • Shaping behaviour: Encouraging sustainable consumption and disposal practices.
Market Insights and Economic Opportunity	• Identifying trends: Understanding material flows to inform business strategies and product stewardship. • Stimulating end markets: Supporting demand for recycled content and closing material loops.
Research and Analysis	• Data-driven insights: Enabling detailed analysis of packaging trends, material lifecycles, and environmental impacts. • Benchmarking: Comparing New Zealand's performance against global standards and best practices.

3.2. New Zealand and Australia – retail data sharing system

The New Zealand retail supply chain—including food manufacturers, suppliers, and retailers—relies on global structured data standards and data sharing systems for sharing product information across logistics, transport, storage, and inventory management. Digital standards and systems facilitate seamless data exchange between buyers and sellers, and enables access to product, business owner, and location data through unique identification numbers linked to databases. **This existing ecosystem can be built upon** and used for sharing plastic packaging data to a wider audience including downstream users of product information such as consumers and collection sites.

The New Zealand/Australia retail supply chain currently uses a mixture of data sharing systems to share food and grocery product information between suppliers and retailers. Suppliers can create and share product master data directly with retailers or they can use a centralised data aggregation service to do this – the National Product Catalogue (NPC) - see Figure 7. The NPC enables 'one to many' data sharing – it is a database managed jointly by GS1 New Zealand and GS1 Australia on behalf of their members. The database is part of the GS1 Global Data Synchronisation Network (GDSN) which uses a global classification system and standardised language for sharing product data (and keeping core product data current and visible). The global network makes the top seven core product attributes visible to buyers and regulators. The NPC aggregates a much larger set of data attributes related to each product including packaging material (refer Appendix 6 and 7) and is tailored for Australian and New Zealand markets. It contains master data for almost 1.5 million unique trade items (a quarter of which are food & grocery items), servicing recipients across NZ and Australia, sourcing data from more than 2,000 suppliers across food and grocery, liquor, healthcare, agribusiness and rail industry sectors.

The attributes of **type** and **weight** of plastic packaging are already available in the NPC although it is neither complete nor accurate in all cases. Other data fields as seen in Figure 8 are currently available for suppliers to add sustainability information such as:

- recycling instructions (e.g. Australian Recycling Label logo[8]);
- material content assessment (e.g. PREP[9]);
- whether packaging is marked as "returnable" or "recyclable";
- recycled packaging content percentage; and
- any recycled scheme marked on the pack (e.g. the NZ Soft Plastic Recycling Scheme).

Figure 7: The National Product Catalogue Data Flow

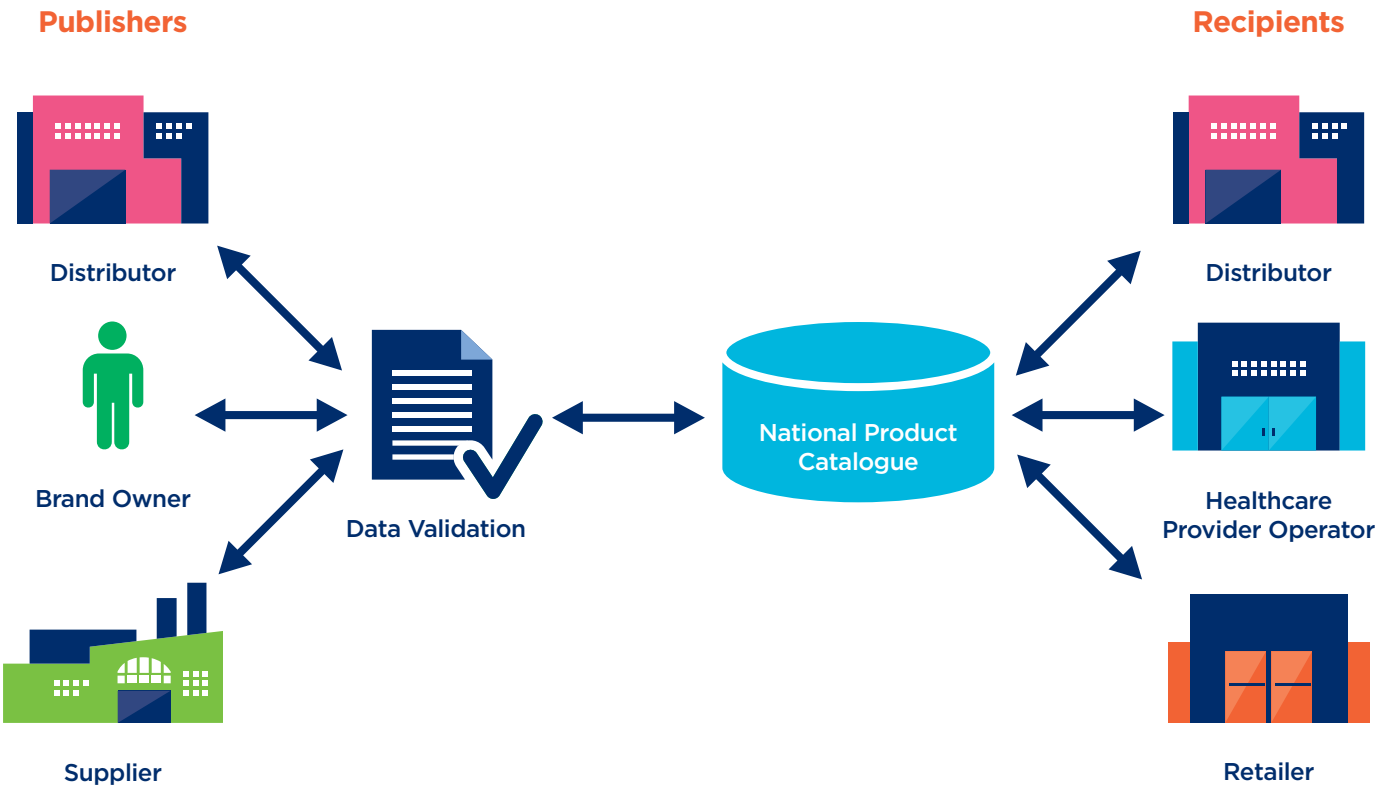
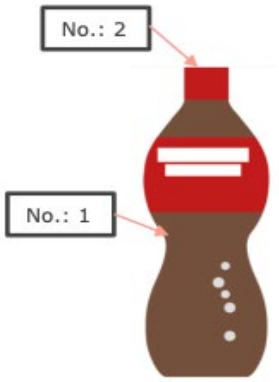


Figure 8: NPC Product Record and Attributes – Bottle of Soft Drink



	Packaging --- No.: 1	Packaging --- No.: 2
packagingTypeCode	BO - Bottle	BO - Bottle
packagingFeatureCode		TWIST_OFF_CAP
packagingMaterialTypeCode	POLYMER_PET	POLYMER_HDPE
PackagingMaterialCompositionQuantity	0.04	0.003
PackagingMaterialCompositionQuantityUOM	KGM	KGM
PackagingRecyclingSchemeCode	1	5
packagingRecyclingProcessTypeCode	RECYCLABLE	
PackagingSustainabilityFeature[0]	REUSABLE	REUSABLE
PackagingSustainabilityFeature[1]	MADE_FROM_RECYCLED_MATERIAL	

Figure 9: Example of Separate Component Level Packaging

Source: Unilever

However, the existing data fields are currently at the product ("trade item") level only – not able to be attributed to individual packaging components. To address this, a trans-Tasman advisory group (the NPC Advisory Group), made up of Australian and New Zealand retailers and suppliers covering food & grocery and general retail sectors, has been collaborating to incorporate additional data attributes for sharing **component level (*separable*) data** for packaging material (see Figure 9).

The Advisory Group has been looking at changes to the technical standard for data in the NPC, based on a new data model that adds plastic attributes for each component – such as material type and recycling information. The new standard aims to use global data attributes as a basis, and add NZ/Australia specific sustainability attributes, such as the number of separately packaged components, additives (such as PFAS or BPA), the addition of Carbon black, Australasian Recycling Label (ARL) Assessment outcome, and post-consumer recycled content percentage.

Typically, a product's **master data** is initially inputted by the brand owner. For plastic packaging, this data comes from the manufacturer of the packaging, and they get their information from the raw material manufacturer. The plastic manufacturer holds this information, and it is shared (e.g. with the brand owner, if different) using a product specification sheet. The brand owner can use this information to indicate sustainability (e.g. recycled content) and re-use or disposal information.

This information then forms part of the product master data and is available for sharing – either via data aggregators (e.g. using an API or uploading the information to an aggregation service system) or directly from a supplier's own system via the web (the Digital Link data sharing standard can do this).

Since 2023, Australian Brand Owners have been able to use the National Product Catalogue to provide data for sustainability reporting via APCO. Specific data fields have been added for this purpose[10].

4. Future Data Needs

This study considers the future data requirements for plastic packaging in New Zealand, including agrichemical containers, some farm plastics, plastic beverage containers, and soft plastic packaging under stewardship or Extended Producer Responsibility (EPR) schemes.

As product stewardship and EPR frameworks develop, suppliers and manufacturers must be able to accurately identify materials and their properties (including recyclability). This is essential for reporting, fee calculation, and compliance monitoring. It is also increasingly important for export readiness, as key overseas markets strengthen packaging requirements.

Although each stewardship scheme is at a different stage of development (and legislative changes are being considered to support an EPR approach) they share a common requirement: the ability to accurately collect and manage diverse data types related to materials placed on the market and recovered.

At a minimum, the required data includes material type, weight and recyclability:

- **Total weight of plastic packaging by resin type** (calculated as item weight × quantity sold)
- **Recovery and processing information**, including recyclability (and causes of non-recyclability to be aware of – such as contamination).

If fees, mandates or differentiated settings are introduced, additional data may be required to determine product eligibility within a scheme and set associated fees, such as:

- Material ownership
- Material origin
- Material function

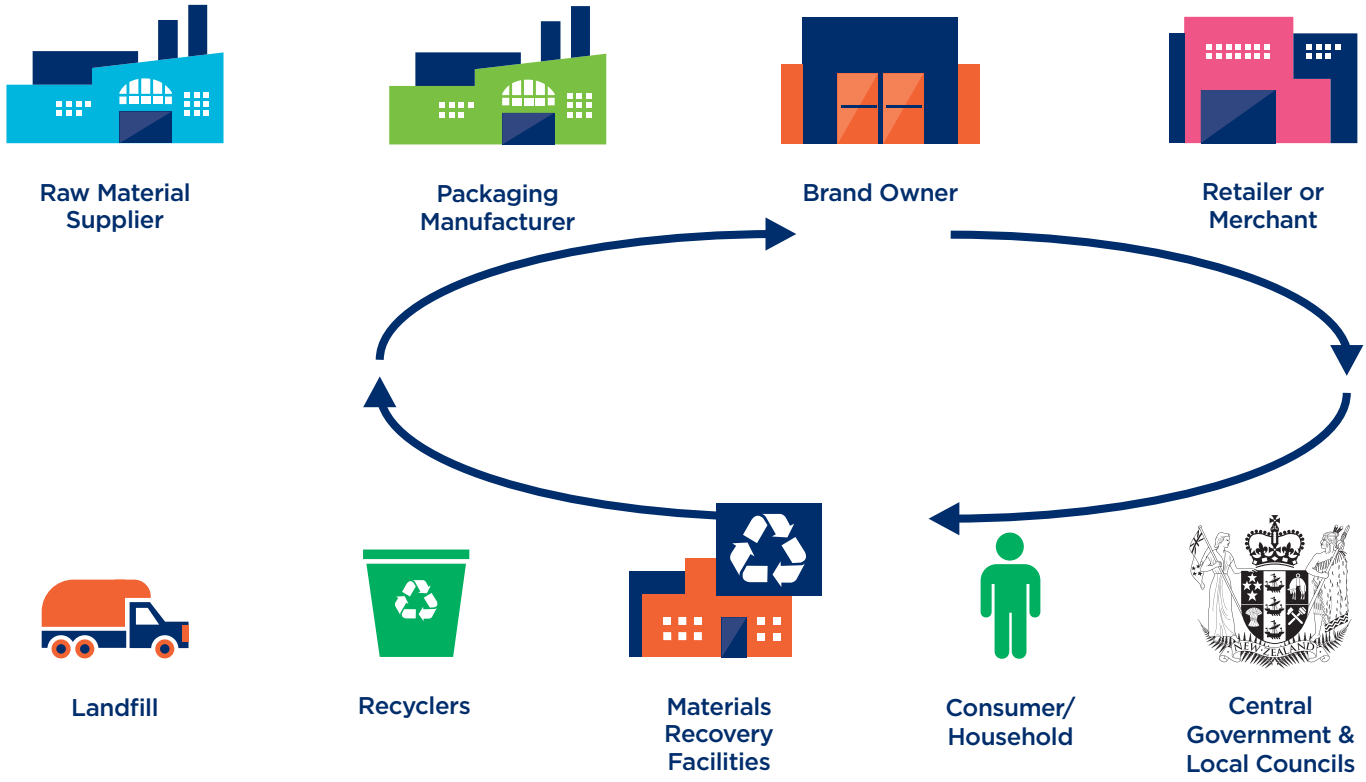
Currently, estimates of plastic mass balances placed on the market (PoM) are derived from aggregate-level surveys. A shift to bottom-up calculations – using product-level data combined with market sales data – would represent a significant improvement, enabling validation of existing aggregate estimates and improving accuracy over time.

There are other potential areas where product-level data could be useful in the future. Mandatory material phase-outs under the *Waste Minimisation Act* could use detailed data on plastic types for reporting and monitoring. Industry standards, such as the Australasian Recycling Label, and international schemes (both mandatory and voluntary) require data for calculating recycling instructions and substantiating claims.

The following sections explore the use of DPPs for future data needs, aligned with the study's purpose: to assess how product packaging data can be identified, captured and shared, including the potential development of a "datahub" to support improved resource efficiency and decision-making across a broad stakeholder base. The table in Appendix 2 summarises the data requirements of different ecosystem participants.

The following diagram is a simple data sharing diagram showing data flows among the main data sharing ecosystem participants.

Figure 10: Packaging Material Data Sharing



Raw material supplier

1. Provides data on material origin, data and certifications.
2. Purchase orders impact production decisions.

Landfill

1. Collect data on types and quantities of material received.

Packaging manufacturer

1. Receives data on material type and recyclability.
2. Purchase orders impact production decisions.
3. Provides data on packaging specifications & sustainability information.

Recyclers

1. Provides data on recycling rates and material quality.

Brand owner

1. Uses data for product labelling, marketing, and sustainability reporting.

Materials Recovery Facilities

1. Collects data on types and quantities of material recovered.

Consumer/Household

1. How & where - recycling at kerbside and in-store collections.
2. Gives feedback to brands and retailers through purchasing decisions, and/or direct interactions.

Retailer or Merchant

1. Uses data for product marketing & sustainability reporting.

Central Government & Local Councils

1. Requires mandatory data reporting.
2. Target-setting and reporting.

4.1. Plastic Packaging Products – data for scheme implementation

Plastic packaging covers an extremely broad scope of products with diverse collection points. Under **product stewardship** schemes, suppliers and manufacturers must be able to accurately identify materials and calculate the mass balance. Making use of existing open global standards will enable scalability and interoperability between different systems and data elements.

The **Plastic Packaging Product Stewardship Scheme Design** proposal describes the views of its stakeholders[11] on the need for national data collection:

The group agreed that a comprehensive national data collection scheme was vital to enable the functioning of a future scheme, including type of resin, colour, quality, collection, reprocessing (and others). The group felt it was critical to have this database developed and in use as early as possible, so that participants in the scheme become assured of its reliability, but also to enable effective forward planning.[12]

There are several common data elements needed in the context of circular decision-making. To determine mandatory reporting requirements and/or the payment of scheme fees, liable parties and material scope need to be defined. In addition, to support recycling infrastructure development, such as collection and sorting locations, and to target education campaigns to reduce material supply and use in the first place, it is useful to know the origin of the material (for example, via an importer, by a brand owner or from food service).

Identification of products, parties and locations, and standardised master data are pre-conditions for scalability, interoperability required by for any hub or distributed system or regulatory intervention.

The New Zealand Business Number (NZBN) is a globally unique business entity identifier that uses a global standard (ISO/IEC 6523). Product information is shared as part of commercial transactions; each product is uniquely identified based on a global standard (ISO/IEC 15459) and 'master data' associated with it is shared between computer systems.

These standards are continuously evolving based on business need. As a result, products made in New Zealand may not yet have master data that includes all the attributes required under an EPR scheme (though this is likely to change over time, particularly as imported products increasingly carry traceability and packaging attributes driven by overseas requirements such as Europe's packaging reforms). The specific data elements required will depend on eventual scheme design, and scheme evolution.

Table 2 describes the types of packaging relevant to a future plastic packaging product stewardship scheme in New Zealand – based on the proposed scheme design. (Everything in this table was within scope for this study's sample data collection, except tertiary packaging such as pallet wrapping).

Once a scheme is operational, information requirements can be extended over time as the scheme matures – e.g. expanding to include a broader range of materials and sectors. For example, to support eco-modulation, early differentiation may focus on recyclable versus non-recyclable materials. Over time, increased granularity is likely to be required to reflect specific packaging and material types and the associated scheme fee differences.

Table 2: Key packaging relevant to plastic packaging stewardship

Data element & rationale	Categories	Examples
Material type – indicates recyclability	Rigid plastic & soft plastic Mono-material plastic Multi-material plastic Bio- degradable plastic Plastic coated fibreboard Other composites containing plastic	• Product packaging uses both PET, HDPE, LDPE, PVC, PP, PS • Plastic coatings and labels • PLA, starch blends • Liquid paperboard • Plastic-coated cans
Function (packaging layers used to distribute goods) – information about market demand & supply	Primary (base consumer pack) packaging and service packaging Secondary (grouped logistics unit) packaging – multipacks & parcel mail Tertiary (transport) Refill away from home Return to producer	• Shampoo bottle, meat tray • In-store clamshells (from a deli) • Courier bags, Meal Kits • Pallet wrapping, strapping • Ecostore soap refillable (in store) • Mecca moisturiser refill
Origin (**of** the plastic **packaging**) – indicates liability; who is placing the product on the market	Product imported by you – the importer Supplied under your brand – Brand Owner Supplied as empty containers Packed or filled by you – the filler Via an online marketplace – e-commerce	• The Warehouse Group • Nestle, supermarket own brand • Importer/distributer • Woolworths (eg, bakery muffins) • Amazon • Restaurant or cafe • Farm supply merchant

4.2. Beverage Container Return Scheme – data for automation

A key goal of a Container/Deposit Return Scheme – often referred to as a Container Return Scheme (CRS) – is to create an uncontaminated stream of targeted material for recycling, raising the value of the materials and increasing the feasibility of container reuse.

Information needed to support the automation of a collection scheme includes:

a. Registration of eligible products with the CRS management agency.
b. Product type and dimensions data for eligibility/ exemption management.
c. Product material type data (including at the component level) to support a variable fee scheme.
d. Container return facilities' data on eligible containers redeemed.
e. Government monitoring of operation and impacts of the scheme.

4.3. Agrecovery Rural Recycling – data for scheme refinement

The AgRecovery Rural Recycling Scheme, officially accredited under the Waste Minimisation Act in 2024, currently has four fully functioning material streams for recycling (agrichemical containers, small seed and feed bags, bale wrap and silage sheets, and large 1T and 500kg fertiliser sacks). As the scheme matures, a greater level of accuracy around material type (including its contents, especially for agrichemicals) and weight may become desirable for the scheme manager (the Product Stewardship Organisation), provided it can be easily and affordably implemented, to support collection planning, accuracy of reporting and material sales.

The Agrichemicals and Containers programme has operated for nearly 20 years, alongside the Plasbak[13] soft plastics scheme focused on bale wrap and other soft farm plastics. The Seed, Feed and Fertiliser Bags programme is newer, with two years of operation. Plastics recovered through these schemes - from agrichemical containers and small bags - are recycled either in New Zealand or offshore. Non-recyclable products are not collected; however, contamination remains a challenge, and contaminated materials are sent to landfill.

Over the past five years, Agrecovery has collaborated with brand owners and recyclers to adjust the composition of small bags to improve recyclability. Recovered materials recycled domestically are currently used in the manufacture of pipes and building products. Local plastics manufacturers such as Astron, Rural Direct, Solo, Flight Plastics and Comspec incorporate recycled plastics into their production processes.

The scheme is currently voluntary, but regulations are being developed that would make participation mandatory. **Under a regulated framework**, those placing targeted products on the New Zealand market (brand owners, domestic manufacturers, importers) will be required to register and pay a stewardship fee to fund a nationwide take-back service for recycling and waste management. Farmers, growers and farm contractors will remain registered with Agrecovery, as they are now, and can choose to participate by recording farm plastics they purchase, removing waste off farm/orchard (by transporting it to a collection site or requesting pick-up), and can request certification that they can use for their own sustainability reporting and disclosure requirements. Packaging suppliers and producers will have compulsory record-keeping and quarterly reporting obligations, with Agrecovery undertaking regular audits.

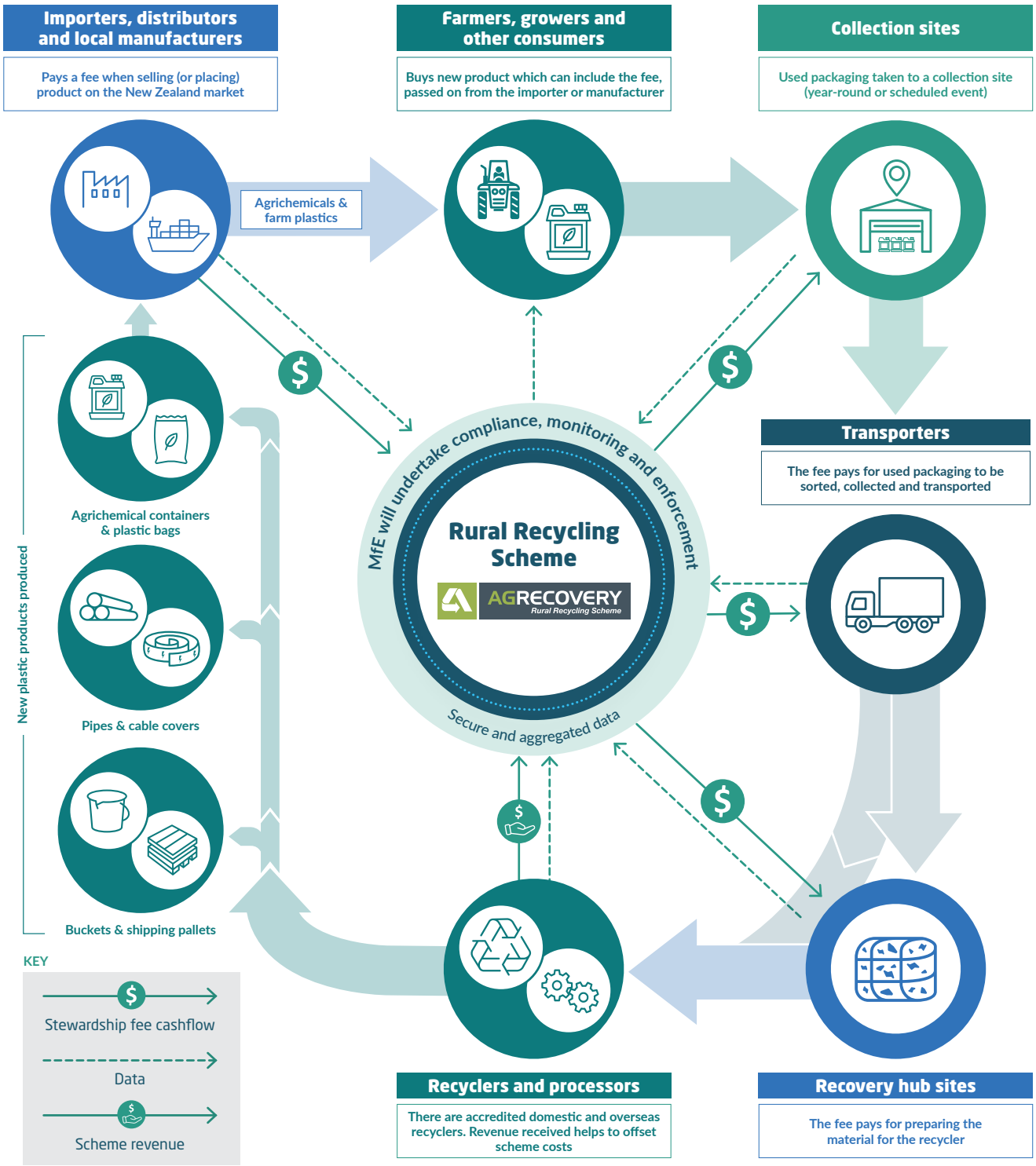
Scheme fees are currently based on estimates of plastic packaging weight, depending on the container size. Producers (distributer, brand owner or manufacturer) register with Agrecovery, self-declare the quantities sold on a quarterly basis, and pay a fee based on container size and weight. An Agrecovery logo is printed on the packaging (or applied as a sticker) to indicate that it is part of the scheme. Eligibility for collection is based on presence of the logo, sighted at farm merchant retail stores and other collection sites, as well as cleanliness of the material (agrichemical containers must be triple-washed and small bags must be clean).

Regulated fees will likely mirror existing voluntary scheme fees:

- Flat fee per container based on size
- Fee for agrichemical content based on ease of disposal
- Lower fees for smaller container sizes - household insect/pest and weed control products
- Flat fee per small bags - seed, feed, and fertiliser bag programme

Under a regulated scheme, the Product Stewardship Organisation (PSO) will be responsible for collecting the fees from producers, reporting to MfE, selling materials to recyclers and re-processors, and disposing waste materials to landfill. The PSO will be required to report regularly to the Ministry for the Environment, which be responsible for monitoring the scheme's effectiveness. The following diagram shows data and cash flows under the new scheme.

Figure 11: Data and cash flows for the Rural Recycling Scheme



Source: Ministry for the Environment and Agrecovery

4.4. Resource & Waste Monitoring – data for accurate reporting

The data needs described above have been in relation to Product Stewardship and Extended Producer Responsibility schemes – data needs for those running, participating in, and overseeing the schemes. The focus of these schemes is on accurate records at the product level – including individual packaging components – to support reporting and fee collection.

Aggregated data is also needed, to enable monitoring and policy development by the government and research organisations. For example, accurate waste data would assist the Government with monitoring its Waste and Resource Efficiency Strategy and for monitoring New Zealand's emissions reduction commitments. The Waste and Resource Efficiency Strategy (2025) sets goals for waste reduction and resource recovery, focusing on reducing landfill waste and improving recycling infrastructure. More consistent packaging data would strengthen monitoring and evaluation over time.

The Parliamentary Commissioner for the Environment[14] has identified a need for more robust environmental information to better manage the environment, including investment in federated environmental data systems. The Commissioner's note[15] recognises that "the benefits of increased sharing and interoperability are facilitated by common standards and systems" (and goes on to reference the National Health Service (NHS) in England as an example of a federated data platform for operational and patient data – GS1 standards are used extensively in the NHS system[16]).

More consistent identifiers and agreed data fields also enable more efficient compliance monitoring over time (including automated checks[17]), because reported information can be validated against consistent reference points and datasets. Reporting requirements under the Waste Minimisation Act 2008 require transparency on recovery rates, landfill disposal, and hazardous waste management.

Another potential driver of data requirements is the United Nations International Legally Binding Instrument on Plastic Pollution (the **Global Plastics Treaty**). Though negotiations have slowed, Treaty discussions have included mechanisms for data collection, reporting, and transparency across the plastics lifecycle. Aligning with open global data standards, including standardised identifiers for plastic types and packaging materials, would facilitate easier data sharing to support these reporting requirements across supply chains.

Local Councils and **Territorial Authorities**, together with community organisations, facilitate and support waste reduction efforts and education campaigns. Local Councils set multi-year plans for municipal waste collection, including sorting facilities and landfill, and are required to report annually to the government. Accurate and comparable data is needed for waste infrastructure investment and planning, promoting and supporting reusable containers as alternatives to single-use plastic packaging, building awareness and fostering change, business development, and research. The new waste legislation being enacted in 2026 will include "strengthening the tools available to monitor and enforce waste legislation and regulations".

4.5. Industry Standards and Guidelines – data for certification

The **Australasian Recycling Label (ARL)**[18] administered by the Australian Packaging Covenant Organisation (APCO) and supported by New Zealand under the leadership of the **Recycling Leadership Forum**[19], uses a standardised assessment framework to determine recyclability. To use the ARL label, packaging is assessed by the Packaging Recyclability Evaluation Portal (the PREP tool) to assess recyclability. APCO uses data provided by suppliers to GS1 Australia and GS1 New Zealand's jointly run NPC, and the PREP tool uses the New Zealand Ministry for the Environment's kerbside recycling guidelines in its assessments. Voluntary schemes are also integrated so that scheme members can apply the ARL on-pack – this happens for the Accredited Soft Plastics Scheme for example.

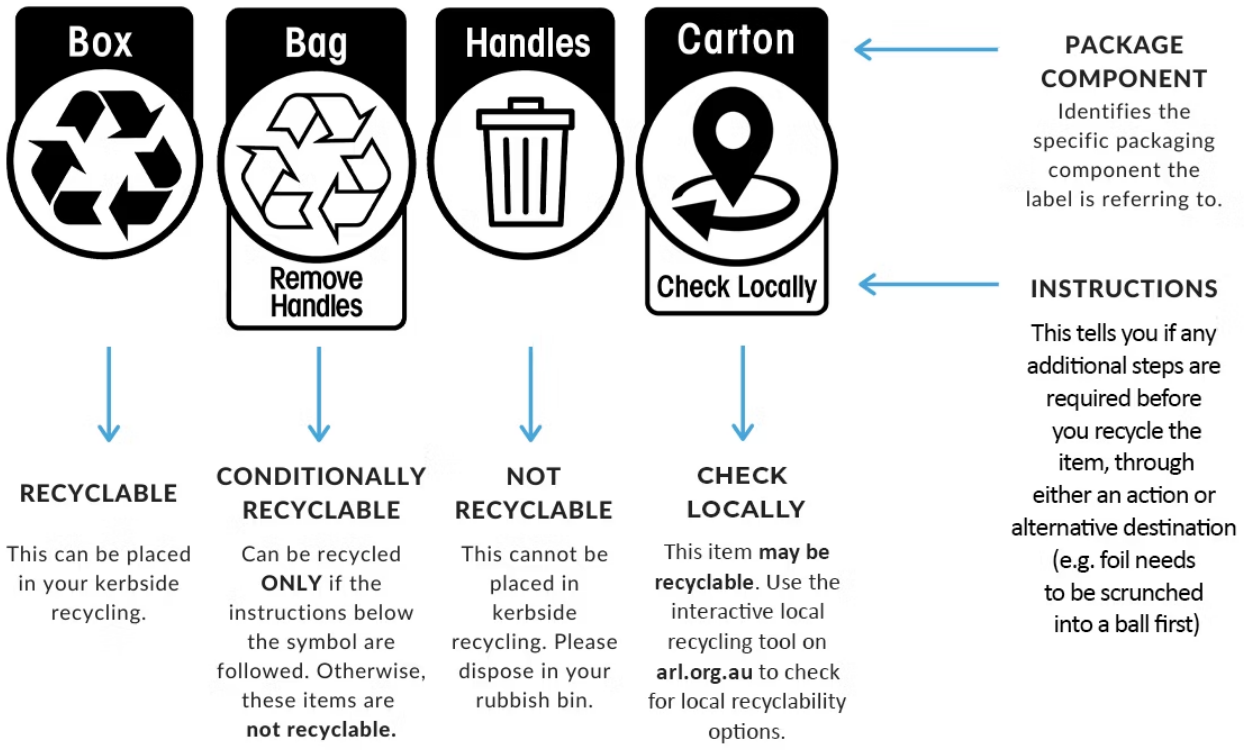
The ARL label (see Figure 12) is found on many food and grocery items in both the Australian and New Zealand markets. APCO has prepared Sustainable Packaging Guidelines[20] to support Australian businesses to design packaging that remains functional while also supporting sustainability goals such as reducing food waste, being recoverable, reusable, or recyclable.

Food businesses may also wish to receive recognition for their sustainability practices through an eco-label. New Zealand's officially recognised eco-label, **Ecochoice Aotearoa**[21] , trade-marked by the Ministry for the Environment, considers minimising packaging and sustainability of materials as part of its certification process.

One metric used for reporting against the **UN's Sustainable Development Goals** is packaging materials used and recovered. In a New Zealand context, such reporting can be used to demonstrate "Zero Waste" government procurement outcomes[22] and to substantiate environmental disclosure statements and product information claims.

To support small businesses to meet these requirements, the **Centre for Sustainable Finance: Toitū Tahua (CSF)** has launched a new resource to help New Zealand's small and medium-sized enterprises (SMEs) navigate the complexities of sustainability reporting[23]. The guide suggest that businesses collect data showing the amount of waste produced (metric tonnes), including the amount of material recycled and the amount sent to landfill, as well as documenting and reporting on reduction targets[24]. Waste audits and assessments – either led by the businesses own policies, as part of a customer requirement, or to meet product or labelling standards – also require data on materials used, reused or recovered.

Figure 12: Australian Recycling Label (ARL)



4.6. Overseas Packaging Regulations – data for compliance

Mandatory and voluntary schemes in other countries also impose data needs on New Zealand businesses. The **European Union's updated Packaging and Packaging Waste Regulation (PPWR)** entered into force on 11 February 2025. The PPWR imposes stringent requirements on businesses across the entire packaging supply chain—ranging from manufacturers and importers to distributors and fulfilment service providers. These businesses must ensure that packaging materials placed on the EU market comply with recyclability standards, reporting obligations, and minimum recycled content targets[25]. Failure to comply will result in products being removed from market rather than fines imposition.

For New Zealand exporters, these requirements can flow through supply chains: EU importers and downstream customers will increasingly require auditable packaging composition data, recycled content substantiation, and credible claims documentation. Without interoperable packaging data, exporters may face higher compliance costs, slower customer onboarding, and increased risk of market-access barriers.

Figure 13: Summary of Data Needs for EU Packaging Regulation

Data Type	Description
Packaging Material Composition	Report the material composition (plastic, glass, metal, paper, textiles, etc.) of the packaging used.
Recyclability Grades	Provide data demonstrating the recyclability grade of packaging (from 'C' to 'A' as per EU standards).
Recycled Content Information	Track and report the percentage of recycled content in packaging (e.g., 30% for plastic bottles by 2030) including safety/provenance compliance for certain types of packaging (e.g. food grade recycled packaging). .
Quantities of Packaging Materials	Document quantities of packaging materials used, broken down by category (glass, plastic, metal, etc.).
Compliance with Hazardous Substance Restrictions	Provide proof that packaging complies with restrictions on harmful substances like PFAS.
Packaging Minimization Data	Show that packaging minimizes weight and volume and avoids deceptive designs (e.g., double walls, false bottoms).
Reusability and Refill Data	Provide information on packaging designed for reuse or refill, particularly for the food-service and beverage sectors.
Labelling Information	Ensure packaging includes required harmonised labels on material composition, recyclability, and reuse.
E-commerce Packaging Compliance	Track and report on packaging used for transport (e.g., cardboard, bubble wrap, or plastic), ensuring compliance with empty space ratio and minimization requirements.

4.6.1 Other global packaging regulations

Regulated sustainability requirements for packaging are being embraced across the globe:

- **Australia**[26] is undergoing major packaging reform: the government is working with stakeholders to establish national recyclability standards, design-for-kerbside-recyclability grading, mandatory recycled content thresholds, and plans to phase out harmful chemicals as part of its circular economy strategy.
- **China**[27] is intensifying its green packaging regulations in 2025, phasing down non-recyclable single-use plastics, introducing stricter over-packaging limits, mandatory recyclability/compostability labelling, and expanding EPR pilots with digital reporting systems. They are also bringing in recycled content targets for non-contact sensitive packaging (i.e. non-food/beverage/medical).
- In **Japan**, the Plastics Resource Circulation Promotion Act[28] now requires PET beverage bottles to contain at least 15% recycled content from 2026 and introduces stricter eco-design rules—like colourless bottles and easily removable labels.
- **South Korea**[29] operates a comprehensive EPR regime under its Recycling Act, which has required producers of packaging—including plastic, paper, glass and metal—to finance and manage take-back, collection, and recycling since 2002.
- **India's**[30] 2024 Plastic Waste Management (Amendment) Rules mandate minimum recycled content in rigid, flexible, and multi-layered plastics starting April 2025, with targets ranging from 30% up to 60% by 2028–29.

4.7. Materials Recovery Facilities – data to enhance sorting

Materials recovery facilities (MRFs) and waste management operators in New Zealand require extensive and precise data to optimise operations and meet regulatory requirements including mandatory data reporting to local councils[31]. Accurate waste composition analysis helps identify the types and quantities of materials processed. This information is crucial for refining sorting processes, adjusting machinery settings, and ensuring that valuable recyclables are recovered efficiently. Without reliable data on incoming waste streams, MRFs may struggle to meet purity standards set by recyclers and manufacturers, leading to contamination issues and reduced market value.

Economic data also shapes decisions for MRFs and waste management providers. Market prices for recovered materials fluctuate, and understanding these trends supports decisions on the financial feasibility of processing specific materials and informs investment strategies and equipment purchases. A national dataset containing detailed packaging attributes, interrogable for trends and material composition, would facilitate better planning and investment decisions.

More accurate data would improve collection and sorting (reducing contamination and improving recovered material value) and provide an aggregated national source of evidence for infrastructure investment.

Current systems vary across New Zealand. Auckland and Christchurch facilities use optical sorting equipment, and barcode scanning could potentially be integrated with these (see Global Case Study in section 6.4 on digital watermarking trials overseas).

Accurate reporting also enables operators to secure funding and meet environmental targets set by local councils and government agencies.

4.8. Where DPPs could help

The table below summarises different use cases for Digital Product Passports and a common national database for plastic packaging attributes in New Zealand.

Figure 14: Areas where DPPs and a national aggregated dataset would be useful

Data Sharing Purpose	Use Cases for DPP/Database
Plastic Packaging Products Extended Producer Responsibility (including a Beverage Container Return Scheme)	1. Product packaging data – for supplier record-keeping, reporting, eligibility and fees. 2. Packaging origin and responsible party identification – business identification linked to products. 3. Collection site record-keeping – for container eligibility, deposit/reward payment, record-keeping and reporting (eg, for beverage container return facilities). 4. Aggregated reporting and performance monitoring - volumes placed on market/imported, collected, recycled onshore, exported, landfilled, and progress against targets.
Rural Recycling Scheme - agricultural chemical containers and small soft plastic bags	1. Packaging product data – for supplier record-keeping, reporting, eligibility and fees. 2. Packaging origin and responsible party identification – business identification linked to products. 3. Collection site record-keeping – for container eligibility, record-keeping and reporting (eg, for container collection sites). 4. Aggregated reporting and performance monitoring - volumes placed on market/imported, collected, recycled onshore, exported, landfilled, and progress against targets.
Resource & Waste Monitoring	1. Aggregated reporting and performance monitoring - volumes placed on market/imported, collected, recycled onshore, exported, landfilled, and progress against targets.
Industry standards and guidelines	1. Packaging recycling instructions and labelling (eg., Australasian Recycling Label and APCO assessment tool (PREP tool)). 2. Product sustainability and recycled content claims (e.g. EcoChoice Aotearoa). 3. Business sustainability reporting (e.g. for finance, disclosures, and Scope 3 targets).
Collection Services and Materials Recovery Facilities	1. Sorting – adding Next Generation barcode scanning to optical sorting equipment. 2. National data collection – use of detailed product database to plan infrastructure investment.
EU Packaging and Packaging Waste Regulation (PPWR)	1. Component level packaging data – unique product identification. 2. Packaging origin and responsible party identification – business identification for supplier declaration accountability. 3. Product sustainability and recycled content – data to substantiate compliance with recycled content and other requirements, including product labelling (including compliance with EU's harmonised labelling requirements).

5. Sample Dataset – plastic packaging in retail

5.1. Summary

To understand what packaging data is realistically available today – and what a scalable national approach would need to handle – the study collected and analysed a sample of 2,000 plastic packaging items used in retail and selected farm environments in New Zealand.

Sample size:

- 2,000 plastic packaged products collected.

Purpose:

- Build an illustrative dataset of plastic packaging attributes to support further analysis and research.
- Demonstrate the range and complexity of plastic packaging currently available in New Zealand retail (and selected farm plastics).
- Test the feasibility of independent data capture, documentation, and validation.
- Identify data gaps and opportunities for improvement, particularly for stewardship/EPR settings and export readiness (e.g. traceability, recycled content substantiations, and credible claims).

Scope:

- Data needs relevant to declared priority products under the Waste Minimisation Act (and therefore required to be managed by product stewardship schemes): plastic packaging and selected farm plastics (agrichemical containers and small bags).
- Plastic beverage containers were included because of likely future relevance, even though the Act treats these separately and work on a Container Return Scheme was put on hold in 2023.

Method:

- Build a dataset of packaging attributes using existing classification and identification systems to test the hypothesis that packaging data can be shared and aggregated by leveraging existing data-sharing infrastructure and global standards.

5.2. Collection Objectives and Scope

The aim of the sample data collection was to establish a practical picture of plastic packaging currently in use, including types and relevant sustainability attributes (e.g. recycled content, recyclability, or reusability claims). This provides insights into what data elements are available now, where the information gaps sit, and what information could be shared using Digital Product Passports (DPPs) and datahubs.

Importantly, this sample dataset was designed as a feasibility and system-design input rather than statistically representative 'national inventory'. Its value lies in demonstrating the breadth of packaging formats and component complexity that a national data approach would need to handle, and in testing whether data can be captured, structured and validated in a way that supports interoperability across supply chains, stewardship schemes, and regulators.

The data collection focused on the requirements for plastic packaging in product stewardship schemes, including retail plastic packaging and selected farm plastics under the Waste Minimisation Act. Plastic beverage containers were included because of stewardship relevance and the likely future need for consistent packaging data should a Container Return Scheme be reactivated.

Data that meets stewardship scheme needs may also serve broader purposes, such as national or business level reporting requirements under a future Global Plastics Treaty (if agreed), substantiating sustainability credentials, meeting voluntary or customer-imposed plastics reduction targets, and supporting Scope 3 emissions analysis. The collection was informed by a desk-based analysis of the data needs of different stakeholders (tested with the Steering Group).

Stewardship schemes typically involve fees paid upfront as part of the purchase price which are used to fund the collection and reprocessing of materials. A container return scheme would normally involve a refundable deposit per item, returned when the container is delivered to an approved collection point. Accuracy in determining the weight of plastic packaging is critical for equitable fee-setting (including eco-modulation), collection planning, and monitoring progress toward targets. Appendix 3 sets out the detailed analysis conducted to determine scope.

To determine which data attributes to collect, the study asked: how could this information support scheme managers (and, in future, EPR settings) to enable efficient resource use and improved recovery outcomes?

Appendix 4 identifies the key packaging attributes in the sample collected.

Data collection targeted attributes that directly support improved recovery outcomes for plastic packaging materials, including:

- Types of resin used for packaging components (all components)
- Colours
- Total packaging weight and component-level weights
- Recyclability information
- Sustainability claims

The goal was to gather a dataset that demonstrates the breadth of materials and the complexity of plastic packaging components across several retail sectors:

- General retail
- Takeaway food service
- Food and grocery
- Farm plastics (agrichemical containers and soft plastics)
- Hardware (DIY and construction-related retail items)
- Online direct-to-consumer purchases

The product collection scope aimed to balance breadth, complexity, and feasibility to support meaningful insights for plastic packaging recovery. Breadth is critical: the collection sought a wide variety of products to reflect the diversity of packaging in the market. Understanding packaging complexity, including the number of components, the mix of materials used, and the key information requirements influencing the design of any data management system is equally important. Given the wider global context of emerging mandatory recycled content requirements – such as in the EU PPWR - the scope also included the 'next layer' of data, such as any recycled content claims.

Study constraints meant prioritising packaging that enters household or farm/orchard waste streams—items purchased at retail and disposed of via kerbside or rural collection centres—rather than attempting to cover all commercial waste streams.

5.3. Collection Methodology

The sample collection was designed to capture a representative sample of plastic packaging currently in use.

Retail items were crowd-sourced from the GS1 team starting February 2025, while farm plastics were collected from Agrecovery centres. Items had to be purchased within the previous six months (where applicable) to ensure currency. The pilot phase in January 2025 tested and refined the data collection process.

Data collection involved physical examination and componentisation of packaging, comprehensive photographic documentation, and standardised data entry aligned with the GS1 classification system. For farm plastics, assumptions were applied where internal components were not visible, and weights were estimated when direct measurement was not possible. Approximately 200 items were sent to the Environmental Innovation Centre from April 2025 for independent validation.

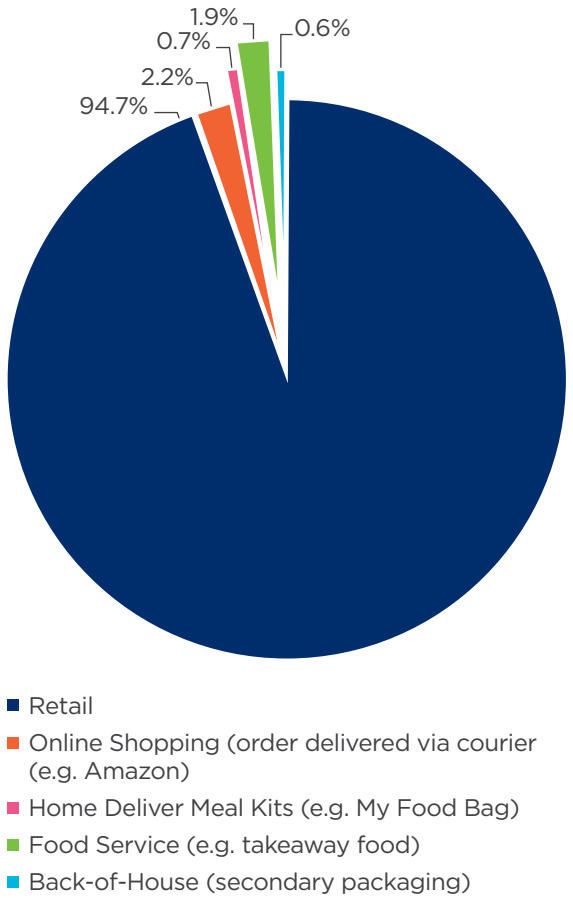
All data underwent quality assurance checks for completeness and consistency, with clear documentation of assumptions and limitations to ensure transparency and support interoperability for future digital integration. A detailed collection methodology is provided in Appendix 5.

5.4. Data sample – key insights

Plastic packaging products were collected from retail including both primary packaging (e.g. from store-purchased, online shopping, home delivered (eg, meal kits), food service) and secondary packaging (eg, packaging outer layers, back-of-house packaging). Feasibility considerations meant that the focus was on products going into either municipal or farm collection streams, rather than commercial waste streams, and tertiary packaging was excluded.

The following pie chart (Figure 15) shows most products collected were from general retail (≈95%). The collection team found it challenging to collect secondary packaging, and the product samples from other sources (online shopping and food service) was very small.

Figure 15: Packaging Origins Collection Distribution



The collection team sought to gather plastic packaging from both the Agrecovery Rural Recycling scheme and plastic packaging from retail that falls within the scope of plastic packaging product stewardship. However, the team found there was very little variation in product offerings and types of bags and containers in the Agrecovery Rural Recycling Scheme. This may be due to a study feasibility consideration – collection sources were limited to those easily accessible from Auckland. However, if packaging materials are nationally consistent, this lack of variation is a good thing from the point of view of recycling. It makes it simpler to find markets for the materials, and easier to provide feedback to suppliers regarding packaging types. Figure 16 shows the split of products collected based on which stewardship scheme it would fall into.

Item metrics collected included type of material (resin number if recorded), packaging format (bag, blister pack, bottle, tub, pot, pouch), number and weight of components, difficulty in disassembling the packaging, and any recycling instructions or sustainability claims on the packaging. As shown in Figure 17, most products in the sample (60%) did not contain any recycling information or sustainability claim. Providing consumers with recycling and sustainability information is a clear area for improvement.

Figure 16: Products Recorded by Stewardship Scheme

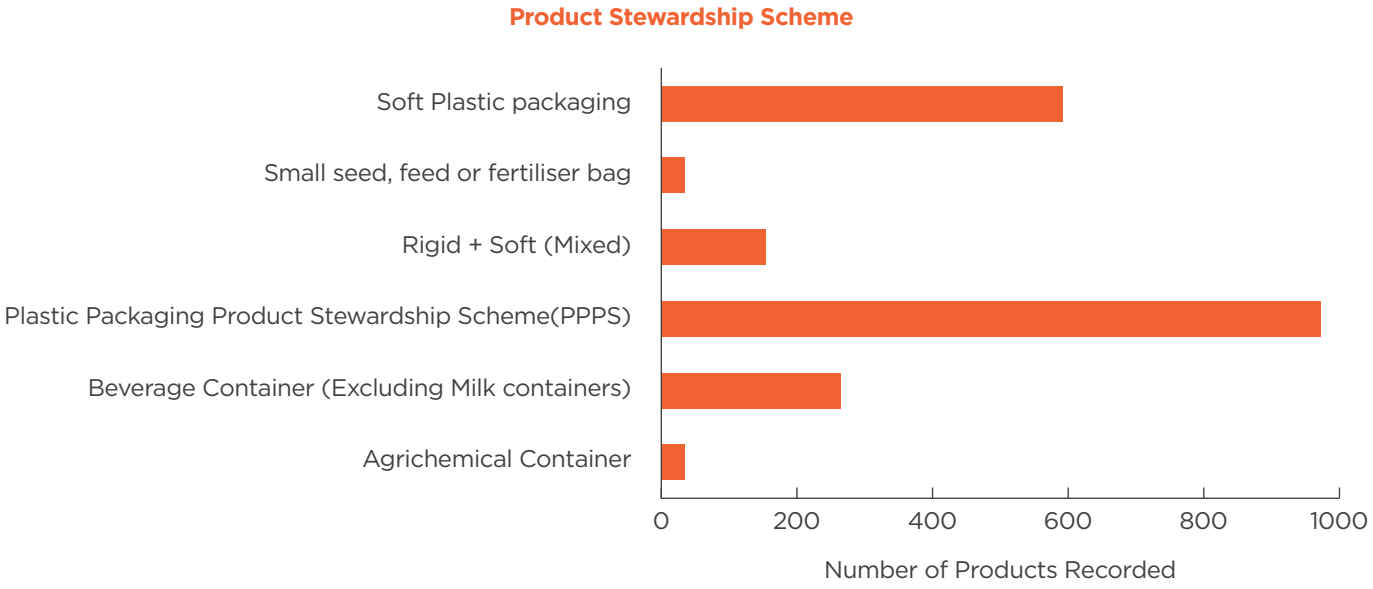
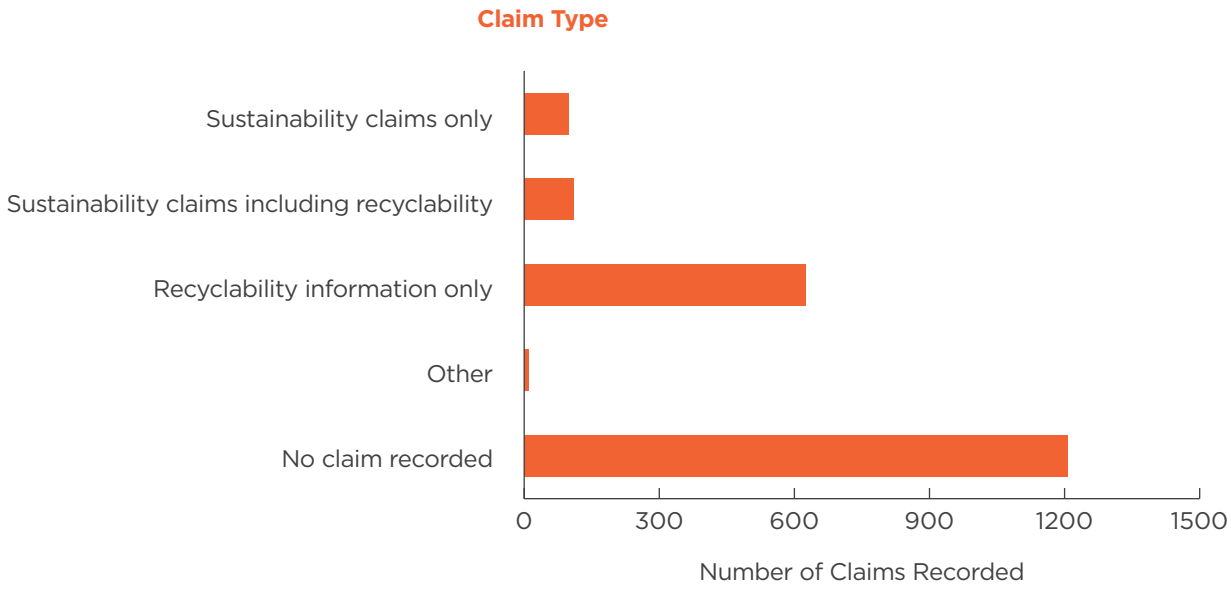


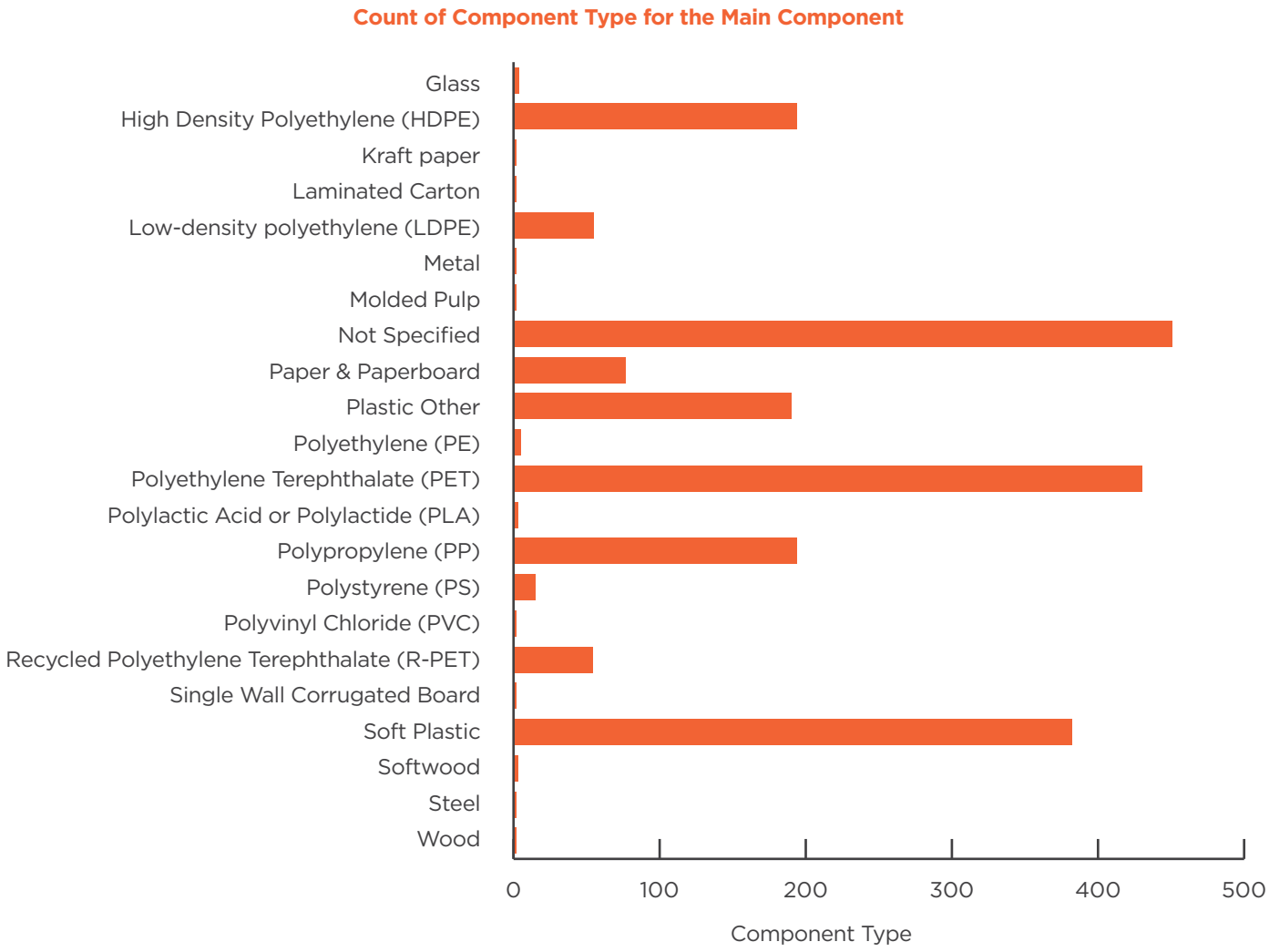
Figure 17: Product Labels – Recorded Claims



A range of colours were observed, with most being clear plastic. The biggest portion of packaging products collected was PET (21%) followed by soft plastics (19%) — likely to be LDPE or PP, as these items were destined for the soft plastic recycling scheme. What stands out is the large number of items with no packaging information to indicate what type of material the main packaging component was made of (23%) (see figure 18).

The collection team did not test each item directly; however, an independent validation sample (~10%) was undertaken by the Environmental Innovation Centre, as a data integrity check.

Figure 18: Packaging Components



5.5. Data Validation – EIC Testing and Findings

A random sample of 201 items was provided for specialised testing by the Environmental Innovation Centre (EIC) using Fourier Transform Infrared (FTIR) spectroscopy. The polymer type or recycling number on the packaging was compared to the FTIR results. **The majority were consistent with the stated polymer type,** although some mismatches were found.

The EIC report notes that 'recyclability' of a product depends on several factors, including understanding the wide variety of plastic polymer(s) that may be used within one single product, ease of product disassembly, and the availability of recycling facilities (and transport/collection systems) for those specific polymers."

Key findings:

- 61% of composite samples need to be disassembled to be recycled according to current national kerbside rules (e.g. lid must be separated)
- 30% of containers sampled were only a single packaging component (eg, a tray)
- 8% of samples were made of multiple parts but were all the same polymer ('No, multicomponent')

To meet current kerbside recycling rules, there is more work that can be done to design packaging with recycling in mind.

5.6. Collection insights and analysis

- Over half of items carried no sustainability or recyclability claims.
- Significant diversity in materials and multicomponent packaging increases complexity for accurate reporting and recyclability evaluation.
- Validation testing identified some discrepancies between on pack identification and tested material properties—underscoring the value of accurate master data and the role of verification approaches to improve data integrity over time, support recovery outcomes and market confidence.

The illustrative dataset is available upon request: please register your interest via the GS1 New Zealand website.

gs1nz.org

6. Roadmap

6.1. Proposed Solution - Summary

More accurate analytics, traceability, and reporting are enabled when packaging data is consistent, comparable, and easy to access. This supports better decision-making by government, industry, and consumers, and enables more meaningful waste minimisation metrics.

A national plastic packaging dataset would also reduce administrative burden by enabling automated data collection, and where appropriate, verification, while supporting more transparent and accountable stewardship of plastic packaging in New Zealand. The study's recommendations are based on the use of global standards. Designing around widely adopted global standards increases interoperability with existing commercial systems and improves the likelihood that New Zealand's approach can align with overseas requirements (including major export markets), without rework.

The recommended approach could be extended over time to other packaging types and priority products (and potentially to products more broadly), to support re-use, repair, and waste reduction. Tyres, textiles, batteries and building materials are examples of product categories where DPPs are being implemented offshore. Existing New Zealand systems already support operational efficiencies using Next Generation barcodes – for example, supporting better stock rotation and early identification of soon-to-expire product – though further opportunities exist (e.g., more efficiently linking supply of withdrawn/recalled food to appropriate demand pathways such as bioenergy or animal feed, where lawful and appropriate).

The key recommendations are:

- **Develop a national dataspace for plastic packaging data sharing** using global standards and systems
- **Use standardised product identification and attribute data formats** to ensure consistency and integration with inventory and waste management systems
- **Leverage data carriers – RFID or Next Generation barcodes with Digital Link technology** – to enable real-time, multi-stakeholder data access to packaging information
- **Build on the existing New Zealand ecosystem** (e.g. GS1 registries and the National Product Catalogue) for interoperability and scalability
- **Enable both centralised and distributed/web-accessible data sharing** via GDSN-compliant data pools and Digital Link technology so data can be shared 'once-to-many'
- **Support Extended Producer Responsibility (EPR) frameworks** that incentivise better packaging design by using detailed packaging attribute information for scheme design, fee-setting (including eco-modulation), and compliance monitoring
- **Provide consumer-facing sustainability information** through Next Generation barcodes to enhance transparency around packaging sustainability, including detailed recycling instructions relevant to the New Zealand context
- **Provide regulatory and policy certainty** about the future direction of material recovery in New Zealand to support investment and innovation
- **Encourage the use of global standards for efficiency** – in both business and government operational processes

6.2. Data Sharing Ecosystem – Concept Design

This study assessed how product packaging data can be **identified, captured and shared**, and how to create a national dataset as part of a data sharing ecosystem. To achieve this, the study findings recommend establishing **a national dataspace** for plastic packaging data sharing in New Zealand, leveraging global data standards and existing systems.

The proposed solution builds on the existing data sharing ecosystem used in the retail sector in Australia and New Zealand (and worldwide), which includes:

- global registries (supporting discovery, visibility and identify verification)
- data aggregation services (supporting data enrichment and 'once-to-many sharing)

These services already enable master data exchange between buyers and sellers and are increasingly used for packaging data and sustainability attributes as well.

A dataspace approach addresses two key challenges at national scale: scalability and data control - allowing multiple datasets to be used together without requiring all data to be centralised into a single database. Product data (including plastic packaging information) can be provided by the Brand Owner and/or accessed from a data carrier on the product (e.g. a Next Generation barcode or RFID). The most appropriate carrier depends on the user and context: Next Generation barcodes are well-suited to consumer and post-consumer use (including recycling instructions), while RFID is typically used for logistics and high-throughput operations.

Data can be shared in real time across supply chains or accessed later using the product's unique identification number. Access controls can be applied so that only authorised users can retrieve specific data. In practice, the data does not need to 'move' into one place – users can access or retrieve if from wherever it is stored (whether in a central data pool, a stewardship scheme database, or a business' own Enterprise Resource Planning (ERP) system).

The key to developing a national dataset is standardised data linked to unique identification. Once there is agreement on consistent definitions for data elements, and attributes are linked to products using unique identifiers, the core components for a national, scalable and interoperable data sharing ecosystem are in place. This is consistent with the approach being taken in the EU and China (see examples in Sections 6.4 and 6.5).

There are various ways to enable sharing, access, substantiation, tracking, and reporting of packaging material types, quantities and provenance (including recycled content) – either within a product stewardship scheme (or schemes) or as broader system infrastructure. To work at a national scale, the ecosystem must support a mix of implementation approaches, so businesses can adopt solutions that fit their operational parameters while still meeting commercial and regulatory incentives.

As described in Section 1.3, the DPP concept is that product data can be accessed via a data carrier on the product itself (such as a Next Generation barcode). The concept is not new, but offshore deployment and regulatory developments – combined with the global rollout of next-generation barcodes – mean New Zealand will increasingly see products carrying digitally accessible product, packaging and sustainability information.

Figure 19: Using the DPP Concept to Create a National Dataset

Key components of the recommended approach include:

- **Standardised Unique Product Identification and Data Formats**: Adopt globally recognised data protocols to support interoperability and consistent data capture. Packaging data for all levels (primary, secondary, tertiary) should be integrated into product master data and linked to unique product identifiers. This enables integration into existing inventory and waste management systems and supports consistent reporting and monitoring against targets.
- **Next-Generation Barcodes with Digital Link Technology**: Use 2D barcodes to enable access to packaging materials and recycling information, and to support real-time updates to information (e.g. where recycling pathways change), without replacing the physical barcode.
- **Centralised and Web-Accessible Data Sharing**: Enable packaging information to be loaded into GDSN-compliant data pools and/or surfaced via Digital Link web addresses embedded in 2D barcodes. This supports 'share once-to-many' data exchange and allows retrieval from business systems or central registries as appropriate.

Unique identification and structured data are the foundational elements and are already largely in place in New Zealand (even if full functionality is not yet realised). These are the key to scalability and interoperability. Multiple data users can access the information in ways that suit them – from fully digitalised automation to manual processes. **Data carriers** provide the link to consumers and post-consumer users. Global identity registries **such as the GS1 Registry Platform (GRP)** enable trusted discovery and verification of product and business identities.

The GRP can also support weblinks to additional product- or location data stored in the suppliers' own repositories (e.g. technical documentation for packaging types). This can support a distributed approach where data remains with the supplier but is discoverable and accessible under defined rules.

The following diagram (Figure 20) illustrates the concept design for a national plastic packaging data sharing data space, building on existing data sharing systems in New Zealand.

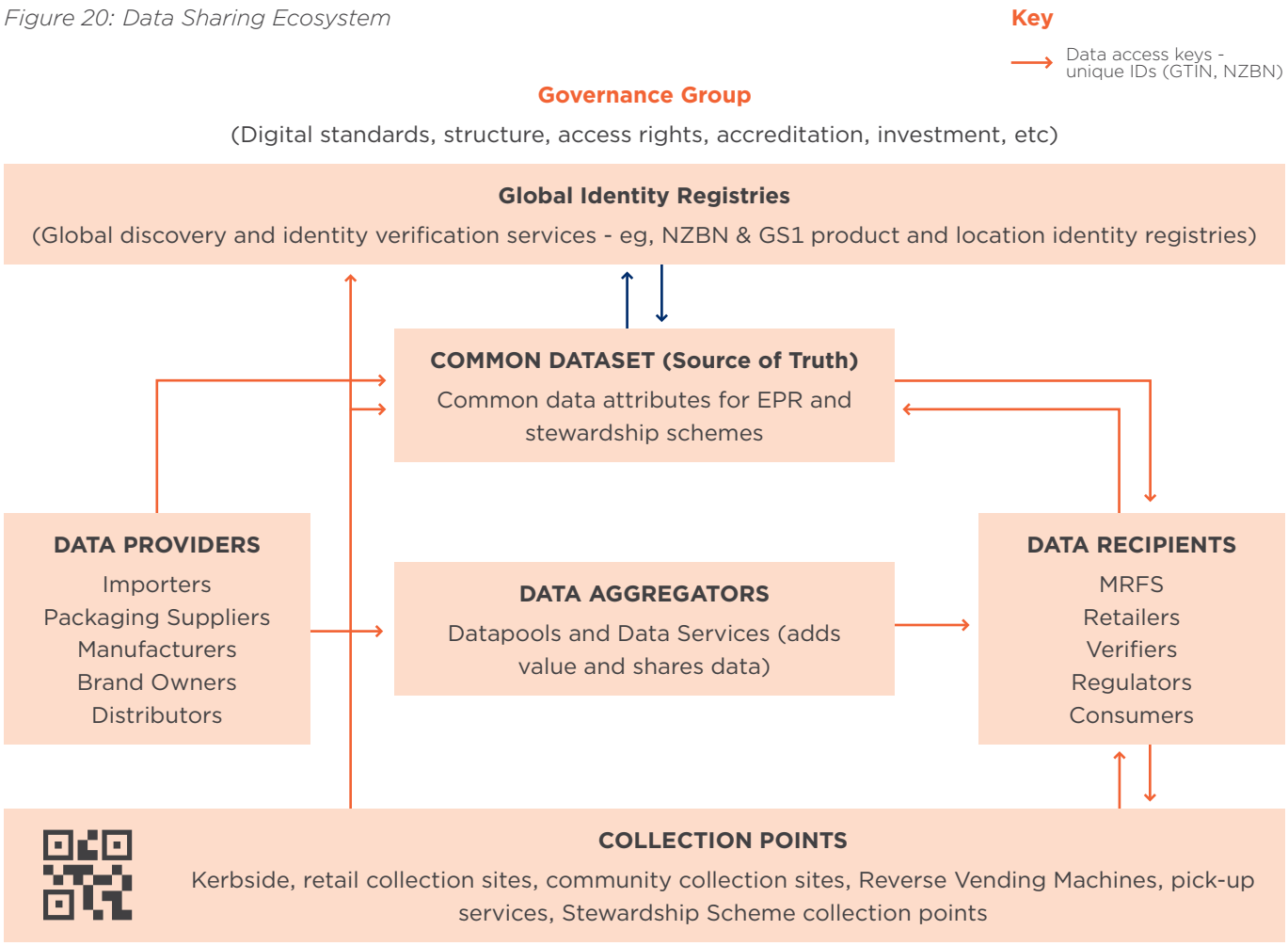
How it would work: Plastic Packaging Resource Management (illustrative)

- **Manufacturer or Brand-Owner** publishes packaging material data (e.g. weight, polymer type, recyclability attributes), linked to globally unique identifiers.
- **Retailers and other supply chain participants** can contribute relevant operational data (e.g. distribution, sales, returns where appropriate)
- **Recyclers and re-processors** can contribute outcome data (e.g. recovery and processing results) where relevant and feasible.
- **Government** and scheme managers can access aggregated, trusted data for:
  - Monitoring Extended Producer Responsibility (EPR) compliance and scheme performance.
  - Designing incentives and investment settings for circular economy outcomes, and
  - Reporting and assessing progress against agreed targets.

Benefits

- **Interoperability:** global standards provide a shared 'language' for product and location identification.
- **Transparency & Traceability:** Data Spaces enable secure, policy-driven access to information.
- **Scalability:** This approach can work across sectors and borders.
- **Regulatory Alignment:** Supports emerging international requirements (including EU PPWR-related information expectations) and improved resource efficiency.

Figure 20: Data Sharing Ecosystem



Source: GS1 NZ

Data Space Participants

As shown in Figure 20, many stakeholders will have multiple roles (both data providers and data users). For simplicity the table describes principal roles only.

The "Common Dataset" is not a centralised database. It is a coordinated set of standardised data elements that can sit across multiple databases but be used as a national dataset because each data point is linked to a unique digital identity (reducing duplication and supporting aggregation).

Table 3: Data Sharing Ecosystem: Stakeholder Roles

Data Sharing Participant	Principal role of key stakeholders
Data Provider	Importer, Packaging Suppliers, Manufacturers, Brand Owners, Distributers
Collection Points	Kerbside, retail collection sites, community collection sites, reverse vending machines, pick-up services, stewardship scheme collection points.
Data Aggregators	Data pools and data services – examples of existing databases (not necessarily with packaging data currently), the National Product Catalogue, On Pack database, Circana, AC Neilson, Reward Schemes, etc.
Data Recipients	MRFs, Retailers, Certifiers and Verifiers (Assure Quality, APCO, Eco Choice Aotearoa), Regulators, Consumers, Customers

This federated approach is consistent with the data sharing foundations described earlier (Section 2): data remains distributed across participants, while a coordinating layer provides common standards, identity management, and interoperability services. This is particularly important where multiple Producer Responsibility Organisations exist and where products may fall under more than one scheme.

With several different 'hands' touching packaging data, opportunities for inaccuracy multiply. The key is linking accurate identification with structured master data, then enabling consistent access and sharing.

This approach is extensible to other stewardship schemes and additional information needs (including labelling). The underlying requirement is use of **standardised data** to support comparability, and interoperability.

6.3. Recommended Implementation Phases – for any scheme

Data providers currently use different methods for data sharing. Depending on their current approach, there are different starting points:

Phase 1: link structured and standardised packaging data to product master data

Product data sheets contain packaging specifications. This information is passed to brands and is used to calculate material quantities, determine recycling instructions and to substantiate sustainability claims. When packaging data is structured and linked to the product identifier (GTIN), it becomes easier to access digitally across the supply chain (including consumers, collection points and re-processors) and aggregate to form a national picture.

Phase 2: deploy Next Generation barcodes with Digital Link on product packaging

The global rollout of Next Generation barcodes with Digital Link technology (2D barcodes) provides a practical mechanism for making packaging data accessible beyond back-office systems. Once packaging data is consistently classified and linked to the GTIN (Phase 1), it can be accessed through the barcode by wholesalers, retailers, consumers and collection sites. This can support recycling guidance, digital deposit return schemes, and potentially future technologies such as digital watermarking.

Phase 3: automate data exchange

Once Phases 1 and 2 are in place, data exchange can be automated. A data user needs only the unique product identifier as the 'key' to access more detailed product information (where authorised and available). Data can be accessed in multiple ways: from a brand owner's system via the web, via a data aggregator, or via a Producer Responsibility Organisation. If unique identification and structured data are used, aggregation and reporting can be supported via ISO Digital Link standards, APIs, or similar machine-to-machine interfaces.

6.4. Plastic Packaging Product Stewardship – Recommended Approach

Based on discussions with plastic packaging product stewardship stakeholders (scheme design participants from the New Zealand food and grocery sector[32]), the preferred solution is one that:

1. **Is global**: meets New Zealand's commercial and regulatory needs while also aligning with overseas regulatory customer requirements (including major export markets).
2. **Builds on existing foundations**: integrates with existing commercial systems rather than requiring entirely new infrastructure.
3. **Works across materials**: supports a broader set of materials, not just plastics, as schemes evolve.
4. **Is interoperable with other product stewardship schemes**: to allow for consistency and comparability. This is especially important if there is more than one Producer Responsibility Organisation and where products may come under more than one scheme.
5. **Is efficient**: supports 'share once-to-many' and machine-readable structured data).
6. **Is reliable**: supports accuracy and reduces manual error, recognising that verification can be designed as risk-based (e.g., stronger checks where incentives for misreporting are higher).

Brand owners noted that NZ's scheme management agencies should ensure packaging/product stewardship data is efficiently managed by leveraging existing datasets to avoid double entry and enable digital labelling (e.g. GS1 Next Generation barcodes - see Section 2: Data Sharing Foundations) rather than taking up valuable label space that competes with health and safety information (such as allergens and ingredients).

"Having a single system across ANZ like what the Packaging Forum want to achieve is ideal. So data can be put in once and then sent to APCO [Australian Packaging Covenant Organisation], NZFGC [NZ Food and Grocery Council], PPPS [Plastic Packaging Product Stewardship], PF [Packaging Forum], Internal reporting etc. Also, would be good to have a way to upload the data in say an XML file if we have an internal system so we again don't have to put in the data more than once."

Brand Owner - R&D Packaging Manager

Depending on each stakeholder's current starting point, the following recommends different actions that can be taken in a phased way.

Phase 1: use barcodes at collection sites and use unique ID to access product master data

Many New Zealand stakeholders are already at Phase 1 – products have unique identifiers linked to master data. Collection sites can scan barcodes to record unique product identifiers and store these in a data management system. Those identifiers can be used to retrieve additional information (where available), such as packaging type and weight.

Unique product identification is widely adopted across multiple sectors globally to support supply chain, procurement, inventory management and product recall. This is true across several sectors relevant to plastic packaging in retail – including building and construction, healthcare, food and grocery and general consumer packaged goods. In New Zealand, this is true for international and domestic brand owners and major retailers.

Some brand owners use proprietary identification systems, limiting external data sharing and comparability. For these stakeholders, adopting globally unique identifiers is a key enabling step.

In other cases, products may have unique identification numbers, but packaging data is not part of product master data, or it may not be provided at the component level.

The PPPS design proposal suggests a scan-back/take-back system whereby targeted materials could be returned to a depot with a small incentive. Barcodes scanned at point of return can automate eligibility checks and counting, reducing human error and enabling aggregation and reporting.

Reverse Vending Machines (RVMs) or automated container return equipment works using product barcodes to identify products for eligible containers. For example, Tomra[33] and Foodstuffs are currently trialling the use of RVMs in an Auckland supermarket[34]. Barcode scanning supports automated identification and reporting.

Phase 2: Next Generation barcodes – digital labelling

Use of Next Generation barcodes is beginning globally, including by New Zealand brand owners. Speed of rollout will depend on demonstrated value. Costs vary depending on operational settings (printing, packaging suppliers, what information needs to be encoded and accessed, and by whom). In some cases where unique identifiers and systems are already in place, the incremental change may be small – for example, adding a web address using the Digital Link standard to provide access to a product page that contains recycling guidance. A key benefit is that the web content can be updated without changing the barcode.

In New Zealand, we are starting to see initiatives such as use of GS1 Next Generation barcodes with Digital Link to create a trade-marked brand and provide consistent consumer information interfaces. The Australia and New Zealand SmartFacts[35] initiative also supports brands and consumers build familiarity with the new technology.

Driven by the Sunrise 2027 initiative, global brands using these barcodes can also be seen on supermarket shelves in New Zealand.

Source: The Mānuka Collective and K10X

Phase 3: automate data exchange

Once data is structured and digitally accessible, automated data exchange becomes possible across commercial and regulatory systems, supporting more efficient compliance and reporting. Data aggregators can access product data using unique identification keys, enhance it with their own data, and create multiple solutions for different stakeholders.

In a New Zealand context, automation could integrate different regulatory systems – for example, by providing data for waste management and other product regulatory systems (eg, hazardous substances registration, building and hardware product imports, product recalls, etc). It could also integrate with commercial systems – for example, the same data could be used by a business to substantiate product recycling labels for a New Zealand market, and to substantiate packaging information required for overseas regulators.

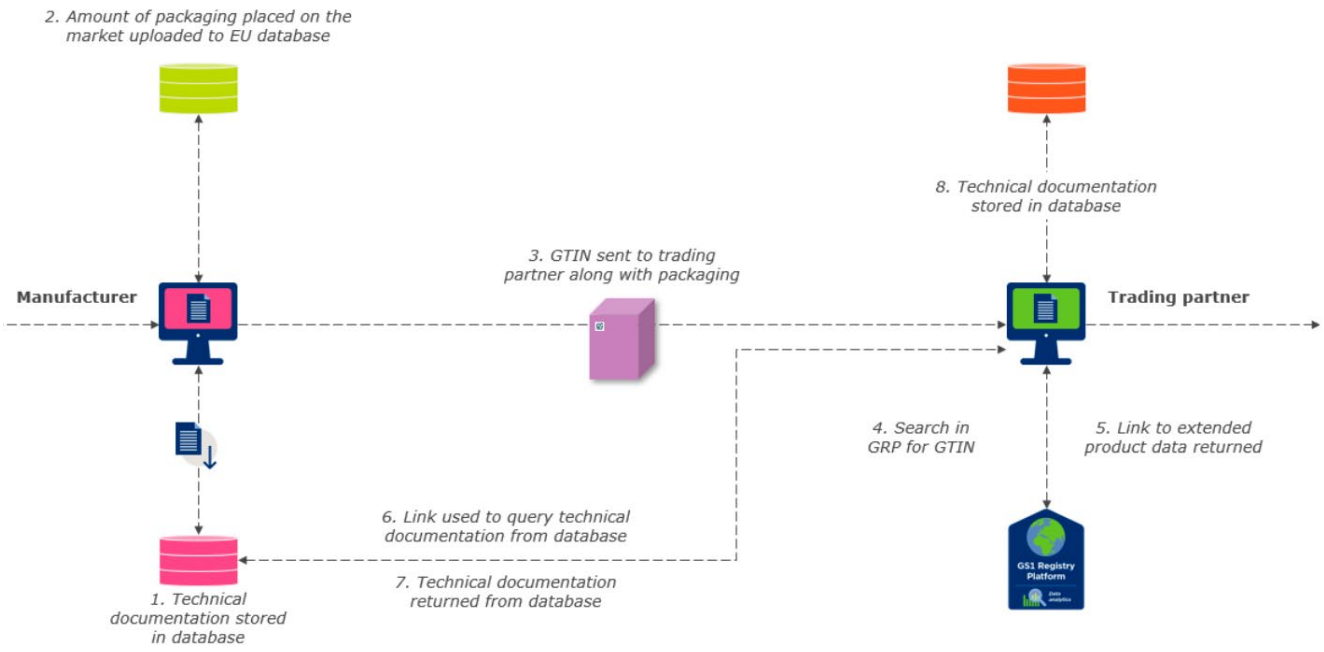
Global Case Studies

Digital watermarks – EU and UK examples

These can support improved purity of material recovery. HolyGrail 2.0[36] is a European cross-industry initiative that is exploring the use of digital watermarks (invisible codes on packaging) for intelligent sorting of packaging waste. Global data standards, including the GTIN and the ISO Digital Link standard, are embedded in digital watermarks to enable accurate identification of material types and recycling requirements, improving sorting accuracy and efficiency and improving purity of material recovery. These watermarks are readable by specialised cameras or scanners and act as a bridge between a product and its data – the unique identification contained on each digital watermark is the 'key', readable by waste sorting technologies, that unlocks detailed recyclability information. Polytag, a UK company, is trialling similar technologies in the UK with its Ecotrace programme[37].

Data Sharing Using Existing Global Infrastructure: EU Packaging Regulation example

Figure 21: How global standards can be used to share data across the supply chain[38]



Digital Deposit Return Schemes – UK trials

Digital Deposit Return Schemes[39] use Next Generation barcodes for product eligibility and return incentives. The consumer scans the barcode of a returned container and receives a digital payment (or other incentive). They could be used by brands to incentivise container returns, or to support initial behaviour change. They may also enable a wider range of collection locations because consumers can return materials using their normal kerbside bins or take products to a collection centre. These augmented barcodes (embedded with product identification on the packaging) determine eligibility and enable the consumer to receive a refund (or other payment/incentive).

All four United Kingdom nations plan to roll out a Deposit Return Scheme for drinks containers in 2027. The Welsh Government has investigated the feasibility of digital deposit return schemes in the UK, including integration into kerbside collections. The Digital DRS Feasibility study[40] concluded that "with the right drivers and adequate timelines, an end-to-end solution could be designed". This is not to underestimate the challenges, particularly around the need for a nationwide coordinated approach. **Polytag** has also conducted DDRS trials using a unique serialised GS1 Digital Link QR code. Customers can scan the product once and get their deposit back. The serialised QR code enables the app to issue the deposit securely, as they can only be scanned once per item[41].

6.5. Agrecovery Rural Recycling Scheme – Recommended Approach

The Agrecovery Rural Recycling Scheme is designed for rural needs with drop-off and on-site collection options. There is less variation in the bags and containers, making it simpler to find post-consumer material markets and to highlight products that could benefit from packaging redesign. Similar systems to those in Section 6.4 would improve scheme efficiency and resource recovery and would allow for data to be compared across different sectors and schemes, supporting national data aggregation.

More accurate identification of materials (including weight and, where relevant, content information) would support fee setting, reporting accuracy, material recovery planning, and eco-modulation aligned to recyclability.

As with retail packaging, suppliers and brand owners use different methods for data sharing, so a phased approach is appropriate.

Phase 1: Use barcodes at collection sites and use unique ID to access product master data

Under the regulated scheme, participation will be mandatory and fees will be collected from all products within scope. Unique identification makes this process easier. Products imported into New Zealand already have unique identification numbers for supply chain management purposes. This identification number provides access to the product's master data, including its packaging data (if provided by the supplier – the scheme manager could make this a requirement under the mandatory scheme). If the product has come from Europe, this data (such as material type and weight) is already likely to be included in the product master data (this would need to be investigated and confirmed) or will become available over time due to European law changes (including both the Ecodesign for Sustainable Products Regulation and the Packaging and Packaging Waste Regulation).

Collecting this information for both reporting and fee collection/setting purposes is relatively simple: require imported products to declare the product identifier (the GTIN) on the import documentation (NZ Customs requires this for certain products already). Individual numbers can be looked up on the global registry (for free) or more sophisticated systems can be set up that provides a much larger dataset for interrogation.

Unlike other retail sectors, globally unique product identification is not yet widely used by New Zealand farm retailers. Where products do not have globally unique identifiers, data capture is still possible, but interoperability and scalability are more difficult as it means seeking the information from each separate system.

To use globally unique identification numbers there is a cost involved – usually an annual membership fee. The business case will depend on the market dynamics for each supplier and the range of benefits that having a globally unique identification number generates. However, benefits can be significant – ranging from retailer demand and incentives to supply chain and logistics efficiencies. It is these operational efficiency drivers that have led to the uptake of digital standards in global retail supply chains.

Take-back scheme – barcode scanning at collection sites

The Agrecovery Rural Recycling Scheme involves a container take-back scheme. Eligible products display a logo on the packaging which tells consumers that the container can be returned to a collection centre. Barcode scanning at collection points could be added to automatically record returns, store product identifiers to enable later data retrieval (where available as part of master data), and reduce manual error.

Phase 2: Next Generation (2D) barcodes – digital labelling

Wider use of unique identifiers in farm retail would allow modern digital labelling alongside the existing Agrecovery logo, enabling consumer engagement, recycling instructions, potential incentive models, and improved data capture at collection points.

This technology is a simple addition if the supplier is already using globally unique identifiers, and it is possible to do both Phase 1 and Phase 2 at the same time – Brand Owners could start using unique identifiers with Next Generation barcodes. Costs depend on the information being encoded into the barcode during printing (eg, batch number), existing printing systems and equipment and desired functionality. RFID or other tag technologies may be appropriate instead of barcodes in specific settings.

Phase 3: automate data exchange

Once data is structured and digitally accessible, automated data exchange becomes possible across commercial and regulatory systems, supporting more efficient compliance and reporting. For example, in the farm plastics context, combining hazardous substances or agricultural chemicals registration with on-farm nutrient management and commercial sustainability requirements could all be done digitally, enabling data to be shared once, to many. Being able to share relevant data between systems becomes possible once you're at Phase 3.

Global Case Study

Automation and scalability - a centralised national data ecosystem

This is the level of data exchange that **China** is currently adopting with its **National Smart Agriculture Action Plan**[43]. The aim is to create new digital platforms, improve efficiency, and digitalise data collection throughout the supply chain. In this way, data is seen as a national utility. The Chinese Government intends to build a national agricultural big data platform by 2028 – and it is built on standardised data systems to ensure consistency of information[44].

How could it work?

Agrecovery estimates that they are recovering 50-60% of hard plastics from the agrichemical container scheme. The goal is to improve that figure.[42] One way to do this is for Brands to create incentives and education campaigns to improve their material recovery rates.

Next generation (2D) barcodes could also be used for this purpose. The supplier (data provider) deploys 2D barcodes that include Digital Link technology which means that the container is linked to the unique product identifier. At the collection point the consumer scans the barcode with their smartphone and receives a reward from the brand owner (for example, discount points). Such systems require serialised barcodes, meaning a change in packaging or label printing is required, plus a software system to handle the reward or payment scheme – so each business would need to carefully consider cost-effectiveness.

6.6. What is Needed to Drive Change

Uptake of globally unique identification (particularly in farm retail) and wider deployment of next generation barcodes (digital labels) would improve access to recycling instructions and sustainability data for consumers, regulators and businesses involved in the material recovery market – addressing a key information gap. **For this to occur at scale, it must be cost-effective and the right incentives need to be in place.**

The supplier needs certainty that it is a requirement (either commercial or regulatory) and that it will bring net benefits, to invest in the necessary software and hardware upgrades. From a business perspective this requires confidence in the policy direction. Uncertainty reduces innovation and investment.

Packaging data requirements are increasingly being driven by regulation and by customer expectations to substantiate claims and verify compliance (in New Zealand and overseas). High-quality aggregated data is also needed to monitor trends and assess progress against targets.

In New Zealand regulated data requirements are currently limited (e.g. waste reporting requirements on Territorial Authorities). A **mandated transparency requirement** – such as through regulated product stewardship – requiring records and regular reporting on packaging materials placed on market and recovered, would be a huge next step. This need not be onerous or costly, and the effort required depends on each business's starting point. Where globally unique identification is already in place and packaging attributes are part of master data, retaining records and reporting can be largely automated.

These existing data sharing methods are not always well understood outside the supply chain community. The key is putting incentives in place for brand owners and suppliers to provide packaging information as part of master data, using standardised fields. If it is in their interests to do so (e.g. to fulfil a compliance requirement for industry or government), it is easy to share the information once it has been inputted by the data provider. The regulator can used scaled approaches to regulatory systems design – it need not be a mandated or onerous obligation. **Guidance instructions on the use of open global digital standards** (if cost-effective for the business to do so) would encourage adoption and open the possibility of **standardised reporting**, leading to more cost-effective system monitoring.

This approach is already becoming necessary for businesses seeking to maintain access to overseas markets. The EU's new packaging requirements begin applying from 2026 with increasing sustainability expectations (e.g. recycled content). Australia has also agreed to a co-regulatory framework for packaging that include sustainable packaging guidelines.[45] China and other Asian economies are moving fast in this area too. Packaging rules are now a feature of market requirements that must be planned for – packaging design and packaging materials are now core in-market regulatory requirements.

Beyond transparency, two further issues are critical: data security and currency – ensuring access is appropriately controlled and that data is kept up to date. These are necessary to maintain trust.

6.7. Proposed Ecosystem – Systems Upgrades

The recommendation is to build on existing data sharing systems for plastic packaging (including food and beverage sector and relevant farm plastics) –to support enhanced data sharing functionality. With minimal enhancements and the right incentives, it is possible to achieve national-level access to consistent and comparable packaging data.

Recommended Actions

Several process and systems upgrades would support a national data sharing ecosystem:

- **Data Providers**: agreement by industry on how to classify packaging materials – to ensure interoperability of data terms; share packaging data using existing systems; plan for next generation barcode functionality where relevant.
- **Data Aggregators**: align to the same classification system and use globally unique product identifiers to access master data; consider using global identity services to support verification and synchronisation.
- **Data Recipients**: identify which access methods best suit operational needs and which data aggregation services may be appropriate.
- **Collection Points**: track next generation barcode roll-out and plan for future scanning capability.
- **Data Governance**: establish an ecosystem governance structure focused on data sharing and interoperability, avoiding siloed or proprietary approaches that increase future costs.

The National Product Catalogue

The Australia New Zealand National Product Catalogue (can hold packaging data at a product level but not at a component level currently). Planning is underway to incorporate component level packaging data (i.e. separable components of packaging such as the bottle, label, screw cap etc). This Trans-Tasman initiative (led by GS1 Australia and New Zealand) is currently on hold, awaiting greater regulatory clarity in NZ and Australia.

Component-level data would enable more accurate material counting and analysis. GS1 New Zealand and GS1 Australia have done detailed preparatory work to support separable component capture, enabling a more granular national dataset using existing data synchronisation systems.

Additional upgrades could include the addition of Digital Links to support web-based access, and APIs to enable automated dataflows to new organisations (e.g. stewardship scheme operators, regulators, or certifiers).

Global Case Study

Packaging Data Service

GS1 Denmark has developed a new service called GS1 TradePackaging[46] to assist producers meet EU producer responsibility scheme requirements by keeping track of and calculating their packaging volumes. The system links to the GDSN local data pool or connects directly to a manufacturer's Enterprise Resource Planning system to retrieve the packaging content and completes the calculation – including pulling industry sales data to calculate Placed on Market material tonnage. The calculation is sent to the local Producer Responsibility Organisation, which calculates the fees payable under the scheme. The packaging data can also be linked to the product and shared to all suppliers, along with all the other product data. Data is classified using the GDSN classifications, allowing it to be linked easily, and shared with many recipients (while the supplier need only enter the information once).

6.8. Recommended Next Steps

The following are the recommended next steps for core data ecosystem participants:

- **Scheme owners** (e.g. Agrecovery and PPPS scheme designers/owners) **should agree on core data terms** using globally aligned classification for plastic types and GDSN data dictionary attributes (Packaging Type, Packaging Function, Packaging Component Type). This allows IT systems and data entry forms to be structured around agreed terms, supporting aggregation, comparability, and reporting against targets.
- **Retailers** (particularly farm merchant stores) **should incorporate GTINs into business systems where not already** in place and incentivise suppliers to provide packaging data as part of product master data. Many rural retailers have their own brands and may act as collection points; packaging returned to collection points may not be their own brands, so sector-wide identifiers enable scalable data capture
- **Regulators should incorporate global identification standards into regulatory guidance** for fee collection, compliance, and reporting, referencing phased implementation approaches to minimise burden and leverage existing commercial systems.
- **Retailers** already using GTINs (most consumer goods), **should incentivise suppliers to provide packaging at component level** to support accuracy and reuse of data for scheme and compliance needs and prepare scanning equipment for the roll-out of Next Generation Barcodes.
- **Brand Owners should plan the transition to Next Generation Barcodes.** This can be done in a phased way, with the simple inclusion of next generation barcodes alongside traditional linear ones. Additional functionality can be added over time such as providing consumers with packaging information and recycling instructions on product information pages using the Digital Link standard. Over time this will support packaging reuse and waste reduction by sharing clear and component-specific instructions. It will also enable export readiness through the sharing of compliance information.

A practical way to bring all these recommendations together is to conduct a data sharing pilot. An industry collaboration to discover and demonstrate the practical steps required for data providers and data recipients to share packaging data in this way would help to identify costs and benefits and build a business case.

7. References/Bibliography

Australian Packaging Covenant Organisation (APCO) and GS1 Australia partnership.
Simplify reporting requirements 2025

APCO.
Sustainable Packaging Guidelines

Australasian Recycling Label (ARL).
https://www.arl.org.au

Bioleader®.
China's Green Packaging Regulations 2025: A Complete Guide for Brands and Manufacturers

Buoyancy Plastics for Change Recycling Private Limited, India.
Japan's 15% PET Bottle Rule Is Redefining Circularity and Forcing the World to Rethink How (and Who) Makes Recycling Possible

Centre for Sustainable Finance, New Zealand.
Starter for Ten – Metrics Guide for SMEs.

Centre for International Economics (CIE), Australia.
The impact and value of supply chain standards on the Australian economy 2025

Department of Climate Change, Energy, the Environment and Water (DCCEEW) Australia.
Reforming Packaging Regulation.

Eco Choice Aotearoa.
https://ecochoiceaotearoa.org.nz/new-zealands-offical-ecolabel/our-story

End Food Waste, Cooperative Research Centre, Australia.
Save Food Packaging Design Criteria Resource Booklet

European Commission. Common European Data Spaces.
Strategy and Policy Paper

European Union - EUR-Lex Access to European Union law.
Official Journal L 40 2025

GS1 Sweden.
EU Packaging and Packaging Waste Regulation (PPWR)

GS1 Denmark - Trade Packaging.
Efficient declaration of packaging data

GS1 Global.
Digital Link and JSONLD documentation.
Radio Frequency Identification (RFID)

GS1 UK.
Compliance Specification for the NHS
A critical juncture for DRS (Deposit return schemes) in the UK

HolyGrail 2.0.
Pioneering Digital Watermarks Initiative for Smart Packaging Recycling in the EU
HolyGrail 2.0 – ECO Trace demonstration

International Data Spaces Association.
IDSA Rulebook – Guiding Principles

Korea International Trade Association (KITA)
Smart BRIDGE to the Future Trade

Ministry of Foreign Affairs and Trade, New Zealand. Market Intelligence report.
New EU rules on packaging and waste will transform its Supply Chain - March 2025

Ministry for the Environment, New Zealand.
Rethinking Plastics in Aotearoa, New Zealand.
The New Zealand Container Return Scheme Design 2020
Product stewardship agrichemicals, containers and farm plastics
Territorial Authority Waste Data & Levy Reporting Obligations.
Waste and Resource Efficiency Strategy
Cabinet paper – policy amendments and Minute of Decision 2025

Foodstuffs, New Zealand - New World case study
New Zealand's first reverse vending machine launch

New Zealand Food & Grocery Council.
https://www.fgc.org.nz

The New Zealand Gazette - The official Government newspaper and authoritative journal of constitutional record.
Declaration of Priority Products Notice 2020go3343.

Nirmal Vasundhara Private Limited – Waste Tracker.
Recycled Plastic Use Becomes Mandatory: Here's What You Need to Know

OECD Environment Working Papers, 2024.
Digital Technologies for Better Enforcement of Waste Regulation and Elimination of Waste Crime. Environment Working Paper No.234

Packaging Recyclability Evaluation Portal (PREP), Australia - online platform
https://prep.org.au

Parliamentary Commissioner for the Environment, New Zealand.
Federated Environmental Information System Note (April 2025)
A Federated System to Improve Environmental Information

Plastic Packaging Product Stewardship Scheme, New Zealand.
https://ppps.org.nz/who-are-we

RELOOP. Digital deposit return systems: What you need to know (2024)
Digital DRS Fact Sheet (2024).

Regional Knowledge Centre for Marine Plastic Debris Economic Research Institute for ASEAN and East Asia (ERIA)
South Korea - Extended Producer Responsibility (EPR) for Plastics and Packaging

SGS New Zealand
EU Issues New Legislation for Packaging and Packaging Waste

Smart Facts - harmonised 'digital product labels' for the Australian and New Zealand food and grocery sectors.
https://www.smartfacts.org.au

Sovereign Magazine.
China's Agricultural New Infrastructure.

TOMRA - Container Markings & Barcodes.
Deposit Return Systems

The Post (NZ) - Brickbats and Bouquets
Mix Product Stewardship Schemes (2025).

Valpak - Research August 2023 - James Skidmore, Dr Hugh McCoach, Zoe Goodman, Shannon Moxham, Dr Rachel Stirrup and Max Grimshaw
Research to Support the Co-design of a Plastic Packaging Product Stewardship Scheme for New Zealand.

Vietnam DPP regulation
Vietnam adopts amended Law on Product and Goods Quality

USDA - Foreign Agricultural Service
China: National Smart Agriculture Action Plan Published

Welsh Government - Deposit Return Scheme for Wales
Evaluation of Digital Technology in a Deposit Return Scheme

Appendix 1: Key GS1 standards and services

Global Trade Item Number (GTIN)

The GTIN is a unique identifier for products, allowing for precise tracking and inventory management. The type of plastic packaging (or any other material) is an attribute associated with the product and part of its master data (for example, the bottle, cap and label of a Coca Cola bottle as well as the cardboard box containing multiple bottles).

GS1 Barcodes

Barcodes are data carriers, enabling access to the data associated with the product or group of products it is attached to. GS1's standard linear barcode (top left) has been used for retail for 50 years. GS1 also has standards for Next Generation Barcodes – the GS1 DataMatrix (bottom left) and the GS1 QR Code with Digital Link (top right).

GS1 QR Code with Digital Link:

This latest Next Generation Barcode enables a GS1 QR Code to link to multiple websites. It is an open-source digital standard that provides scalable access to dynamic distributed data (ISO/IEC 18975: 2024). It uses standardised structured data elements, works at retail Point of Sale (POS) and is "native" to smartphones, meaning that it can be read by using the phone's camera (no app is needed). GS1 members globally are beginning to roll out the use of this standard. A GS1 DataMatrix can perform the same functions but is limited by the fact most smartphones cannot read a DataMatrix.

Global Data Synchronisation Network (GDSN):

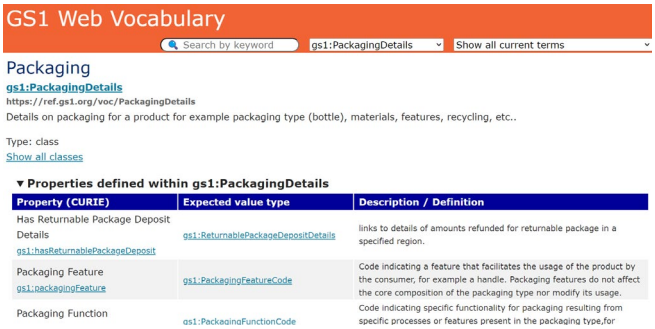
GDSN enables real-time sharing of product data among trading partners, ensuring that all stakeholders have access to accurate and updated information regarding product specifications, logistic and merchandising data and includes material type and recyclability. In New Zealand (and Australia) the GDSN operates as the National Product Catalogue (NPC) and holds master data on almost 1.5 million unique trade items, servicing recipients across New Zealand and Australia, sourcing data from more than 2,000 suppliers across both markets. To enable this data synchronisation GS1 has established extensive global product master data standards to determine how specific elements and features of trade items are described and classified.

NPC Online Data Dictionary link here

GS1 Web Vocabulary:

As an alternative to data sharing through the GDSN (where data is exchanged between data pools), the GS1 Web Vocabulary enables data on the Web to be visible and linked to a product as part of a data stack of information. It is a simple low-cost mechanism for the exchange or retrieval of structured master data as Linked Data / JSON-LD, via simple Web requests, also with the option to embed such data within Web pages, so that it's available to search engines, artificial intelligence crawlers etc. A smartphone app can scan a 2D barcode, read a GS1 Digital Link URI and then make a Web request for the data.

https://ref.gs1.org/voc/



EPCIS – Event Tracking

Can be used to track and trace products through the supply chain including packaging lifecycle events such as production, distribution, recycling, and disposal events.

Allows real-time updates and consumer transparency. Smart contracts can automate EPR compliance and sustainability verification.

Appendix 2: Data needs of different ecosystem participants

Stakeholder	Plastic Packaging Data Needs
Raw Material Suppliers and/or distributers	Required for processing: • Type of plastic resin supplied (e.g., PET, HDPE, LDPE, PP, PS, bioplastics) • % of recycled vs virgin plastic content • Source of raw materials (e.g., fossil-based, bio-based, recycled sources) • Chemical additives used and their impact on recyclability If required for traceability: • Compliance with sustainability guides and certifications (e.g. APCO's Sustainable Packaging Guidelines, or the International Sustainability & Carbon Certification) • Carbon footprint and energy consumption in resin production.
Plastic Packaging Manufacturers	• Material durability and barrier properties for product protection • Demand forecasting for different types of plastic packaging • Biodegradability and compostability data (where applicable).
Product Manufacturers, Fillers and Brand Owners	• Design for recyclability (e.g., see the Save Food Packaging Design Criteria Resource Booklet[47]) • Compliance with food safety and other regulatory requirements (e.g. FSANZ standards, NZ Food Act) • Meeting business and industry food waste and sustainable packaging targets • Production efficiency and waste reduction metrics.
Product Stewardship Scheme Owners	• Material type and weight per unit of product – to calculate fees. • Recyclability of material types – to determine fees and set eco-modulated rates • Business identity to manage compliance and charge fees.
Retailers	• Plastic packaging inventory levels and stock management • Cost analysis of recycled vs. virgin plastic packaging • Consumer demand and feedback on sustainable plastic packaging • Supplier sustainability compliance (e.g., use of recycled plastic, circular economy commitments) • Return logistics data for reusable plastic packaging (e.g., refillable bottles, deposit-return schemes).
Consumers	• Clear disposal and recycling instructions for plastic packaging • Information on whether packaging is recyclable, reusable, or compostable to support purchasing decisions • Transparency on plastic content (e.g., "100% recycled PET") • Incentives for returning or reusing plastic packaging (e.g., bottle deposit schemes) • Digital tools (e.g. QR codes) for tracing packaging sustainability information • Labelling guides to support eco-friendly consumer choices.

Stakeholder	Plastic Packaging Data Needs
Logistics Providers and Scan-back Depots	• Plastic packaging weight and volume for transport efficiency • Return logistics tracking for reusable plastic packaging • Optimization data for plastic packaging in supply chain storage and distribution.
Materials Recovery Facilities and Plastics Recovery Facilities	• Plastic type identification for sorting and processing (e.g., PET vs. PP vs. multi-layer plastics) • Contamination levels in collected plastic packaging • Recycling yield rates for different plastic types • Demand and pricing for recycled plastic materials • Data on plastic waste leakage into the environment • Compliance with local and international recycling regulations (e.g., Basel Convention on plastic waste trade).
Government & Regulators	• Compliance data for plastic waste regulations and bans (e.g., single-use plastic restrictions) • National and regional plastic recycling rates and industry performance tracking • Environmental impact assessments of different plastic packaging types • Public education campaign effectiveness on plastic waste reduction.
NGOs & Advocacy Groups	• Corporate sustainability commitments regarding plastic packaging reduction • Lifecycle analysis data for different types of plastic packaging • Policy recommendations for reducing plastic waste • Consumer behaviour and awareness trends related to plastic waste • Transparency on plastic supply chains and waste management effectiveness.

Appendix 3: Data collection scope

The intent was to consider the data needs and data management systems for plastic packaging sold under regulated (or proposed) product stewardship schemes under the Waste Minimisation Act and include plastic beverage containers, which have been considered separately (under a Container Return Scheme which is currently on hold). Data provided or collected for the purpose of the stewardship schemes may also be relevant for other data reporting, credential substantiation and decision-making (e.g. Global Plastics Treaty reporting obligations, voluntary or customer-imposed plastics reduction targets and/or sustainability performance, and Scope 3 Emissions analysis).

Product stewardship or extended producer responsibility schemes involve fees (paid upfront as part of the purchase price) which are used to fund the collection of the material for reprocessing. A container return scheme involves the payment of a deposit per item as part of the purchase price, which is returned to the buyer when it is returned to an approved collection point.

Accuracy of the weight of the plastic material enables accurate and equitable fee- and target- setting (including eco-modulation), collection planning, and monitoring of progress. Sample data was intended to create an illustrative dataset of types of resin used for the container, colours, weight of total packaging as well as components, and recyclability information. We wanted to understand the breadth of materials, and complexity of the packaging components across several retail sectors: general retail; takeaway food service; food and grocery; farm plastics (agrichemical containers and soft plastics); and hardware (retail items that may be used for DIY or by the construction industry). Imported materials (e.g. via online marketplaces) were also included.

Scope for data collection were also considered from the following perspectives:

1. Product Origin – where the product comes from.
2. Packaging Function – whether containing a single product or a group of products.
3. Packaging Destination - where it goes post-consumption (re-use, re-fill or collection site).
4. Plastic Packaging Product Stewardship or Extended Producer Responsibility Schemes.

Product Origin

Identifying the origin of the material would support scheme and fee design as well as infrastructure planning. For the purposes of this collection, origin information was identified where known.

Table 4: Plastic Packaging Origins within Collection Scope

Plastic Packaging Origins	Examples
Supermarket or butcher	Meat tray, muffin 'clam shell' container, fresh produce bag, shampoo container, milk bottle
Other retail stores including dairies and service stations (eg, Farmers, The Warehouse, Chemist Warehouse, Z-Energy)	Soft plastics, hard plastics, beverage containers, packaged food and grocery items. Includes back-of-house packaging – purchased items used to prepare food onsite, or to receive purchased grouped items sold separately in store.
Plant nursery retailer, garden centre, hardware store, agribusiness retail store	Plastic plant pot, fertiliser container, seed bag, agrichemical spray.
Home Delivery Meal Kits - Food Box Company	My Food Bag – soft plastic produce bag, plastic lined herb blend packet.

Packaging Function

Another way to consider collection scope is to look at the packaging function. Within scope is:

- **primary packaging** (base consumer pack – e.g. a plastic beverage container or a coffee cup)
- **secondary packaging** (e.g. a box of beers, courier parcel packaging, as well as back-of-house packaging – used by a supermarket in the deli to make food on-site, or by a café to prepare food for sale).

But **not** tertiary packaging (transport packaging such as pallet wrapping and strapping) – this is out of scope.

Packaging destination

In-scope products include those destined for **re-use** (return to producer) or **re-filling** by the consumer in a designated store. Plastic packaging destined for a **collection site** - material recovery and recycling via local council kerbside or collection centres, voluntary collection locations (e.g. the Soft Plastics Recycling Scheme) or farm plastics pick-up or collection centres were also within scope.

Products going into c**ommercial waste streams were out of scope.** (Though we acknowledge that there is a clear need for more data around commercial construction and demolition (C&D) waste as well).

Packaging Product Stewardship and Extended Producer Responsibility schemes

We set product collection scope based on a detailed comparison of stewardship schemes and Container Return Scheme scope. The following list is based on that analysis.

Plastic packaging containers and their lids/caps.

- Available for retail sale (at grocery, hardware, pharmacy or other stores or purchased online including from overseas, including back-of-house packaging).
- Eg, food & grocery items, cosmetics, pre-packaged, over-the-counter pharmacy items. (This is a broader scope than what goes into your kerbside recycling bin).
- Plastic resin codes 1, 2, 3, 4, 5, 6 or 7, singly or in combination with one or more of these plastics or any non-plastic material.

Soft plastic packaging sold at retail.

- Eg, available in grocery or hardware stores.

Beverage containers including their lids/caps.

- Including liquid paperboard.

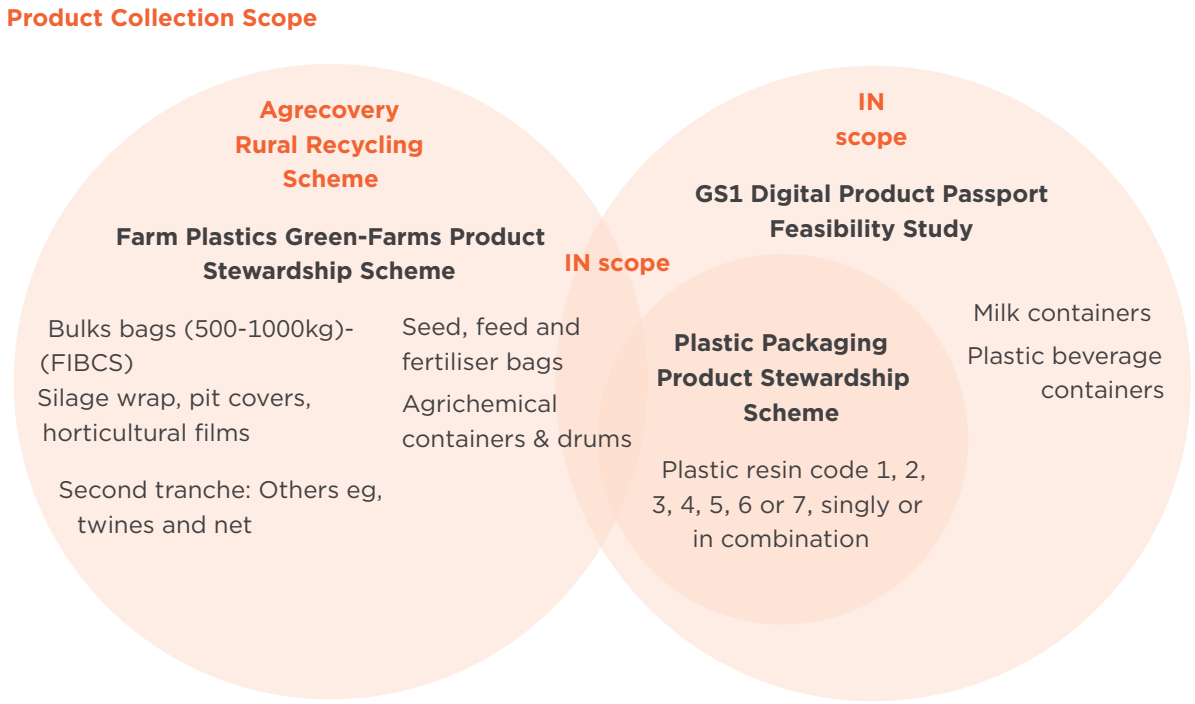
Agrichemical containers.

- Available for sale at farm supply merchants.

Small seed, feed and fertiliser bags.

- Available for sale at farm supply merchants.

Diagram 10: Product Collection Scope compared to Rural Recycling and PPPS scope



Scope of stewardship schemes compared to scope of collection

The following table describes the scope of products for data collection, using the stewardship schemes' product scope as a reference.

Table 5: Data Collection Scope Compared to Stewardship Scheme Scope

Product Stewardship Scheme Details [48]		Scope of GS1 Data Collection
Plastic packaging	All packaging used for consumer goods at retail or wholesale level (**excluding beverage containers**) made of plastic resin codes 1, 2, 3, 4, 5, 6 or 7, singly or in combination with one or more of these plastics or any non-plastic material, **and not refilled by the producer for retail sale or able to be refilled by the consumer at a retail establishment.**	Consider the NZ system for collection, sharing and management of plastic packaging data for consumer grocery and non-grocery sold at retail, including back of store use. Though we expect it to be extensible, we will not explicitly consider data needs for hospitality or industrial-sized B2B trade. **Include** refillables – an illustrative dataset that includes information around the recyclability of these containers will allow benchmarking and further research. **Include** milk containers – because these are included in the PPPS proposal.
Plastic beverage containers	Work to develop a Container Return Scheme was deferred in March 2023. Key Design Elements of the CRS (currently on hold) were: • Including all single-use metal, plastic (PET, HDPE, PP, and recyclable bio-based PET and HDPE), glass (all colours) and liquid paperboard (LPB) beverage containers • Container size 3 litres and smaller • Including beverage container lids • Exempt fresh milk in all packaging types • Exempt beverage containers that are intended for refilling and have a verifiable producer established return and refill system in place	We will consider data needs for all plastic beverage containers (whether they are destined for MRFs/recycling, landfill, or are eventually covered by a Container Return Scheme). Data collection will also be relevant for a Digital Container Return Scheme. Our sample data set will include any beverage container that is plastic or has plastic contained in it: • Including all single-use, plastic (PET, HDPE, PP, and recyclable bio-based PET and HDPE), and liquid paperboard (LPB) beverage containers • Container size 3 litres and smaller • Including beverage container lids **Include** beverage containers that are intended for refilling. **Include** beverage containers made of Liquid paperboard (LPB) (these are within scope of the PPPS Proposed Scheme Design).

Plastic agrichemical containers	All agrichemicals and their containers up to and including 1000 litres in size or equivalent packaging for dry goods that are used for: any horticulture, agricultural and livestock production, including veterinary medicines; industrial, utility, infrastructure and recreational pest and weed control; forestry; household pest and weed control operations; or similar activities conducted or contracted by local and central government authorities. This includes but is not limited to all substances that require registration under the Agricultural Compounds and Veterinary Medicines Act 1997, whether current or expired, and their containers (packaging), which are considered hazardous until they have been triple-rinsed.	We will collect data from the following: Containers registered with Agrecovery, that used to contain chemicals (any application – agriculture, horticulture, livestock, veterinary medicines, pest and weed control) that have been returned, triple-washed, to an Agrecovery collection facility. Data collection for this group will not include lids. Containers (same as above) available for retail purchase (farm merchants, grocery, and hardware stores) but not registered with Agrecovery. Data (including images) for these items will be collected in-store only, by examining the product. **Include composite products** – ie, mixed materials.
Farm Plastics	All: plastic wrapping materials for silage or hay including, but not limited to, baleage wrap, hay bale netting, baling twine and covers for silage pits; plastic sacks for packaging agricultural and horticultural commodities including, but not limited to, fertiliser sacks, feed sacks and bulk tonne bags of polyethylene or woven polypropylene; or other plastic packaging and products used for agriculture and horticulture including, but not limited to, protective nets, reflective ground covers, and other plastic containers.	Silage wrap – **out of scope.** **Soft Agricultural Plastics** (seed, feed and fertiliser bags) – collect data for bags that can be photographed in-field. • plastic sacks for packaging agricultural and horticultural commodities – including, small fertiliser sacks, feed sacks made of woven polypropylene and/or polyethylene. Other farm plastics include nets, covers and films – **out of scope.**

Appendix 4: Key packaging attributes

<table>
<tr><th>Data Elements</th><th colspan="2">Examples</th></tr>
<tr><td rowspan="2">Packaging type

From GS1 GDSN

Code List</td><td>Bottle

Other rigid plastics include caps and lids, tubes, blister packs.</td><td>Bag

Other soft plastics include a plastic film on a tub.</td></tr>
<tr><td colspan="2">Other types of plastic packaging include pots, tubs and trays, and plastic lined cartons.

Article level: GTIN

 
</td></tr>
</table>

Features Code List	List each separate packaging component  Source: GS1 NPC Advisory Group & Unilever.
For each feature list the material type (Material Type Code List) For plastics, the resin type number is often stamped into the resin.	Resin types: 1 – Polyethylene Terephthalate (PET) 2 – High Density Polyethylene (HDPE) 3 – Un-plasticised Polyvinyl Chloride (PVC-U), Plasticised Polyvinyl Chloride (PVC-P) 4 – Low density Polyethylene (LDPE), Linear low-density Polyethylene (LLDPE) 5 – Polypropylene (PP) 6 – Polystyrene (PS), Expanded Polystyrene (EPS) 7 – Includes all other resins and multi materials such as laminates. Compostable/biodegradable plastics such as Polylactic Acid (PLA)
For each feature describe the material colour	Black Coloured (eg, white, purple) Clear (like a water bottle, ie, clear/see-through) Opaque (eg, milk bottle)
For each feature – weigh it (this will only be possible for food and grocery items collected by the GS1 team and some farm plastics).	Jar + Lid - combined weight Label – leave blank but can be worked out afterwards using the jar and lid weights. If evidence of a seal, note that down too. e.g. garlic jar.

For each feature list the recycling instructions provided on-pack:

Eg: ARL recycling labels, “recycle at store” instructions, or the Agrecovery label with instructions:

“Container disposal”..recycle empty container through Agrecovery..”

Australasian Recycling Label (ARL)

For each feature list any sustainability claim provided:

Eg: “reusable”, “plant-based”, “compostable”. “This bottle is made from 100% recycled plastic”.

Appendix 5: Collection methodology

Overview and Alignment to Objectives

This methodology was designed to support the project's objectives to develop a current picture of plastic packaging in use—covering material types, sustainability attributes (recycled content, recyclability, and reusability), and the data elements available for potential sharing via Digital Product Passports and data hubs. The approach prioritised the attributes needed by product stewardship and extended producer responsibility (EPR) schemes under the Waste Minimisation Act, while also ensuring the dataset would be made available for broader reporting and analysis (e.g., sustainability claims substantiation, Scope 3 emissions analysis, and potential future Global Plastics Treaty reporting). The sampling strategy sought to capture the breadth and complexity of plastic packaging across several retail sectors, with particular focus on food and grocery and farm plastics, and with targeted inclusion of beverage containers.

Sampling Frame and Inclusion Criteria

- **Population of interest:** Plastic packaging used for consumer products and farm inputs, including food and grocery, agrichemicals, seed/feed/fertiliser sacks, and beverage containers. Commercial waste streams were out of scope.
- **Inclusion window for purchased items:** Items were required to have been purchased within the previous six months at the time of collection to ensure data currency and relevance.
- **Representativeness:** The sample aimed to cover a broad range of packaging formats and resin types. A subset of items was selected for external testing to be representative of the total sample.
- **Scope notes:** Although beverage containers were separated under the Act, they were included to support potential container return scheme (CRS) considerations and stewardship/EPR design needs.

Product Collection Methodology

Food and Grocery Packaging (Retail)

- **Source and start date:** Packaging items were crowd-sourced from the GS1 team; and collected from recycling sites (Soft Plastics Recycling and cosmetics (Mecca)). Collection commenced in February 2025. **Eligibility:** Items had to be purchased within the last six months to reflect current market packaging.
- **Existing products from GS1 On Pack data base:** The collection team identified products where the same packaging was duplicated across a wider range (for example, soft drinks). Full data was collected for all components of the initial packaging product, then the data was extrapolated, using existing images in GS1's On Pack database, for additional products within the range. **Eligibility:** Data only used if it was captured by the collection team within the last 12 months and seen in market within the same period (using Circana market sales data); duplicated products needed to be an exact match to the initial physical product captured for the collection.
- **Other collection sources considered but not feasible:** collection from other sources was not feasible for a variety of reasons: recycling and sorting centres – products were not complete (components separated), product contaminated or squashed and difficult to photograph; direct from plastic container manufacturers – not random, feasibility of gathering sufficient material, not all components present.

Agrichemical Containers and Seed/Feed/Fertiliser Sacks (Farm Plastics)

- **Source and locations:** Products were collected from **Agrecovery** collection sites, including **Farm Source Helensville** and other sites in the wider Auckland area. Products were also collected from agricultural product suppliers present at Field Days.
- **Acquisition method:** Items were sourced directly from collection points and were **not purchased due to the cost**; this necessitated additional assumptions for certain non-visible internal components and weight estimation (see Assumptions and Limitations).

Data Collection and Validation Methodology

Pilot Data Collection (Process Validation)

- **Timing: January 2025**.
- **Purpose:** To test and refine the data capture process prior to full-scale collection.
- **Activities:**
  - Physical examination of each product to identify and separate distinct packaging components.
  - Comprehensive photographic documentation (all sides, top, and bottom).
  - Standardised data capture by the verification team into a project spreadsheet aligned to the **GS1 classification system** for plastic packaging features and attributes.

Operational Data Capture (Main Phase)

- **Procedures (all sources):**
  - **Physical examination:** Items were inspected and componetised (e.g., container body, closures, labels, pumps, liners) to enable component-level data capture.
  - **Photographic record:** images were taken of all sides and the top/bottom of each item, ensuring traceability and visual verification.
  - **Standardised entry:** Data for each component was recorded using consistent field definitions mapped to the GS1 classification, including resin type, colour, component weight (where available), recyclability indicators, and sustainability claims.
- **Special procedures for non-purchased farm plastics:**
  - **Shelf/collection-point photography:** Items were documented in situ using mobile phones, and data was recorded directly into the spreadsheet.
  - **Component assumptions:** Where internal components were obscured (e.g., pumps assumed to include internal plastic tubes), reasonable assumptions were applied based on typical product configurations.
  - **Weight estimation:** Where direct weighing was not possible, weight was estimated using net weight indications on packaging and clearly noted in the dataset as **estimated**.

External Validation and Laboratory Testing

- **Timing:** From **April 2025**.
- **Process:** Approximately **200 items** were sent in batches to the **Environmental Innovation Centre** for testing, analysis, and independent verification of packaging content and attributes.
- **Sampling rationale:** The validation subset was selected to be representative of the overall sample, considering product category, packaging format, and material type.

Data Management and Quality Assurance

- **Data structure and standards:** All entries followed a structured template aligned with the GS1 classification system to ensure comparability across items and components.
- **Verification:** A dedicated verification team reviewed entries for completeness, consistency, and correct application of field definitions (e.g. resin coding, colour descriptors, recyclability flags).
- **Traceability:** Each item's photographic record was linked to its component-level data to enable retrospective checks and external review.
- **Version control:** Updates and corrections were logged to maintain an auditable data history.

Assumptions and Limitations

- **Non-purchased items:** For farm plastics collected at Agrecovery sites, some internal features could not be directly observed. Assumptions (e.g. presence of internal tubes in pumps) were applied and flagged in the dataset.
- **Weight estimation:** Where weighing was not feasible, component or total weights were **estimated** based on net weight indications on packaging; these values were clearly identified as estimates and may have higher uncertainty.
- **Temporal coverage:** The purchase window for retail items was limited to the previous six months to represent current packaging; products outside this window were excluded.
- **Category coverage:** The methodology focused on food/grocery and farm plastics; beverage containers were included for stewardship relevance. Other categories referenced in the project objectives were considered during sampling design but are not the primary focus of the collection processes described above unless explicitly noted in the dataset.

Ethical and Operational Considerations

- **Access and permissions:** Photography and data capture at collection sites were conducted with site permission and in accordance with local operational protocols.
- **Data confidentiality:** Proprietary or sensitive product information (beyond packaging attributes) was not collected. Images and data were stored securely for research and validation purposes.

Timeline Summary

- **January 2025:** Pilot data collection and process validation.
- **From February 2025:** Commenced crowd-sourced collection of food and grocery packaging (GS1 team).
- **From March 2025:** Collection of agrichemical containers and farm plastics from Agrecovery sites (including Farm Source Helensville and nearby locations).
- **From April 2025:** External validation and laboratory testing at the Environmental Innovation Centre (representative subset of ~200 items).

Summary

This methodology combines a structured sampling approach with rigorous, standardised data capture and targeted external validation. It is calibrated to the needs of stewardship and EPR schemes while producing a dataset that is broadly relevant in regulatory, operational, and sustainability contexts. Clear documentation of assumptions and estimation procedures ensures transparency, and the alignment to GS1 classification standards supports interoperability and future digital integration.

Appendix 6: GS1 Packaging related data attributes and code lists

Attribute Name	Attribute Type	Description
packagingTypeCode property: https://ref.gs1.org/voc/packagingType in GS1 Web Vocabulary GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=Packaging&name=packagingTypeCode&version=12	Code List	Code identifying the type of package used as the container for the trade item.
packagingFeatureCode property: https://ref.gs1.org/voc/packagingFeature + code list: https://ref.gs1.org/voc/PackagingFeatureCode in GS1 Web Vocabulary (needs a refresh from GDSN) GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=Packaging&name=packagingFeatureCode&version=12 GDSN code list: https://navigator.gs1.org/gdsn/class-details?name=PackagingFeatureCode&version=12	Code List	This attribute is used to relate the other attributes in the group to a defined feature of the packaging
packagingMaterialTypeCode property: https://ref.gs1.org/voc/packagingMaterialType + code list: https://ref.gs1.org/voc/ PackagingMaterialTypeCode in GS1 Web Vocabulary GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=PackagingMaterial&name=packagingMaterialTypeCode&version=12 + GDSN code list: https://navigator.gs1.org/gdsn/class-details?name=PackagingMaterialTypeCode&version=12	Code List	The materials used for the packaging of the trade item, for example glass or plastic.
packagingMaterialCompositionQuantity + measurementUnitCode https://ref.gs1.org/voc/packagingMaterialCompositionQuantity in GS1 Web Voc + https://ref.gs1.org/voc/QuantitativeValue GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=PackagingMaterial&name=packagingMaterialCompositionQuantity&version=12 + GDSN class: https://navigator.gs1.org/gdsn/class-details?name=Measurement&version=12	Code List	The quantity of the packaging of the trade item. Can be weight, volume or surface, can vary by country.

packagingRecyclingSchemeCode https://ref.gs1.org/voc/packagingRecyclingScheme in GS1 Web Vocabulary + code list: https://ref.gs1.org/voc/PackagingRecyclingSchemeCode GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=Packaging&name=packagingRecyclingSchemeCode&version=12 GDSN code list: https://navigator.gs1.org/gdsn/class-details?name=PackagingRecyclingSchemeCode&version=12	Code List	A code determining the recycling scheme the packaging of this trade item will fall within when recycled. Applies to recyclable packaging with or without deposit.
packagingRecyclingProcessTypeCode https://ref.gs1.org/voc/packagingRecyclingProcessType in GS1 Web Vocabulary + code list: https://ref.gs1.org/voc/PackagingRecyclingProcessTypeCode GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=Packaging&name=packagingRecyclingProcessTypeCode&version=12 GDSN code list: https://navigator.gs1.org/gdsn/class-details?name=PackagingRecyclingProcessTypeCode&version=12	Code List	The process the packaging could undertake for recyclable & sustainability programs.
packagingSustainabilityFeatureCode Not yet in the GS1 Web Vocabulary – but can easily be added (requires a Work Request) GDSN attribute: https://navigator.gs1.org/gdsn/attribute-details?parent=Packaging&name=packagingSustainabilityFeatureCode&version=12 GDSN code list: https://navigator.gs1.org/gdsn/class-details?name=SustainabilityFeatureCode&version=12	Code List	A feature of the packaging that contributes to sustainability initiatives for example that it is made from renewable materials.

For further packaging-related attributes currently defined in GDSN, please see:
https://navigator.gs1.org/cross-standard/attribute-quick-search?search=packag

For further packaging-related code lists currently defined in GDSN, please see:
https://navigator.gs1.org/cross-standard/code-quick-search?search=packag

For all packaging-related terms (properties, code lists, classes) currently defined within the GS1 Web Vocabulary, please see:
https://ref.gs1.org/voc/?search=packag

Appendix 7: Packaging Code Lists (GS1 National Product Catalogue - NPC)

Single Use Plastic Material Type
ACRYLONITRILE_BUTADIENE-STYRENE
CERAMIC
COMPOSITE
GABLE_TOP_CARTON
GLASS
LIQUID_PAPERBOARD
LIQUID_PAPERBOARD_ASEPTIC
METAL_ALUMINUM
METAL_STEEL
MICROBEADS
NYLON
OTHER
OXO-DEGRADABLE PLASTIC
PAPER_CARDBOARD
PAPER_HIGH_WET_STRENGTH
PAPER_PAPER
PAPER_WAXED
PLASTIC_BIO_PLASTIC
PLASTIC_OTHER
POLYMER_CPB
POLYMER_EPS
POLYMER_HDPE
POLYMER_LDPE
POLYMER_MDPE
POLYMER_PET
POLYMER_PLA
POLYMER_PP
POLYMER_PS
POLYMER_PVC
POLYMETHYL_ACRYLIC
SILICONE
TEXTILES
WOOD_BAMBOO
WOOD_TIMBER

Packaging Function
ANTI_TAMPERING
ANTISEPTIC
ATOMIZER
CHILD_RESISTANT_CLOSURE
COATED
COMPRESSED
DISPENSER
FLEXIBLE
GIFT_WRAPPED
HYGIENIC
ISOTHERMIC
MODIFIED_ATMOSPHERE
OXYGEN_INFUSED
PEEL_OFF
PINPACK
PROTECTED
REINFORCED
RIGID
SIFT_PROOF
TAMPER_EVIDENT
VACUUM_PACKED
WATER_RESISTANT
HERMETICALLY_SEALED
RECLOSABLE
SEALED

Packaging Sustainability Feature
BIODEGRADABLE
CARBON_NEUTRAL
CIRCULAR_ECONOMY
INCINERABLE
MADE_FROM_RECYCLED_MATERIAL
MADE_FROM_RENEWABLE_MATERIAL
MADE_WITH_100_PERCENT_RENEWABLE_WIND_POWER
OXO_DEGRADABLE
PARTIALLY_MADE_FROM_RECYCLED_MATERIALS
REUSABLE

Packaging Recycling Process Type
COMPOSTABLE
ENERGY_RECOVERABLE
RECYCLABLE
REUSABLE

Packaging Claim Type
MADE_WITH
MADE_WITH_100_PERCENT
PARTIALLY_MADE_WITH

Packaging Claim Element
BIODEGRADABLE_MATERIAL
BIOGAS
RECYCLED_MATERIAL
RECYCLED_MATERIAL_MASS_BALANCE
RENEWABLE_MATERIAL
RENEWABLE_MATERIAL_MASS_BALANCE
WIND_POWER

Packaging Material Colour Code Reference
BLACK
BROWN
GREEN
NON_TRANSPARENT_BLACK
NON_TRANSPARENT_OTHER
OPAQUE_BLACK
OPAQUE_BLUE
OPAQUE_BROWN
OPAQUE_GREEN
TRANSPARENT_BLACK
TRANSPARENT_BLUE
TRANSPARENT_BROWN
TRANSPARENT_COLOURLESS
TRANSPARENT_GREEN
TRANSPARENT_OTHER
WHITE
YELLOW

Packaging Recycling Scheme	
1	Polyethylene Terephthalates
2	High-density Polyethylenes
3	Polyvinyl Chlorides
4	Low-density Polyethylenes
5	Polypropylenes
6	Polystyrenes
7	Plastics Other
20	Corrugated fibreboard (cardboard)
21	Mixed paper/Non-corrugated fibreboard
22	Paper
40	Steel
41	Aluminium
50	Wood
51	Cork
60	Cotton
61	Jute
70	Colourless glass
71	Green glass
72	Brown glass
80	Composite: Paper and Fibreboard/Miscellaneous Metals
81	Composite: Paper/Fibreboard and Plastic
82	Composite: Paper and Fibreboard/Aluminium
83	Composite: Paper and Fibreboard/Tinplate
84	Composite: Paper and fibreboard/Plastic/Aluminium
85	Composite: Paper and Fibreboard/Plastic /Aluminium/Tinplate
87	Composite: Card-stock Laminate or Biodegradable Plastic
90	Composite: Plastic/Aluminium
91	Composite: Plastic/Tinplate
92	Composite: Plastic/Miscellaneous Metals
95	Composite: Glass/Plastic
96	Composite: Glass/Aluminium
97	Composite: Glass/Tinplate
98	Composite: Glass/Miscellaneous Metals
ABS	Acrylonitrile butadiene
PA	Polyamide
CEN	CEN
EKO_PULLO	EKO PULLO
PALPA	PALPA
X_70	Mixed glass

Packaging Feature
BASE
BEAM
BREAKABLE_SEAL
BUNG_SEAL
BUTTERFLY_TAP
CAN_END_360
CAP
CARRIER
CHAMPAGNE_CORK_NATURAL
CHAMPAGNE_CORK_SYNTHETIC
CONSUMPTION_UTENSIL
CORE
CORK_AGGLOMERATE
CORK_ALTERNATIVE
CORK_STOPPER
COUPLING_A
COUPLING_D
COUPLING_G
COUPLING_KEY_K
COUPLING_M
COUPLING_S
COUPLING_S3
COUPLING_U
CREEL
CROWN_CAP
CROWN_RING_PULL
EDGE_PROTECTION
FLAP
GLASS_CORK
HANDLE
INDUCTION_SEAL
INNER_CONTAINER
INTEGRATED_TAP_BREWERY_BARREL
INTERNAL_DIVIDER
LABEL
LBR
LID
LINER
LOE
LSST
LUG
MICROWAVE_SUITABLE
NATURAL_CORK
NESTING_EDGE
OTHER
PEEL_OFF_FOIL_LID
PEG
PLANT_BASED_CORK
PLASTIC_SCREW_CAP_WITH_BASE
PULL_OFF_TAB
PUSH_TAP
RING_HOLDER
RIVET
SCREW_CAP
SCREW_CAP_METAL
SCREW_CAP_PLASTIC
SCREW_TAP
SHRINK_BAND_SEAL
SLEEVE
SPIGOT_PLASTIC
SPIGOT_STEEL
SPOUT
STICKER_SEAL
SYNTHETIC_CORK
TAG
TWIST_OFF_CAP
WICKER_OUTER_CONTAINER
WRAP

Packaging Type	
AA	Intermediate bulk container, rigid plastic
AE	Aerosol
AM	Ampoule
BA	Barrel
BBG	Bag in Box
BG	Bag
BJ	Bucket
BK	Basket
BL	Berlingot
BO	Bottle
BPG	Blister pack
BRI	Brick
BX	Box
CG	Cage
CHB	Chub
CM	Card
CMS	Clam Shell
CNG	Can/Tin
CP	Capsule
CQ	Cartridge
CR	Crate
CS	Case
CT	Carton
CU	Cup/Tub/Bowl
CY	Cylinder
EN	Envelope
GTG	Gable Top
HG	Hanger
JG	Jug
JR	Jar
MPG	Multipack
NE	Not packed
NT	Net
PB	Pallet Box
PLP	Peel Pack
PO	Pouch
PT	Pot
PU	Tray
PUG	Packed, unspecified
PX	Pallet
RK	Rack
RL	Reel
RO	Roll
SG	Syringe
STR	Stretchwrapped
SW	Shrinkwrapped
SY	Sleeve
TU	Tube
WIRE	Wire
WRP	Wrapper
X11	Banded package
ZU	Flexible Intermediate Bulk Container

Packaging Material Type
ALUMINUM_OXIDE
BAMBOO
CELLULOSE_HYDRATE
CERAMIC
CLOTH_OR_FABRIC
COMPOSITE
CORK_NATURAL
CORRUGATED_BOARD_A_FLUTE
CORRUGATED_BOARD_B_FLUTE
CORRUGATED_BOARD_C_FLUTE
CORRUGATED_BOARD_DOUBLE_WALL
CORRUGATED_BOARD_E/B_FLUTE
CORRUGATED_BOARD_E_FLUTE
CORRUGATED_BOARD_OTHER
CORRUGATED_BOARD_SINGLE_WALL
CORRUGATED_BOARD_TRIPLE_WALL
FIBRE_BURLAP
FIBRE_COTTON
FIBRE_FLAX
FIBRE_HEMP
FIBRE_JUTE
FIBRE_OTHER
FOAM
GLASS
GLASS_BOROSILICATE
GLASS_COLOURED
GLASS_CRYSTAL
LAMINATED_CARTON
METAL_ALUMINUM
METAL_ALUMINUM_METALLIZED
METAL_BRASS
METAL_COMPOSITE
METAL_IRON
METAL_LEAD
METAL_OTHER
METAL_STAINLESS_STEEL
METAL_STEEL
METAL_TIN
METAL_ZAMAC
MINERAL_CALCIUM_CARBONATE
MINERAL_OTHER
MINERAL_TALC
NATURAL_RUBBER
OTHER
PAPER_CORRUGATED
PAPER_KRAFT
PAPER_KRAFT_WET_STRENGTH
PAPER_MOLDED_PULP
PAPER_OTHER
PAPER_PAPER
PAPER_PAPERBOARD
PAPER_RAYON
PLANT_LEAVES
PLASTIC_BIO_PLASTIC
PLASTIC_OTHER

Packaging Material Type (cont)
PLASTIC_THERMOPLASTICS
POLYMER_APET
POLYMER_BOPE
POLYMER_BOPP
POLYMER_CELLULOSE_ACETATE
POLYMER_CPET
POLYMER_CPP
POLYMER_EPE
POLYMER_EPOXY
POLYMER_EPP
POLYMER_EPS
POLYMER_EVA
POLYMER_EVOH
POLYMER_HDPE
POLYMER_IONOMER
POLYMER_LDPE
POLYMER_LLDPE
POLYMER_MDPE
POLYMER_MIX
POLYMER_NYLON
POLYMER_OPP
POLYMER_OTHER
POLYMER_PA
POLYMER_PAN
POLYMER_PC
POLYMER_PCL
POLYMER_PE
POLYMER_PEN
POLYMER_PET
POLYMER_PETG
POLYMER_PHA
POLYMER_PLA
POLYMER_PMMA
POLYMER_POM
POLYMER_PP
POLYMER_PS
POLYMER_PU
POLYMER_PVA
POLYMER_PVC
POLYMER_PVDC
POLYMER_SAN
POLYMER_SILICONE
POLYMER_TPS
POLYMER_XPS
RUBBER
SILICON_OXIDE
VINYL
WOOD_HARDBOARD
WOOD_HARDWOOD
WOOD_MEDIUM_DENSITY_FIBREBOARD
WOOD_ORIENTED_STRANDBOARD
WOOD_OTHER
WOOD_PARTICLE_BOARD
WOOD_PLYWOOD
WOOD_SOFTWOOD

Endnotes

1 https://pce.parliament.nz/media/ksxlm5rj/pce-note_federated-environmental-information-system-april-2025.pdf

2 https://digital-strategy.ec.europa.eu/en/policies/data-spaces

3 https://docs.internationaldataspaces.org/ids-knowledgebase/idsa-rulebook/idsa-rulebook/2.-guiding-principles

4 EU Packaging and Packaging Waste Regulation (PPWR) » GS1 Sweden

5 Rethinking Plastics in Aotearoa New Zealand

6 Proposed Scheme Design for a Plastic Packaging Product Stewardship Scheme

7 FY26-FY27 Business Plan and Statement of Intent - APCO

8 New Zealand Food and Grocery Council (fgc.org.nz)

9 PREP - Home

10 https://apco.org.au/news/20Y9e00000004VAEAY

11 WHO ARE WE? - Plastic Packaging Product Stewardship

12 Proposed Scheme Design for a Plastic Packaging Product Stewardship Scheme February 2025, section 1.6.1

13 https://plasback.co.nz/

14 Letter and Note: A federated system to improve environmental information | Parliamentary Commissioner of Environment

15 pce-note_federated-environmental-information-system-april-2025.pdf

16 GS1 UK compliance specification for the NHS

17 https://one.oecd.org/document/ENV/WKP(2024)4/en/pdf

18 Australasian Recycling Label

19 The Australasian Recycling Label (ARL) in New Zealand | Ministry for the Environment

20 https://apco.org.au/sustainable-packaging-guidelines

21 https://ecochoiceaotearoa.org.nz/new-zealands-offical-ecolabel/our-story/

22 https://www.procurement.govt.nz/guides/broader-outcomes/reducing-emissions-and-waste/

23 Centre for Sustainable Finance launches practical sustainability guide for SMEs | NZBusiness Magazine

24 CSF-Starter-For-Ten-DME-Metrics-Guide_mobile.pdf, page 7

25 New EU rules on packaging and waste will transform its Supply Chain - March 2025 | New Zealand Ministry of Foreign Affairs and Trade

26 https://www.dcceew.gov.au/environment/protection/waste/packaging/reforming-packaging-regulation

27 https://www.bioleaderpack.com/chinas-green-packaging-regulations-2025-a-complete-guide-for-brands-and-manufacturers/

28 https://www.plasticsforchange.org/blog/japans-15-pet-bottle-rule-is-redefining-circularity-and-forcing-the-world-to-rethink-how-and-who-makes-recycling-possible

29 https://rkcmpd-eria.org/extended-producer-responsibility/legal-framework/south-korea

30 https://nirmalvasundhara.com/recycled-plastic-use/

31 https://environment.govt.nz/what-government-is-doing/areas-of-work/waste/waste-disposal-levy/territorial-authority-waste-data-and-waste-levy-reporting-obligations/

32 Representatives from the Packaging Forum, Food and Grocery Council, Plastics New Zealand, brand owners, and sorting operators.

33 TOMRA is the inventor of and world leader in reverse vending machines, used in the collection and recycling of drink containers – including aluminium cans, plastic bottles, and glass bottles, with approximately 80,000 reverse vending machine installations across more than 60 markets.

34 New World launches New Zealands first reverse vending machine at a supermarket

35 Home - Smart Facts

36 https://www.digitalwatermarks.eu/

37 https://www.youtube.com/watch?v=xyR3ipXqyIM

38 EU Packaging and Packaging Waste Regulation (PPWR) » GS1 Sweden

39 From RELOOP_Factsheet_Digital-DRS_2024.pdf (reloopplatform.org): Unlike classic DRS, where consumers pay a deposit upfront and return the empty containers to designated return locations for refunds, digital or serialised DRS involves the use of additional or alternative return pathways. In DDRS, consumers utilise smartphone apps to scan empty containers, which are then placed into existing kerbside recycling bins. Aside from the key difference in return pathways, the concept of DDRS relies on the use of serialised barcodes or QR codes to uniquely identify each container within the system. See this fact sheet for information on Digital Deposit Return Scheme trials, including a comparative analysis, and research on the feasibility of implementing DDRS at scale

40 Evaluation of digital technology in a deposit return scheme: reports | GOV.WALES

41 https://polytag.io/case-studies/ocado-uv-tags-track-recycling/

42 https://www.thepost.co.nz/business/360570821/brickbats-and-bouquets-mix-product-stewardship-schemes-assessed?utm_medium=email&_hsenc=p2ANqtz-_bBwk6gEgFhMI_3gm_xMnwXjVK1aDBU2uN-oa4iCemRT1VdhX3tQaTzP1xsNjvYLy-ZS91xt1tM9gqnWFDpwZQ38ahUA&_hsmi=348085957&utm_content=348085957&utm_source=hs_email - accessed on 31 March 2025

43 China: National Smart Agriculture Action Plan Published | USDA Foreign Agricultural Service

44 A Billion Dollar Future: Building China's Agricultural New Infrastructure - Sovereign Magazine

45 https://apco.org.au/sustainable-packaging-guidelines

46 GS1Trade Packaging | Efficient declaration of packaging data

47 https://endfoodwaste.com.au/wp-content/uploads/2023/11/EFWCRC_121_SFPDC_ResourceBooklet-1.pdf

48 https://gazette.govt.nz/notice/id/2020-go3343 and redacted-cab-22-min-0539-v2.01.pdf (environment.govt.nz)