

# Waste (Resource) Matters



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## Our partners



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# Glossary and Key Terms

**Bale** - A bundle of plastics tightly packed and bound.

**Biodegradable** - Broken down either biologically or chemically (i.e. broken down by bacteria or other organisms).

**CABG** - Consumer attitude-behaviour gap - this refers to consumers having positive attitude towards consumption, but the behaviour is inconsistent and often conflicting with the attitude.

**Circular economy** - The term used by various stakeholders with slight variations to emphasise a holistic approach to reducing plastic pollution by considering impacts and activities throughout the entire lifecycle, both before and after consumption. This approach involves retaining resources through circular systems of reuse and recycling, rather than disposal.

**CIWM** - Chartered Institution of Wastes Management.

**Closed-loop recycling/system** - A policy term that denotes the use of recycled material to remanufacture the same product that the material was used for previously (e.g. recycled High-Density Polyethylene (HDPE) from milk bottles to make milk bottles again). The term 'closed-loop system' is sometimes used to refer to a discrete assemblage of companies and organisations that work together along the value chain to collect, sort, and reprocess polymer material so that it can be returned to the same products.

**Composite material** - A material which is produced from two or more constituent materials. These constituent materials typically have differing chemical or physical properties, and they are combined to create a composite material with properties unlike the individual constituents.

**Degradable** - Changes in chemical make-up of a polymeric material that causes changes in the in-use properties that are not wanted.

**DMR** - Dry Mixed Recycling - Also called co-mingled recycling: a term used usually to denote the mixed materials that are added to local authority kerbside collections.

**Downcycling** - Refers to the process of recycling materials into applications that are of lower quality or value compared to the original product particularly in relation to their ability to be recycled again.

**DRS** - Deposit Return Scheme.

**ESG** - Environmental, Social and Governance considerations organisations make, specifically linked to reporting and investment.

**EPR** - Extended Producer Responsibility.

**Frame** - Cultural influences and mental filters that shape individual's understandings of the world, forming a schema of interpretation based on anecdotes and stereotypes.

**Green hushing** - A term used to indicate practices of avoiding clear communication with consumers about the known or potential environmental impacts of packaging offered as an alternative to plastic packaging, when these alternatives may be no more sustainable and potentially less so.

**HDPE** - High-Density Polyethylene is a thermoplastic polymer known for its high strength-to-density ratio produced from the monomer ethylene.

**IOM3** - The Institute of Materials, Minerals and Mining.

**Jazz** - A term used in waste and recycling to indicate coloured polymer packaging in contrast to 'natural' or clear (non-coloured) packaging. The colour is usually achieved through adding 'masterbatch' pigments or other additives to the polymer material during packaging production.

**LDPE** - Low-density polyethylene is a thermoplastic produced from the monomer ethylene.

**Mechanical recycling** - A term used to describe a variety of processes/technologies capable of recovering usable plastic from plastic waste by mechanical processes (including compounding, drying, grinding, re-granulating, sorting, washing).

**Monomers** - A molecule that can react with other monomers to produce a polymer.

**Mono materials** - A term used by participants to refer to packaging made from one polymer (or other material) only, without additional material layers, components or adhesives that make separation and reprocessing more complex.

**MRF** - Material Recovery (AKA recycling or reclamation) Facility: a site for sorting and separating mixed materials in recycling collections.

**Natural** - A term used in waste and recycling sector to indicate the non-colouring of polymer packaging. The term is used to contrast to coloured or 'jazz' packaging.

**NERC** - Natural Environment Research Council, the UK's leading public funder of environmental science research aimed at advancing scientific breakthroughs, sustaining natural resources, predicting and responding to natural hazards, and understanding environmental change.

**Net Zero** - A policy term to denote the aim to reduce greenhouse gas emissions as much as possible, with the remaining amount produced being offset via carbon sinks or carbon capture schemes, in order to address the climate crisis.

**Non-target materials** - Materials that can be recycled but are not identified as target material by a Material Recovery Facility that receives them<sup>1</sup>.

**OPRL** - On-Packaging Recycling Labels (a not-for-profit organisation).

**PCPP** - Post-Consumer Plastic Packaging refers to the packaging materials used for consumer products and the waste generated from these materials after they have been used and discarded. This includes materials such as plastic bottles, containers, and packaging for food.

**PET** - Polyethylene Terephthalate is the most common thermoplastic polymer resin of the polyester family.

**Polymers** - Any class of natural or synthetic substances made of macromolecules, which are multiples of monomers e.g. cellulose, proteins, nucleic acids, plastics, rubber, concrete, glass, and paper are polymers.

**Post-consumer** - A term that indicates the source of waste material for recycling has come from households or other pathways to which consumers have added material after they have used it. It contrasts to pre-consumer waste that is often considered to be cleaner and more attractive for recycling.

**Post-consumer plastic packaging pathway** - A term used to describe the collective set of actions and practices applied to plastic packaging that start from the point of disposal by households and that move materials onwards, between or within stakeholder organisations, until some point of final disposal. The actions include those of collecting, sorting, and separating, washing, reusing, recycling, transforming, etc.

**PP** - Polypropylene. A thermoplastic polymer produced from the monomer propylene.

**Pre-consumer** - A term that indicates the source of waste material for recycling has come from manufacturing processes (post-industrial use), that is, before the packaging has been through its intended use by consumers. It is often considered to be less contaminated for recycling than post-consumer waste.

**PRF** - Polymer Recovery Facility (for sorting between polymers).

**PTT** - Pots, Tubs, Trays. A common abbreviation to describe a range of rigid packaging formats, often although not exclusively made from polypropylene. PTT is often contrasted to bottle formats.

**RDF** - Refuse Derived Fuel.

**REACH Regulations** - Registration, Evaluation, Authorization and Restriction of Chemicals.

**RECOUP** - A not-for-profit and charitable organisation operating in plastics resource efficiency and recycling.

**Social and environmental life cycle assessments (S-LCAS)** - Assessment technique to evaluate the social and socio-economic dimensions of products, tracing their impacts across the life cycle, from extraction and processing of raw materials to final disposal, passing through manufacturing, distribution, use, reuse, maintenance, and recycling<sup>2</sup>.

**SRF** - Solid Recovered Fuel.

**Target materials** - Material/s identified by a receiving Material Recovery Facility for separation from other waste materials and/or to produce bulk quantities of specific material/s<sup>1</sup>.

**UK Plastics Pact<sup>3</sup>** - A national voluntary initiative that brings together businesses from across the plastics value chain with government and NGOs to address plastic waste.

**UKRI** - UK Research and Innovation.

**Upcycling** - The process of repurposing used plastic packaging to produce a greater value or quality than the original.

**Value** - Value is defined as having 'contingent, multiple and transient' values<sup>4</sup>, ranging from valueless to valuable depending on its context, where waste is not the opposite of 'value' (i.e. where it has zero value), but rather is 'valuable' to different stakeholders in different ways based on different material affordances, legislative regimes, available technologies, markets, etc.<sup>5</sup>.

**Latent value** - As value that may be available but not fully extracted, representing a gap between current reality and full potential as a means of teasing out key conflicts and opportunities for change.

**Virgin feedstock** - Refers to petrochemical feedstocks, derived from fossil fuels (e.g. crude oil and natural gas).

**Virgin plastic (packaging)** - Plastic packaging composed of virgin feedstocks that have been extracted, refined and processed.

**WCA** - Waste Collection Authority (usually a district, city or borough council, or unitary authority).

**WDA** - Waste Disposal Authority (usually a county council, or unitary authority).

**Wishcycling** - The process of depositing items in recycling bins in the hope that they will be recycled, without having a clear understanding of whether such items are recyclable.

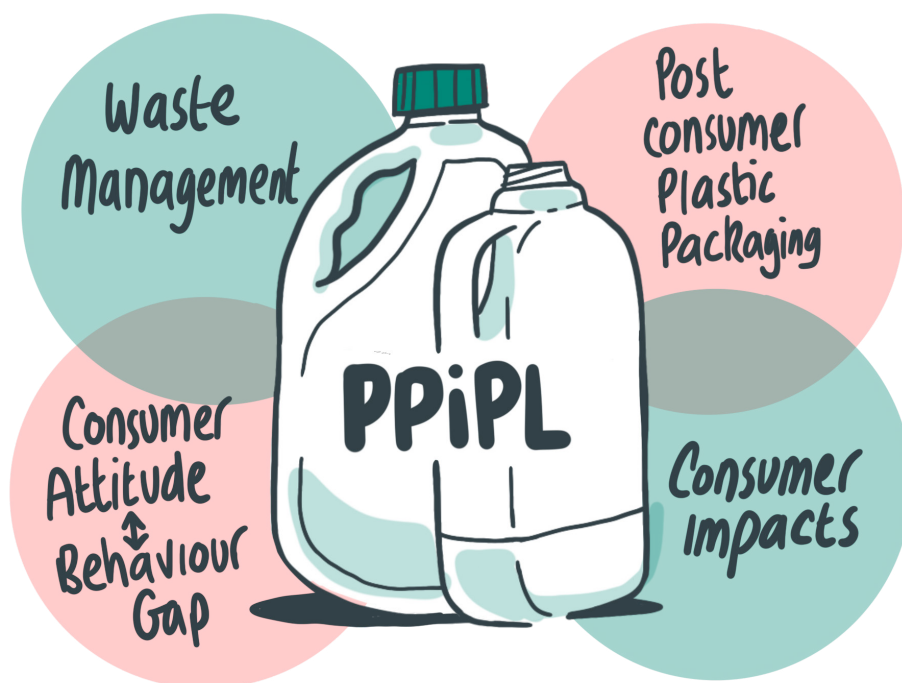
**WRAP** - Waste and Resources Action Programme.



# Executive Summary

## Challenge

Approximately five million tonnes of plastic are used annually, with almost half of that used for packaging<sup>6</sup>. However, recycling rates are low at only 44.2%<sup>7</sup>. Despite environmental and social concerns<sup>8</sup>, plastic production and consumption continue to rise<sup>9</sup>, making managing and reducing the volume of plastic waste a significant societal challenge<sup>10</sup>. The UK Plastics Pact was developed to support the elimination of unnecessary single-use packaging and increase the reusability, recyclability, and compostability of packaging by 2025. How do we ensure the UK Plastics Pact is achieved? Our waste management research<sup>11</sup> examined post-consumer plastic packaging in the UK; consumer impacts on waste management and recycling; and, the consumer attitude-behaviour gap.



## Methodology

Locally situated perspectives on post-consumer plastic packaging were investigated to identify competing value systems, drivers, barriers, and opportunities for change. Insights were gathered from 128 professionals across 65 organisations<sup>12</sup> spanning waste collection, handling, sorting, management, recycling, packaging production, food packaging use, policy, and compliance practices.

## Post-consumer plastic packaging landscape

National government policy emphasises waste reduction, resource efficiency, and a transitioning towards a 'circular economy' for resource use. Concurrently, government commitments to address the climate crisis and achieve net zero emissions by 2050 have shaped debates about post-consumer plastic packaging and its management, considering factors including fossil fuel use, carbon emissions, and food waste.

In addition to responding to government policy and incentives, companies have voluntarily taken action, driven by UK Plastics Pact launched in April 2018 and enabled by the Ellen MacArthur Foundation's New Plastics Economy initiative. The Pact's members, representing over 75% of all consumer plastic packaging, have committed to achieving the following targets by 2025:

**01**

**Eliminate problematic or unnecessary single-use packaging through redesign, innovation or alternative (reuse) delivery model.**

**02**

**100% of plastics packaging to be reusable, recyclable, or compostable.**

**03**

**70% of plastics packaging effectively recycled or composted.**

**04**

**30% average recycled content across all plastic packaging.**

There are still concerns about the UK's capacity to manage increasing household packaging waste, alongside uncertainties regarding the impact of future regulations (including the Extended Producer Responsibility and a Deposit Return Scheme) on material flows. Despite ongoing concerns and uncertainties, the UK is making progress with increased recycling and reduced exports. However, there are differences in outcomes for various polymer materials. PET (Polyethylene terephthalate) and HDPE (High-Density Polyethylene) recycled content is already re-incorporated into food packaging that it was previously used for, known as closed-loop recycling. Closed-loop solutions are also emerging for other polymers, such as PP (Polypropylene), but for 'soft' plastics (film or flexible), such solutions are still lagging behind.

Against this backdrop of government policy, voluntary initiatives and market activity, our research highlights the following findings:

## Drivers, barriers, and opportunities regarding post-consumer plastic packaging management



### Simplicity amid complexity:

Accommodating demands for simplicity in packaging for consumers, stakeholders are faced with complex material, packaging, policy, collection, market, and logistical demands.



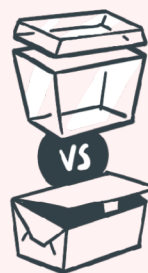
### Reconceptualise waste:

While policy goals prioritise circular resources and closed-loop outputs, the term waste has yet to be reframed as a resource in the language employed for household recycling collections.



### Contingency and variability:

Post-consumer plastic packaging management complexity leads to variable pathways throughout the value chain, creating challenges for sustainable waste management and complicating recycling narratives for consumers.



### Plastic vs. alternatives:

Stakeholders responsible for handling post-consumer waste perceive consumers' shift away from plastic packaging towards alternative formats as exacerbating recycling complexities unknown to consumers.



### Contamination:

The main emphasis on contamination shows how challenging it is to put recyclability into practice as a latent or hidden value. Consumers also have different understandings of what "recyclability" means.



### Redundancy of colour:

The colour of recycled polymer packaging influences its potential applications, prompting consideration of whether certain uses of colour in packaging are redundant and can be eliminated in the future.



### Land, space and logistics:

While significant attention has been directed towards addressing space and storage concerns at the consumer and household level, waste and recycling systems encounter similar challenges regarding the availability of land and space.



### Recycling and litter:

While litter is often blamed for consumer aversion to plastic, recycling alone may not fully address this issue. Additionally, litter picking alone may not maximise the potential for recycling resources.

## Post-consumer plastic packaging stakeholders' characterisation of the consumer and impact of consumer practices



**Consumers play a pivotal role** in shaping the 'ideal' and 'worst case' outcomes, where their disposal practices influence the realisation of local waste management objectives by:

- + their packaging preferences directly influence the composition of recycling collections post-consumption, thereby affecting recycling efficiency;
- + how they prepare and present waste for recycling;
- + and how they distinguish between different streams for waste and different collection containers for residual and recycling.

It is crucial to recognise that consumers are not the sole contributors to influencing variations between positive and negative outcomes in recycling processes.

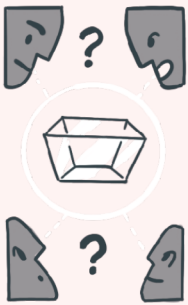


**Consumer convenience is both a barrier and a potential solution** to improving recycling practices and could be utilised to avoid contamination, especially in residential blocks where rearranging waste bins for easier access could reduce contamination.



### Overcommitment:

Highly committed/ well-intentioned consumers are inadvertently contributing to recycling contamination by including non-recyclable items in recycling collections, creating contamination problems that need to be addressed later.



### Ownership and responsibility:

There are complex dynamics surrounding ownership and responsibility for household waste and recycling containers, which often lead to ineffective waste management practices, requiring further exploration.



### Indifference to high quality recycling:

There is a discrepancy in consumer perceptions regarding recycling. While stakeholders prioritise developing higher-quality end uses and closed-loop recycling systems, consumers may not fully understand or appreciate these efforts.



### Disproportionate focus on the consumer:

Retailers and consumers were initially credited for driving changes in practices, but later stages revealed significant activity without explicit consumer involvement. Limited direct interaction occurred between consumers and reprocessing companies, with some companies hesitant to engage publicly.

## Conclusions: New ways of thinking about the consumer attitude-behaviour gap

The policy emphasis is on generating higher value outputs from recycling and circular resource use. Among reprocessors, packaging producers, retailers, and brands, there is active coordination to utilise post-consumer plastic packaging more effectively. This brings an optimism for achieving simpler recycling systems and closed-loops for food-grade packaging. However, realising a circular economy remains a distant goal. Further discussions are needed to improve relationships and material flows across the value chain, aiming to optimise outputs while minimising environmental and social impacts. While significant actions are underway, how to involve the consumer remains unclear.

Our analysis of how stakeholders view consumers has identified three perceived gaps between consumer attitudes and behaviour:

### Consumer Attitude-Behaviour Gap (1)

#### Attitude:

Plastic is bad because it is harmful, therefore moving away from plastic packaging would create less harm.

#### Behaviour gap:

Consumers purchase alternative packaging, e.g. biodegradable, instead of plastic, generating new problems for the polymer recycling value chain and not necessarily creating any greater sustainability.

### Consumer Attitude-Behaviour Gap (2)

#### Attitude:

Recycling is positive and should be increased to prevent waste.

#### Behaviour gap:

Consumers do recycle but do not always add the right materials to the recycling streams, and therefore make recycling outputs more difficult to achieve.

### Consumer Behaviour-Attitude Gap

#### Behaviour gap:

Consumers recycle (as it is positive).

#### Attitude:

Consumers do not fully trust that companies are doing the right thing with the materials that are being recycled.

# Recommendations



## **National Level: Voluntary and Public**

1. Communication campaign to rethink the role of plastic
2. Reframe UK Plastics Pact targets
3. Continue to promote collaboration for wider packaging sustainability

## **Policy: Central Government**

1. Net Zero Future
2. Prioritise waste prevention over recycling
3. Widen simplification and uniformity

## **Policy: Local Government**

1. Communication campaign
2. Optimise community bonds
3. Accompany council tax notifications with news of recycling stream outputs

## **Waste/Resource Management**

1. Future resource use
2. Showcasing polymer recycling

## **Plastic Packaging Producers**

1. Packaging design to include input from the waste sector
2. Protection-orientated packaging
3. Transparency regarding the environment and social
4. Impacts of packaging
5. Waste reduction initiatives

# Future research

Future research agendas emerged from our study, aiming to support transitions to more sustainable packaging solutions, including household relationships with bins/containers and examining the circular material flows, fates, and frictions.

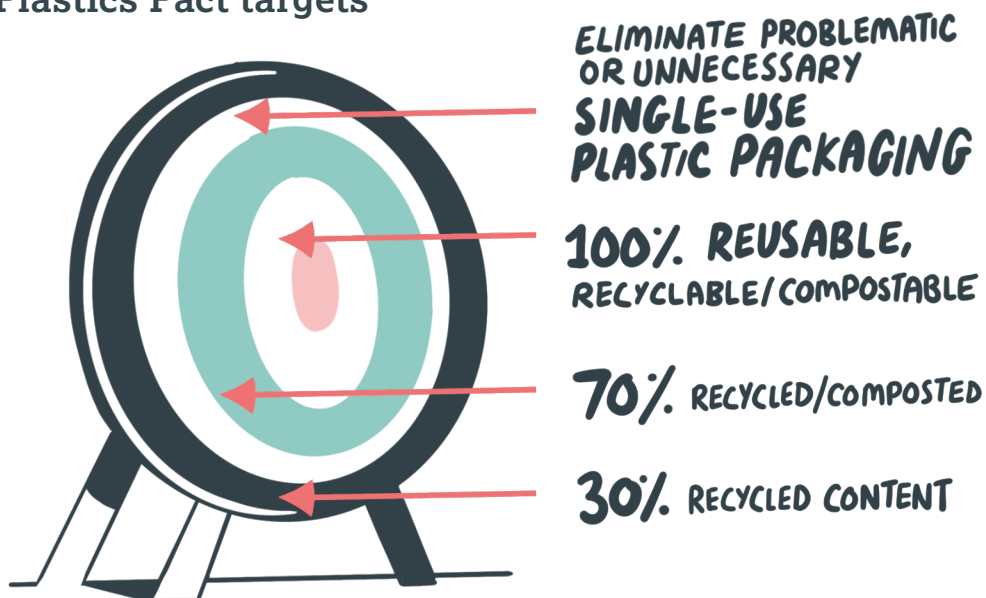
# Introduction

Approximately five million tonnes of plastic are used annually, with almost half of that used for packaging<sup>6</sup>. In 2021, 2.5 million tonnes of plastic packaging waste was generated. Plastic ranks third in packaging material by tonnage but lags significantly in recycling<sup>13</sup>. Only 44.2% is recovered and recycled, marking the lowest rate among packaging materials except wood<sup>7</sup>. Notwithstanding the critical environmental implications of the excessive use of plastic<sup>8</sup>, plastic production and consumption continue to rise<sup>9</sup>.

Managing and reducing the volume of plastic waste is a significant challenge facing society today<sup>10</sup>.

To tackle this issue, the UK Plastics Pact, led by the organisation Waste and Resources Action Programme (WRAP), has brought together UK government, businesses, and NGOs in a pledge to eliminate unnecessary single-use packaging. The Pact also aims to significantly enhance the reusability, recyclability, and compostability of plastic packaging by 2025<sup>3</sup>.

## The UK Plastics Pact targets



Despite ambitious targets and ongoing public debate on the environmental and societal impacts of plastic, academic research suggests that actual consumption practices often diverge from consumers' views on plastic packaging<sup>14</sup>, pointing towards an attitude-behaviour gap and highlight a lack of understanding of the factors that shape, influence and contextualise this gap. This report outlines the findings and recommendations from our research gathering waste management insights.

# Plastic Packaging in People's Lives (PPiPL): Waste management insights

The waste management research gathered insights from experts working in the field regarding their perspectives on consumers' impacts on waste management and recycling efforts, as well as the landscape of post-consumer plastic packaging in which they operate. The overarching aim was to produce a deep understanding of the latent value attributed to plastic packaging waste and disposal practices by everyday experiences from waste management. For this research, value is understood as 'contingent, multiple and transient'<sup>4</sup>, implying that waste's value varies depending on context. Waste holds different values for different stakeholders based on local preferences and perceptions

of desirability or undesirability. The idea of relative or latent value refers to value that may exist but has not yet been realised, representing a gap between current reality and full potential. From understanding hidden value, we aimed to deliver actionable insights for consumer and business behaviour across the value chain.

Post-consumer plastic packaging (PCPP) is consumer-generated packaging waste discarded after use. In the context of food products, PCPP encompasses plastic bottles; rigid pots, tubs, trays (often abbreviated to PTT); and, film packaging (soft or flexible) such as bags or peel-off lids attached to PTT.

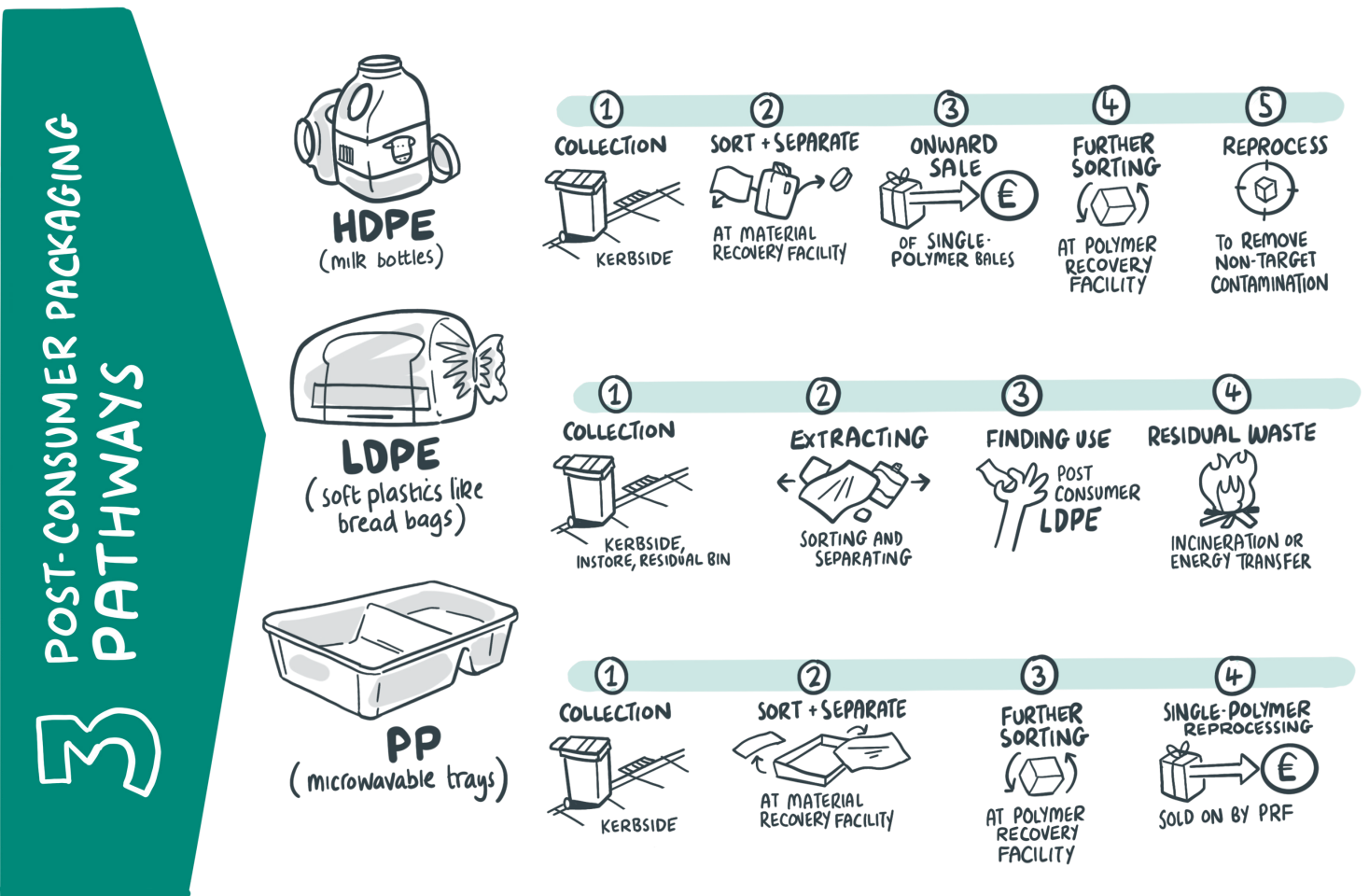




# Overview of Study

We used qualitative research<sup>15</sup> to explore multiple and diverse stakeholder perspectives within the waste management value chain. Insights were gathered from 128 professionals across 65 organisations<sup>12</sup> spanning waste collection, handling, sorting, management, recycling, packaging production, food packaging use, policy, compliance, and regulation. We sought locally situated perspectives on the PCPP landscape, material pathways, attitudes towards the consumer, and the drivers, barriers, and opportunities for enhancing waste management practices. A qualitative approach allowed us to uncover the complexity of PCPP waste management practices, and to uncover potentially overlapping yet conflicting perspectives.

## Post-consumer plastic packaging value chain



The starting point for investigating waste management practices was local authority dry mixed recycling (DMR) household collections in two university cities, one located in the north of England and the other in the south. In both cities, household waste and recycling follow a two-tier local authority structure, with the City Council serving as the Waste Collection Authority (WCA) and the County Council as the Waste Disposal Authority (WDA). Nonetheless, there are notable differences between the two cities.

The initial stages of the PCPP, involving household collections and material sorting, are mostly set within clear local authority boundaries driven by statutory duties. The subsequent value chain transforms into marketplace arrangements. The companies involved change and shift over time, and often operate on national or international scales<sup>16</sup>. Consequently, retaining local or regional distinctions becomes less relevant, and discussions shift towards national issues.

### Comparison of waste management practices in the two areas of the study<sup>7</sup>

ASPECT	SOUTHERN CITY	NORTHERN CITY
Waste and recycling levels	<ul style="list-style-type: none"> <li>+ Lower levels of household waste</li> <li>+ Higher level of recycling</li> <li>+ Recycling rate surpasses national average</li> <li>+ Single bin for recycling collection</li> </ul>	<ul style="list-style-type: none"> <li>+ Higher level of household waste</li> <li>+ Lower level of recycling</li> <li>+ Recycling rate falls below national average</li> <li>+ Two bins: one for paper/card, one for metal/glass/plastics</li> </ul>
Organisation of recycling	<ul style="list-style-type: none"> <li>+ Managed through Local Authority Trading Company structure owned entirely by the City Council</li> <li>+ Recycling collections sent to commercial material recovery facility via waste transfer station operated by a separate waste management company</li> </ul>	<ul style="list-style-type: none"> <li>+ Local authority operates in-house collection service</li> <li>+ Recycling transported to material recovery facility owned by waste disposal authority via waste disposal authority-owned transfer station</li> </ul>
Geographic size and population	<ul style="list-style-type: none"> <li>+ Smaller area, less rural</li> <li>+ Slightly larger population, concentrated in fewer households</li> <li>+ Higher proportion of students</li> <li>+ Shorter waste/recycling collection rounds and vehicle journeys</li> </ul>	<ul style="list-style-type: none"> <li>+ Larger area, more rural</li> <li>+ Smaller population, dispersed over more households</li> <li>+ Lower proportion of students</li> <li>+ Longer waste/recycling collection rounds and vehicle journeys</li> </ul>

# Data collection

The research comprised of two stages. First, stage one, a literature review was conducted<sup>17</sup>, alongside:

- + 32 semi-structured<sup>18</sup> interviews with industry experts:
  - Packaging producers
  - Retailers
  - Reusers
  - Waste management
- + 3 workshops involving 42 experts<sup>19</sup>

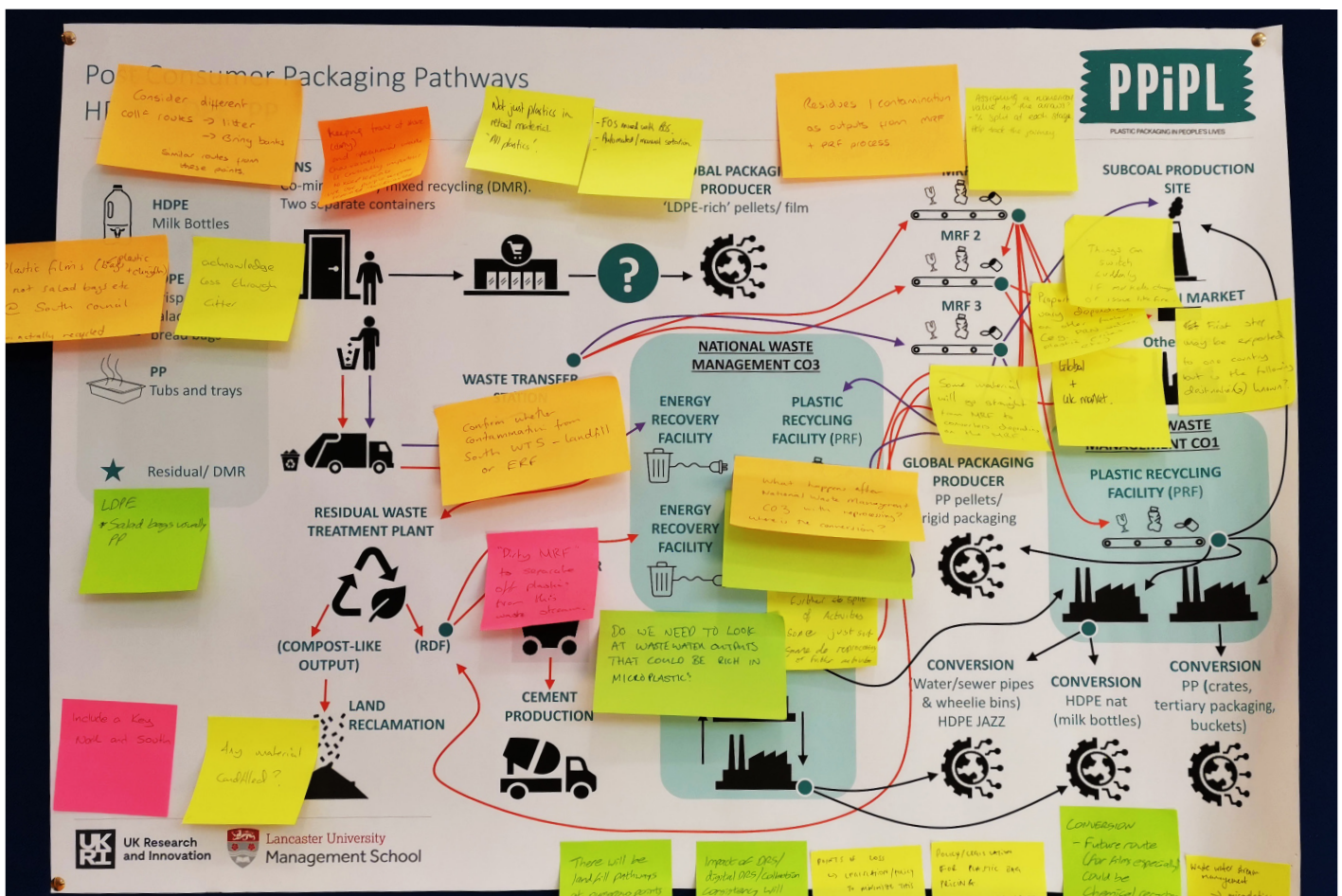
The aim was to identify three plastic packaging formats with significant potential for circular economy pathways.

In the second stage, a mobile ethnology<sup>15</sup> was employed to follow the three identified plastic packaging formats:

- + High-Density Polyethylene (HDPE)
- + Low-Density Polyethylene (LDPE)
- + Polypropylene (PP)

This approach allowed us to move across different organisational contexts, engaging with various stakeholders to understand the practical management process for PCPP, how this is valued locally and the emergence of latent values.

The second stage involved 58 participants across 22 organisations, spanning 28 locations, with data gathered through interviews, site visits and workshops.



## Data analysis

Data analysis occurred in two phases. First, **template analysis**<sup>20</sup> was used to identify emergent themes relating to the impact of the consumer on waste management and recycling practices.

Second, the dataset was analysed to explore **local valuation** of PCPP and **the potential emergence of latent value**. **Frame analysis**<sup>21</sup> was used to establish what was valued by study participants, the various stakeholders. The analysis highlighted how stakeholders perceived PCPP as either positive, negative, or relative value.

Positive value denotes beneficial aspects, negative value pertains to detrimental factors, and relative value involves conditional or potential value influenced by other factors and variables. Ten frames of value were used to attribute significance to plastic packaging and packaging pathways, serving as lenses through which value was understood and integrated differently.

### Cautionary note

Our study was initiated shortly before the COVID-19 pandemic closed many of our usual operations and modes of engagement, particularly impacting the delivery of the first stage of data collection and participant availability for online focus groups and interviews. While following plastic packaging through various pathways allowed us to engage with diverse stakeholders across organisations, it is important to acknowledge gaps in our data. We collected empirical data from specific starting points in England, thus not capturing all voices, such as residents of other regions or a broader diversity of socio-economic backgrounds. Rapid changes were occurring during the study, including organisational upgrades and responses to new technologies, as well as regulatory adjustments regarding recycled feedstock in food-contact packaging<sup>22</sup>. Additionally, due to time constraints, insights into the fate of non-target contamination material after extraction were limited. These limitations should be considered when interpreting our findings.

## Ten plastic packaging frames

**1. Circular resource use:** Circularity, possibilities of re-use, retaining future material use value by working towards 'closed loop' recycling to provide material to convert back into the same applications, and avoiding 'fallout' and material loss over time.

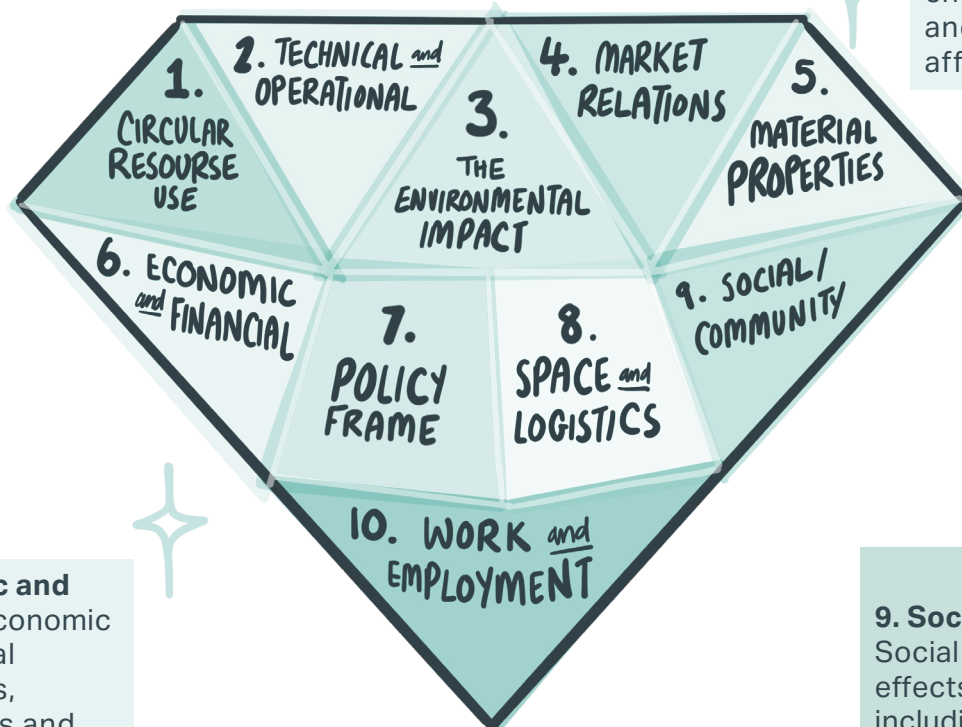
**2. Technical and operational:** Mechanical, operational, technical, and technological dimensions of working closely with waste materials.

**3. Environmental impact:** Environmental sustainability, environmental, ecological or biodiversity damage, and moving towards achieving net zero climate change goals.

**4. Market relations:** PCPP market viability and business continuity of a single organisation, their relationship to suppliers and/or customers (including consumers via branding and marketing), and to material availability or scarcity for their operations.

**5. Material properties:** Plastic packaging as an identifiable material with particular chemical properties and associated affordances.

### "10 FRAMES OF VALUE"



**6. Economic and financial:** Economic and financial implications, transactions and fluctuations in prices and costs.

**7. Policy:** Compliance or non-compliance with national primary and secondary legislation, regulatory standards, professional and industry codes of conduct, and also internal organisational policy and commitments, such as ESG and CSR statements. [There is an overlap here with the economic/financial frame.]

**8. Space and logistics:** Infrastructure (equipment, sites) availability and capacity, land use planning and land availability, transport logistics, as well as space and logistics at household level.

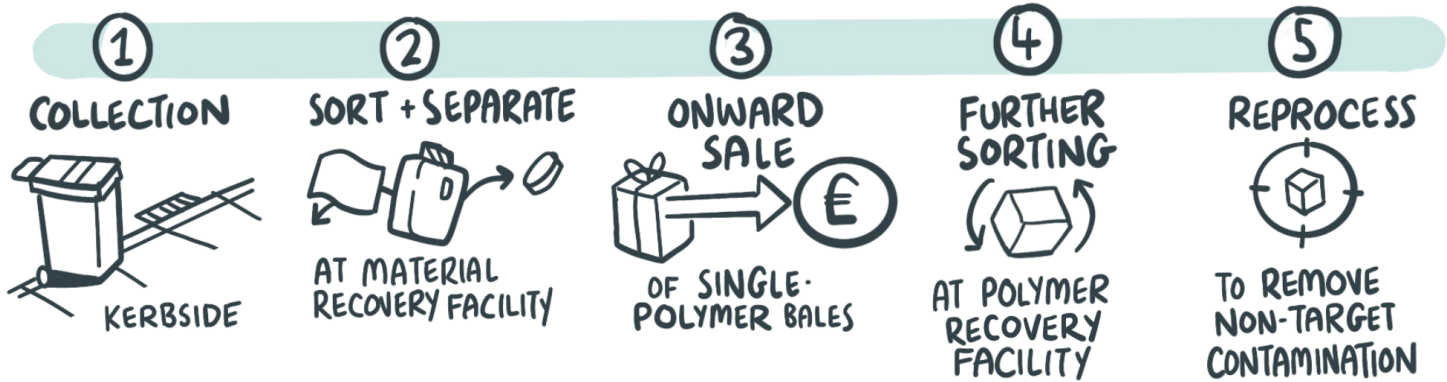
**9. Social/community:** Social and community effects of PCPP, including a political dimension in terms of moral or normative value, and including 'public opinion'.

**10. Work and employment:** Staffing, jobs, work, and employment conditions.



# PCPP pathways

Milk bottles: High Density Polyethylene (HDPE)



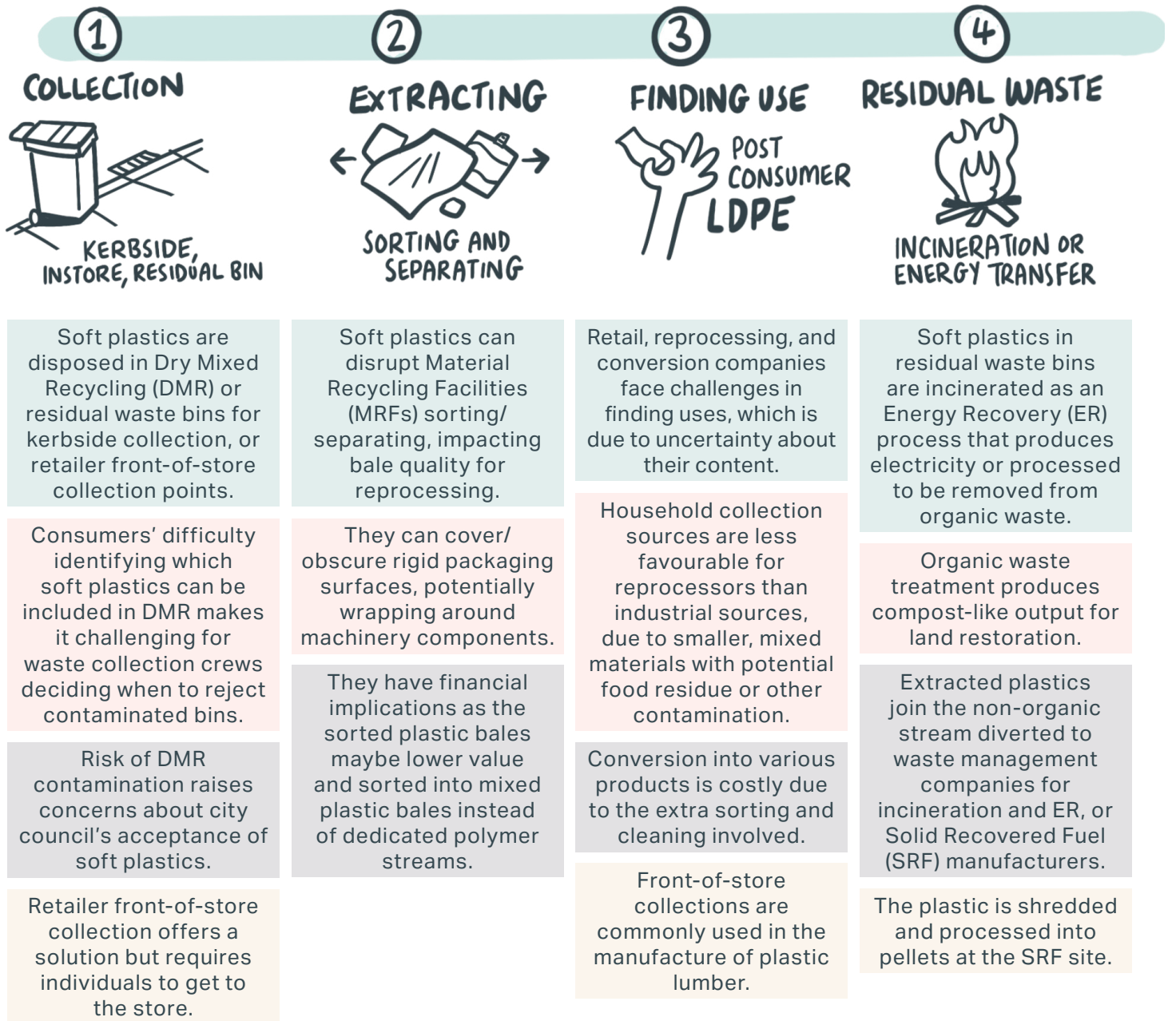
<p>Volumes peak in the winter due to increased consumption in hot milk based drinks.</p>	<p>Mixed waste is transported to MRFs and sorted into distinct polymer material streams.</p>	<p>MRFs have different contracts for selling HDPE bales, including for high-value HDPE natural bales sold to companies specialising in recycling to food-quality standards.</p>	<p>HDPE natural bales, intended for reuse in milk bottles, undergo re-sorting by polymer recovery facilities to remove non-target materials.</p>	<p>HDPE bales can be further sorted to remove non-target contaminants, before reaching a company specialising in food-grade materials.</p>
<p>Volume plays a role in determining the destination of recycling, due to capacity and contractual obligations.</p>	<p>Examples include HDPE natural (clear) bales; HDPE jazz (coloured) bales, and/or HDPE mixed bales.</p>	<p>Bales can also be sold on the open market, so not all milk bottles are recycled into new ones.</p>	<p>The re-sorted and cleaned-up bales are sold to produce food-quality standard materials.</p>	<p>HDPE natural is granulated into tiny flakes before further sorting and washing removing smaller contaminants.</p>
<p>Mixed recycling collections are delivered to intermediate waste transfer stations for storage before being transferred to a Material Recovery Facility (MRF) for sorting and separating.</p>			<p>Extracted non-target material bales are used in alternative products, e.g. garden furniture.</p>	<p>Natural flakes are reprocessed into food-grade pellets, rigorously tested for quality, and sold to manufacturers.</p>
				<p>Jazz is sold for various uses, e.g. waterpipes, detergent bottles.</p>

## Key themes HDPE

- + Food-grade closed-loops (milk bottles) have higher values than non-food grade uses, due to additional testing and quality assurance costs. Inefficiencies arise from HDPE natural being lost to non-food grade streams.
- + The value distinctions between HDPE natural, white, and jazz highlight the loss of value from using colour in packaging. More discussions about targeted colour use might be advantageous e.g. to distinguish food and non-food grade packaging and consider how packaging could be better identified and diverted into streams. Standardised packaging colours could enhance long-term sustainability.

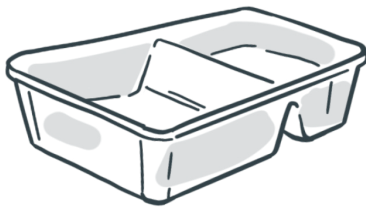


## Soft Plastics: Low Density Polyethylene (LDPE)

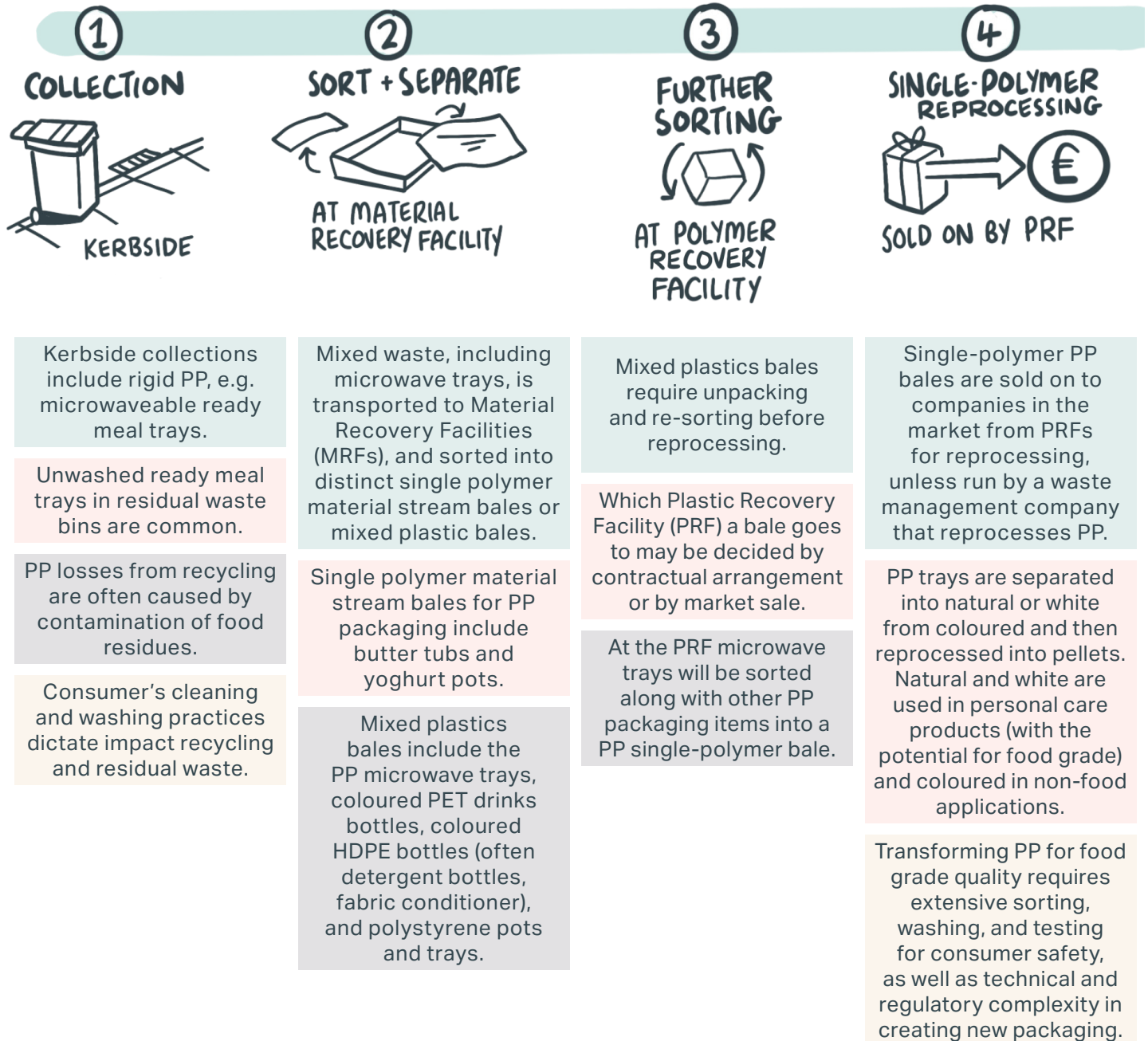


### Key themes LDPE

- + Concerns about consumer confusion on disposal pathways, with implications for recapturing soft plastics.
- + Collecting post-consumer LDPE is financially challenging compared to other materials
- + The alternative values of extracting soft plastics for recycling vs. residual waste.
- + The value of post-consumer collection competes with cleaner pre-consumer sources, necessitating the development of an end market for post-consumer materials.



## Microwaveable trays: Polypropylene (PP)



### Key themes PP

- + The market for PP is fast-changing, with fluctuations in demand, prices, supply, and quality for PP-rich streams.
- + Regulatory requirements for PP's safety contribute to limited availability of food grade recycled PP (rPP) due to reprocessing complexities. However, the regulatory framework alone will not increase food grade rPP, without investments in reprocessing facilities, which face an uncertain future without feedstock security.
- + The scarcity of high quality rPP prompts concerns about packaging producers favouring materials with more readily available recycled supplies.



# Post-Consumer Plastic Packaging Landscape

The PCPP participants operated within specific policy contexts, guided by UK government legislation and targets for England, voluntary initiatives, and market infrastructures.

## Government legislation and targets

The statutory responsibilities for waste management in England are set out in the *Environmental Protection Act 1990*. Waste collection duties are allocated to Waste Collection Authorities (WCAs: which are usually city, district, or borough councils), while Waste Disposal Authorities (WDAs: which are usually County councils) handle waste disposal responsibilities prioritising methods with the least environmental impact<sup>23</sup>, where waste prevention is the preferred option and landfill as end disposal is the least preferred.

A range of more recent Government policy and strategy papers, including the *2018 A Green Future: Our 25 Year Plan to Improve the Environment*<sup>24</sup>, the *2018 Our Waste, Our Resources: A strategy for England*<sup>8</sup>, and the *Environment Act 2021*<sup>25</sup> reinforce the emphasis on the waste hierarchy and waste reduction, and include a goal to eliminate 'avoidable' waste, including a ban on single-use plastic items introduced in October 2023.

Waste reduction targets are included in the *Environment Act 2021* which aims to reduce residual waste tonnages per person by 2042, against 2019<sup>25</sup> levels. This target was further supported by a 2023 waste prevention paper *The waste prevention programme for England: Maximising Resources, Minimising Waste*<sup>26</sup> that emphasises reuse systems. However, to date, no significant reduction in tonnage of household waste has been achieved<sup>27</sup>.

Recycling targets have been set for local authorities, with current targets of at least a 55% recycling rate by weight by 2025, and 65% by 2035. A previous goal to recycle 50% by 2020 was not met: the 2020 recycling rate for households in England was 44%<sup>28</sup>. A new 'simpler common-sense' approach to recycling<sup>29</sup>, allowing individuals across England to recycle the same materials in their homes, workplaces, and schools has recently been announced<sup>30</sup>, accompanied by tougher regulations.

# The policy landscape



1990

The statutory responsibilities for waste management in England are set out in the Environmental Protection Act 1990. Waste collection duties are allocated to Waste Collection Authorities, while Waste Disposal Authorities handle waste disposal responsibilities and are required to treat waste<sup>23</sup>, prioritising methods with the least environmental impact. Recent government policies prioritise waste reduction and follow the waste hierarchy.

The Environment Act 2021 sets a target to reduce residual waste per person by 2024, against 2019 levels.

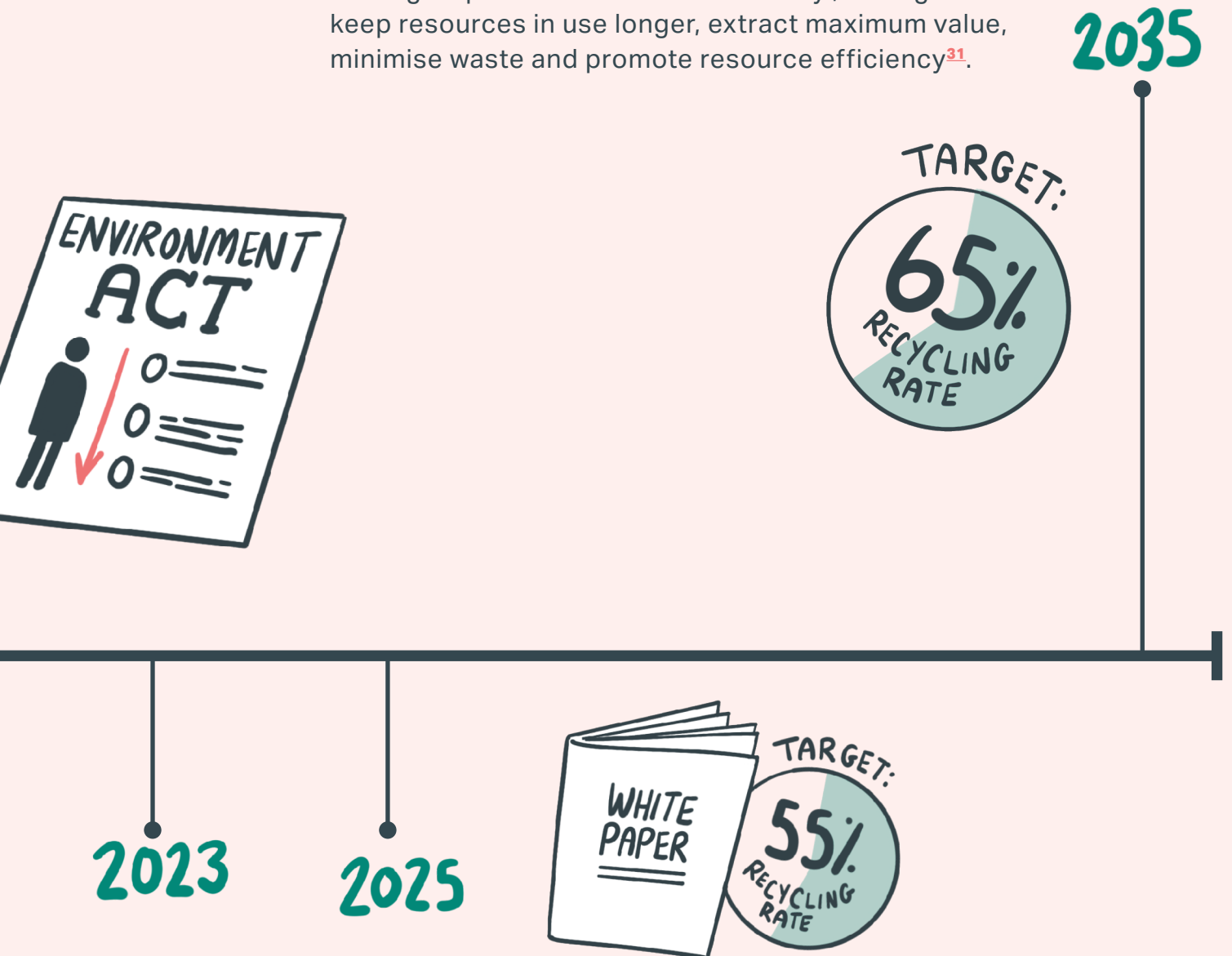
2021



2018

This includes the 2018 A Green Future: Our 25 Year Plan to Improve the Environment<sup>24</sup>, the 2018 Our Waste, Our Resources: A strategy for England<sup>8</sup> and the Environment Act 2021<sup>25</sup>. These policies aim to eliminate avoidable waste, including a ban on single-use plastics implemented in October 2023.

A new 'simpler common-sense' approach to recycling<sup>29</sup> - allowing individuals across England to recycle the same materials in their homes, workplaces, and schools - is to be introduced, accompanied by tougher regulations<sup>30</sup>. Government policies and strategies promote a 'circular economy', aiming to keep resources in use longer, extract maximum value, minimise waste and promote resource efficiency<sup>31</sup>.



The 2023 waste prevention programme for England: Maximising Resources, Minimising Waste emphasises reuse systems as a means to support this goal. However, no significant reduction in tonnage of household waste has been achieved<sup>26</sup>.

Recycling targets have been set for local authorities, with current targets of at least a 55% recycling rate by weight by 2025, and 65% by 2035.

Government policies and strategies also emphasise resource efficiency and a 'circular economy', which involves keeping resources in use for longer, extract maximum value from them, minimising waste, and promote resource efficiency<sup>31</sup>. A circular economy therefore is associated with increasing the duration of the useful life of products, and productively using their resources again when they do eventually reach end of life. The Government's 2020 Circular Economy Packaging policy statement notes that a more circular economy will require change throughout value chains, novel ways of turning waste into a resource, and changes to consumer behaviour.

Closed-loops are positioned as part of a circular economy where materials are returned through reprocessing and remanufacturing to the original products that they constituted (e.g. creating HDPE milk bottles from HDPE milk bottles). Closed-loop plastics recycling is considered to be more environmentally beneficial than 'open loop' recycling (e.g. where HDPE bottles might be converted to other products such as plastic pipework)<sup>6</sup>. However, in most cases recycled content replaces virgin feedstock only partially rather than completely<sup>32</sup>.

In 2022, the UK Government introduced a *Plastic Packaging Tax* on plastic packaging containing less than 30% recycled content to encourage the use of recycled content in packaging.

The concept of food grade or food contact standard recycled content has recently been a source of EU policy development<sup>22</sup>. Food safety legislation and legislation such

as the *REACH Regulations* on chemical use<sup>33</sup> mandate that packaging manufacturers comply with stringent standards for food packaging and when incorporating recycled content that will be, or could be, in contact with food. These aim to protect consumers and human health and add regulatory complexity to the development of recycling technologies to produce recycled polymer to a standard that can be used in food packaging.

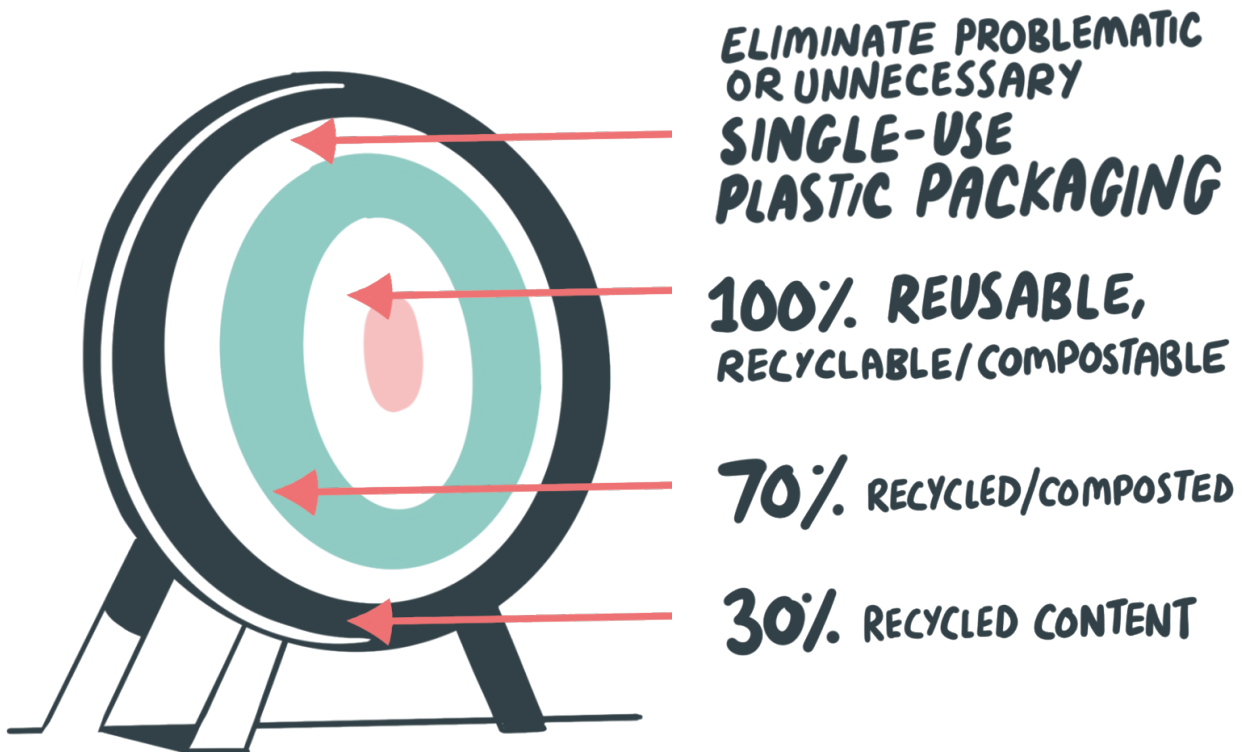
Plans for an *Extended Producer Responsibility* (EPR) scheme, to encourage packaging to be designed for easier recyclability, and a *Deposit Return Scheme* (DRS), to encourage bottles to be collected, are being developed at the time of writing.

Intersections with other policy goals such as Government commitments to address the climate crisis and reach 'net zero' to decarbonise the economy by 2050, have influenced debates about PCPP and its management. These debates have directed focus towards the subjects of carbon emissions and food waste<sup>34</sup>. The subjects have been used to advocate for the retention of plastic packaging but also to move more quickly to reuse systems and to local food production and distribution.

While Government can set recycling targets, it is the market that largely decides what happens after collection. Company activity is shaped by regulatory requirements, financial stimuli such as the *Plastic Packaging Tax*, voluntary engagement with Government research collaborations and innovation funds<sup>35</sup> as well as collaborative opportunities such as those provided by the UK Plastics Pact.

## Voluntary initiatives: The UK Plastics Pact

In April 2018, the UK Plastics Pact launched. It was the first of a global network of Plastics Pacts enabled by the Ellen MacArthur Foundation’s New Plastics Economy initiative<sup>36</sup>. The Pact’s members, representing over 75% of all consumer plastic packaging, have agreed to meet the following targets by 2025:



### The UK Plastics Pact targets and progress

<b>UK PLASTICS PACT 2025 TARGETS</b>	<b>PROGRESS REPORTED IN 2022-2023 ANNUAL REPORT<sup>37</sup></b>
Eliminate problematic or unnecessary single-use packaging	99.6% Reduction in problematic plastic items 55% Reduction in weight of problematic items and materials 8% Reduction in total weight of household plastic packaging
100% of plastic packaging to be reusable, recyclable, or compostable	71% Recyclable 73% Recyclable or reusable 96% Reduction in hard-to-recycle design components 94% Rigid plastic packaging now recyclable
70% of plastic packaging effectively recycled or composted	55% Effectively recycled 54% Plastic recycled in the UK 61% Increase in material recycled in the UK since 2018
30% average recycled content across all plastic packaging.	24% Average recycled content (up from 8.5% in 2018)

## Markets and infrastructure

The plastics industry in the UK, which is closely linked with the chemicals industry and manufacturing, comprises around 6,200 companies and directly employs 180,000 people<sup>38</sup>. There are 16 reprocessors<sup>39</sup> who manufacture washed flake from household plastic packaging<sup>40</sup>.

A recent RECOUP report<sup>40</sup> notes that significant gaps in infrastructure, particularly at reprocessor stage, will need to be addressed to meet government recycling and circular economy targets.

More specifically, the report notes:

- + Insufficient capacity to deal with household packaging in general and with food-grade reprocessing specifically.
- + New policy initiatives such as EPR and DRS are 'likely to cause significant shifts in volumes, materials, and formats in kerbside recycling', consequently this will affect the waste streams and required collecting and sorting facilities.

Despite these concerns, more recycling is now occurring in the UK. In addition:

- + Export levels have recently reached less than 50% and are increasingly shipped to European countries rather than further.

However, there are disparities between what plastic packaging formats are being recycled and converted. PET and HDPE bottles attract relatively high recycling rates. The suitability for closed loop use varies between PET, PE and PP with the latter presenting most significant challenges<sup>41</sup>. Meanwhile, PCPP formats such as film or flexible plastic are harder to recycle and much less attractive to the market.

Recycled polymer material placed on the market from post-consumer sources not only has to compete with virgin polymer but also with recycled pre-consumer (post-industrial) material that tends to be cleaner, easier to recycle and hence more attractive to recycler markets.

Other packaging materials may have started to be substituted for plastic. For example, between 2017 and 2019, aluminium, glass, and, paper and card packaging use has increased<sup>6 42</sup>.

# ‘Ideal’ and ‘Worst-Case’ Scenarios in PCPP Management

**The recyclability of plastic packaging is dependent on the context, and must be clear, and operationalised under appropriate conditions to achieve the state of ‘being recycled’.**

Recyclability is fundamentally a latent value. By this we mean recycling is a value that is only realised in appropriate contexts and conditions. Although plastic packaging can be recycled, whether it will be recycled, and if so, into what, are entirely different considerations (see later section [Contamination: Why the issue of ‘recyclability’ might be a red herring](#)).

The analysis reveals contrasting positive and negative conditions influencing the sustainable management and likelihood of recycling of PCPP, with some conditions consistently viewed positively or negatively across priority areas, pointing to ideal and worst-case scenarios. This is important as it deepens our understanding of the conditions that lead to PCPP being recycled, and hence the latent value becoming realised.

In the **ideal scenario**, optimal recyclability is achieved when waste streams are predictable, well-understood in terms of materials and flow patterns, and can be efficiently managed in processes compliant with policies at various levels. This ensures the production of recycled content suitable for high-quality end uses, ideally reintegrated into products similar to their original material.

In the **worst-case scenario**, recyclability remains latent, characterised by uncontrolled and inconsistent waste management practices. Waste is misplaced as litter and/or is contaminated, often ending up in the wrong bins and waste streams. This results in materials remaining unused for productive outputs and impacting negatively upon the environment.

These scenarios provide essential background context to highlight key issues arising for the waste management and recycling sectors.

The ideal scenario	The worst-case scenario
Organised, controlled, managed according to policy	Uncontrolled
Resource (reusable and reused)	Waste
High quality (clean)	Low quality (dirty, contaminated)
Knowable, specificable, traceable, accreditable	Unknown, uncertain, inconsistent

# Drivers, Barriers and Opportunities from PCPP Pathways

## Simplicity amid complexity

**Accommodating demands for simplicity in packaging for consumers, stakeholders are faced with complex material, packaging, policy, collection, market, and logistical demands.**

Stakeholders in the PCPP value chain recognise the necessity of navigating complexity despite the positive value often associated with simplicity, clarity, and certainty, as attempts to simplify one aspect introduce complexities elsewhere. For instance, while there is advocacy for simpler packaging types such as 'mono' materials, challenges arise in transitioning to such packaging, particularly in film packaging. Transitioning to 'mono' film packaging would require thicker layers, impacting logistics and waste management.

Additionally, recent government reforms aiming for 'simpler recycling' face challenges due to lack of standardisation in collection containers and unique configurations at recycling facilities. The introduction of new materials and packaging innovations reintroduces complexity, while addressing consumer heterogeneity requires nuanced messaging. Achieving greater simplification across the PCPP value chain demands time, resources, infrastructure, and collaboration, highlighting the difficulties in realising simplicity despite its idealised status.

“

**There's some instances where we might be handing across certain types of film to specialists and saying, "what's that?", people that have worked in the industry for a number of years, and they go "well, I think that's PE".**

(Packaging Manager, National Retailer, Participant 114)



## Reconceptualising recycling as outputs rather than inputs: A new way of viewing waste?

**While policy goals prioritise ‘circular’ resources and ‘closed loop’ outputs, the term ‘waste’ has yet to be reframed as a ‘resource’ in the language employed for household recycling collections.**

Participants emphasised the importance of considering outputs alongside inputs in recycling processes, with some questioning the term ‘recycling’ when applied to specific outputs. There is a push for material to return to its original packaging format, highlighted as the ultimate goal of PCPP recycling. Polymer degradation makes it difficult to maintain closed loops in

recycling. This leads to non-closed loop recycling or ‘downcycling’, where recycled material is temporarily repurposed for non-packaging products. Some waste management companies have rebranded to prioritise outputs, yet this shift has not reached household recycling collections in everyday consumer language.

“

**If you want to preserve the value of the recycled materials, ideally it has to be closed loop. So, products like film, without any contamination after its use, recycled, potentially going back into the same application.**

(Division Director, Reprocessor/Converter Company, Participant 112)

“

**...the plastic lumber is potentially, you could argue, almost entombing that plastic into a use that has a 20-30 year life, and maybe in 20 or 30 years’ time we’ll have the technology that will be able to deal with that bench once it’s reached the end of its life, and we can recover that plastic. Or it might just be that it can’t be recovered, and it has to be incinerated.**

(Packaging Manager, National Retailer, Participant 114)

## Contingency and variability across PCPP pathways

**Post-consumer plastic packaging management complexity leads to variable pathways throughout the value chain, creating challenges for sustainable waste management and complicating recycling narratives for consumers.**

Complexities within PCPP management introduce contingencies and variabilities in material pathways, potentially directing polymer material unintentionally towards lower-value uses or residual waste disposal. While consumer choices initially dictate recycling or residual bin placement, subsequent decisions by collection crews and waste transfer station staff regarding contamination levels may redirect loads to residual waste.

At Material Recovery Facilities (MRFs), sorting processes determine whether polymer packaging items enter the correct stream, with issues such as equipment configurations causing losses, especially with flexible plastic film. Mis-sorting often occurs due to time pressures, prioritising quantity over quality. These outcomes result in sub- or non-optimal pathways for materials, leading to either diversion of PCPP to residual waste treatments, increased transportation distances if and when non-target material is redirected to suitable reprocessing sites, and/or potentially resulting in lower-quality end uses.

Market relationships between MRF sites and other organisations define material movements, with internal organisational structures influencing pathways.

Despite the internal markets supporting infrastructure investment, potential frictions or downsides for wider sustainability and resource efficiency remain unexplored. The complexities involved in material pathways make it challenging to provide consumers with a clear understanding of recycling processes, in terms of what happens next and where their recycling goes to.



**There will be some people who you work with quite intensely sometimes [to find homes for outgoing offtakes], maybe for a year, and then things change in their operation or your operation, and you're not dealing with them so much or not at all, and it's like the relationship has run its course almost.**

(Supervisor, Material Recycling Facility, Participant 70)

## Plastic vs alternative packaging materials: A diversion from other strategies?

**Stakeholders responsible for handling post-consumer waste perceive consumers' shift away from plastic packaging towards alternative formats as exacerbating recycling complexities unknown to consumers.**

Participants in waste and polymer recycling sectors expressed concerns about swapping plastic packaging for alternative formats, citing increased complexities in the recycling process. The shift was attributed to consumer perceptions of plastic as environmentally harmful, often influenced by media coverage (e.g. the 'The Blue Planet effect' <sup>43</sup>). Some worried that consumers might not fully grasp the environmental implications of alternative choices, such as the energy required to recycle aluminium cans replacing plastic bottles.

Despite regulation, including the *Competition and Market Authority's Green Claims Code*<sup>44</sup>, companies were accused of 'green hushing', withholding information about new packaging. While some defended plastic for its benefits in food preservation and energy reduction, debates arose over whether such arguments hindered more radical transformations in food systems needed for net zero goals. The emphasis on recycling and material debates risked overshadowing broader efforts toward sustainability, potentially masking the essential role of consumers in achieving net zero.

“

I was at a festival thing, and they were selling, they were making a big thing about selling water in tin cans [...] I said to the person, "Do you know what the melting point of this is? It's like 500 degrees Celsius. Do you know what the melting point of a plastic bottle is? It's like 160. What are you doing?" How can that be more resource-efficient to put all that energy in to do this sort of thing?

(Division Director, Reprocessor/Converter Company, Participant 122)

## Contamination: Why the issue of ‘recyclability’ might be a red herring

**The main emphasis on contamination in waste management shows how challenging it is to put recyclability into practice as a latent or hidden value. Consumers also have different understandings of what “recyclability” means.**

The concept of “contamination” emerges as a central theme in our research, highlighting the tension between prioritising larger vs. smaller volumes of cleaner material streams in recycling operations. While efforts are made by local authorities to enhance recycling rates while minimising contamination, challenges arise when potentially recyclable items are incorrectly sorted or end up at MRFs ill-equipped to handle them. This results in non-target materials, labelled as contamination, permeating the recycling value chain and complicating processing efforts. For example, a plastic bottle, one of the most commonly recycled items, is deemed ‘contamination’ in this stream because it does not align with the processing capabilities designed for soft film and flexible plastic packaging. Although some stakeholders view contamination as manageable and even beneficial for adding value through re-sorting, others express concerns about the additional labour and investment required to maintain high-quality recyclates.

Contamination affects the entire recycling chain beyond consumer actions, requiring management alongside recyclables. Redirecting most non-target materials to specialised reprocessing sites is common, yet the economic costs, often involving long-distance transport, are uncertain.

Improving recyclability demands a close examination of material stream generation and handling, considering environmental, logistical, and economic implications. Evolving consumer perceptions of recyclability and new materials introduce additional challenges, potentially worsening contamination in recycling processes.

As the conversation on recyclability evolves and new materials enter the market, there is a growing need for consumer education. In addition, research into the economic and environmental impacts of managing contamination is required to ensure the sustainability of recycling processes.

“

**If a plastic bottle got into a [soft plastics] collection point, it probably would be detected as polyethylene, but it would be a contaminant to the recycling.**

(Packaging Manager, National Retailer, Participant 83)

## PCPP colour: Is colour unnecessary?

**The colour of recycled polymer packaging influences its potential applications, prompting consideration of whether certain uses of colour in packaging are redundant and can be eliminated in the future.**

While policy efforts have targeted certain single-use plastic items as unnecessary and avoidable, our data raises questions about the necessity of colour in plastic food packaging. MRFs, Polymer Recovery Facility (PRFs), and reprocessing companies use colour as a sorting variable in their processes, with coloured polymer packaging often segregated from natural ones. In one company, for example, 'jazz' polymer (any packaging that has had colour added into the material during its production) was separated from natural polymer packaging and sent for non-food uses, while only the natural polymer went on to be reprocessed for food-grade quality recyclate.

However, the addition of colour to packaging contributes to its downcycling over time. While many packaging producers are already working to reduce the amount of colour added to plastic packaging, a more transformative approach would involve divorcing colour entirely from packaging. This shift would prioritise the functional properties of polymer packaging, such as food protection and cost-effectiveness, over marketing and consumer appeal, necessitating significant changes in thinking from both consumers and stakeholders in the pre-consumer (polymer production, packaging production, brand, retail) stages of the value chain.

“

**Perversely HDPE natural tends to be more valuable than aluminium cans. It's not always been the case, but with the price at the minute, milk bottles are worth more than aluminium cans [...] HD natural is the highest value, it's way more valuable than PET. It's three times the value. HD natural is the gold standard kind of polymer. It's been like that for the last 3 or 4 years since we've been running.**

(Shift Manager, PRF, National Waste Management and Recycling Company, Participant 129)

## Land, space, logistics: Consumers under-appreciation of other requirements for successful recycling?

**While significant attention has been directed towards addressing space and storage concerns at the consumer and household level, waste and recycling systems encounter similar challenges regarding the availability of land and space.**

The complexities and variabilities of material streams and pathways, including transportation routes, carbon emissions, and waste volumes, pose significant challenges for waste and recycling infrastructure. Land scarcity emerges as a critical issue, essential for end disposal sites (such as landfill and energy recovery facilities), reprocessing plants, and intermediate treatment facilities (waste transfer stations, MRFs, PRFs). While calls for national self-sufficiency in waste management aim to address concerns about environmental and social impacts, challenges persist in finding suitable sites amidst competition from other land uses, particularly housing that could command much higher land value. Participants highlight the tension

between proximity principles and national self-sufficiency in waste management policies. For them, waste is not an issue that respects national borders.

In many ways, these issues of land, space, and storage mirror those faced at household level. The ongoing discourse often focuses on enhancing the convenience of recycling systems for consumers, aiming to minimise household space requirements and reduce the number of separate containers needed. Consumers may have a limited awareness of the local and regional space needs associated with recycling operations, as well as the consequences of resource movements on the operational and environmental aspects of recycling systems.

“

**We produced some joint communications, one of them was about where our waste goes in a particular quarter, and City [council] didn't want us to publish it. And that's because 18% went outside of Europe. [...] An important point is because it's a commodity and a rapidly changing market, from one month to another it can completely change where it goes. [...] And we buy a lot of new packaging from abroad, so we have to send waste back there to turn into something new. But it's that transparency for the general public.**

(Waste Strategy Officer, County Council (WDA), Participant 95)

## Recycling and litter: Two separate issues

**While litter is often blamed for consumer aversion to plastic, recycling alone may not fully address this issue. Additionally, litter picking alone may not maximise the potential for recycling resources.**

Participants distinguished between litter management and plastic/material recycling in their work, viewing litter as an environmental pollution issue and recycling as addressing resource efficiency. While recycling provides a pathway for PCPP, it does not address the root cause of litter, which concerns site managers striving to contain and prevent litter within PCPP management sites (that is, the recycling process itself, with waste being transferred between and stored at site, being one potential source of litter).

However, litter management was not seen as a viable source of material for recycling. While diverting PCPP from residual waste to recycling streams was considered crucial for resource efficiency, achieving this without consumer involvement at the household level posed challenges. Local authority street sweeping and community litter picking activities often added material to municipal residual waste rather than diverting it to recycling streams. Additionally, public realm litter bins required consumers to differentiate between residual and recycling bins, which proved difficult in practice.

Although some evidence suggests the feasibility of transferring PCPP from residual waste to recycling streams, this process yields lower-quality material and market value compared to consumer-segregated recycling at the household level.



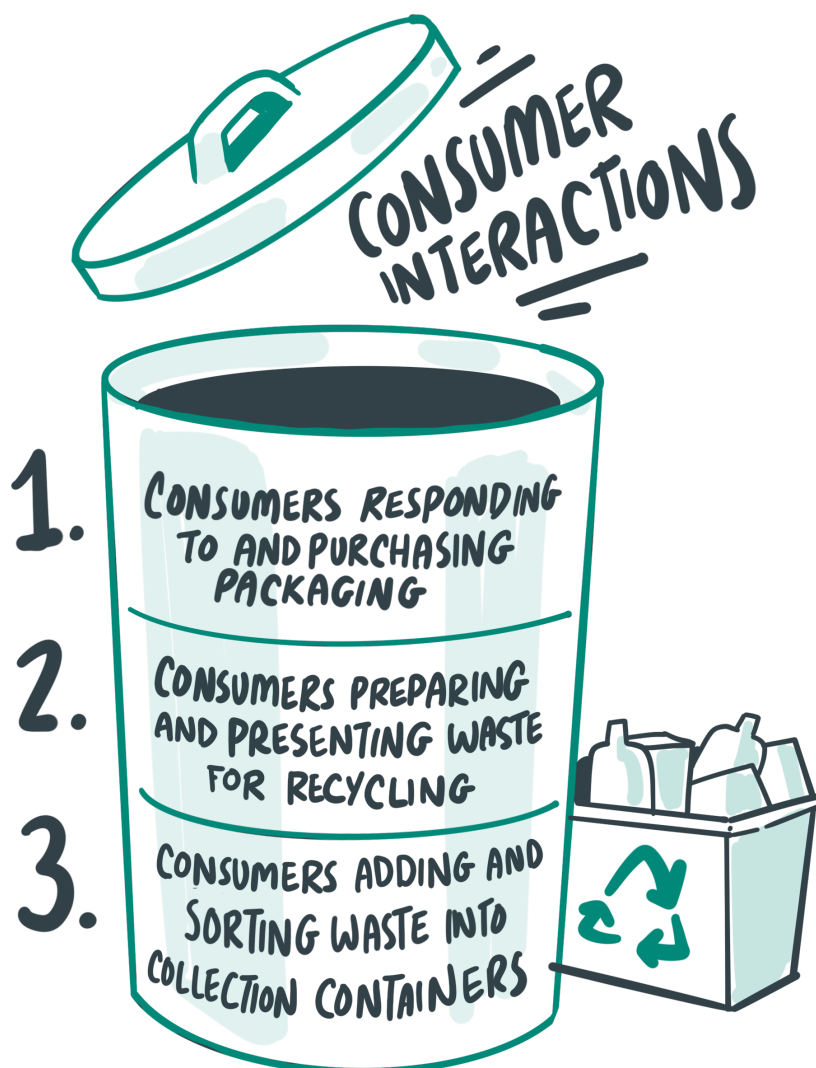
**It just doesn't happen. People don't put it in the right bins. The value of litter is small, but the resource needed to keep on top of it is very high.**

(Service Manager, Waste Collection Company (city council owned), Participant 90)

# How PCPP Stakeholders Depict the Consumer

## Consumers contribute to 'ideal' and 'worst-case' outcomes

Consumers play a pivotal role in shaping the 'ideal' and 'worst case' outcomes. Their disposal practices influence the realisation of local waste management objectives, impacting operational practices across different sites and stages within the PCPP value chain. Three key aspects of how consumers interact are:





## Consumers responding to and purchasing packaging

Consumer packaging preferences directly influence the composition of recycling collections post-consumption, thereby affecting recycling efficiency. The demonisation of plastic by consumers has prompted packaging producers to adopt alternative materials, introducing complexities in recycling, especially with complex or laminated packaging that hinders sorting and separation into recyclable single-material streams. Integrating recycling benefits with broader waste reduction objectives still presents challenges.

## Consumers preparing and presenting waste for recycling

Household collection crews and local authorities observed that residents had 'bad habits', often neglecting to clean packaging, separate different materials, and follow recycling instructions. These habits can lead to issues such as odour, pests, and technical disruptions at sorting facilities. These habits hinder the efficiency of waste collection and sorting processes, causing challenges for recycling facilities in identifying and processing materials effectively.

## Consumers adding and sorting waste into collection containers

Consumer decisions regarding waste disposal influence the cleanliness of recycling streams. Their decisions about which items to place in containers and how they differentiate between containers significantly influence whether waste streams are clean or contaminated. The contaminated waste streams are identified by the presence of material that is either 'objectionable' (e.g. non-target film plastic not designated for household collections) or 'prohibitive' (e.g. polystyrene or PVC, requiring extraction). These practices affect the overall quantity of recyclable material available, as improper disposal often leads to the loss of recyclables to residual waste streams.

Despite the focus on consumers, it is crucial to recognise that they are not the sole contributors to variations between positive and negative outcomes in recycling processes. Factors such as the quality of waste material, determined by packaging properties set by manufacturers, and the post-household practices of collection and sorting also play significant roles. Assuming that household-level contamination can be addressed at the household level alone overlooks the fact that contamination persists throughout the polymer reprocessing pathways. The challenges are particularly evident when looking at, for example, blocks of flats, where high contamination levels often render recycling efforts unviable due to the extensive post-household sorting and separation required, resulting in diverted waste to residual streams.

## Convenience is both a barrier and a solution

Consumer convenience is both a barrier and a potential solution to improving recycling practices. While convenience is often cited as a reason for consumer reliance on single-use plastics and reluctance to engage in complex recycling systems, it is also viewed as a route to encourage recycling participation, especially in residential blocks where rearranging waste bins for easier access could reduce contamination.

Consumer convenience poses a significant obstacle to change, particularly in relation to the ease of purchasing food in plastic packaging, which inhibits a shift towards more sustainable reuse and refill systems by eliminating the need for consumers to remember refill containers or modify their shopping practices. On the other hand, the inconvenience of identifying, preparing, and separating recycling could lead to reduced recycling rates, which emphasises the importance of making recycling easier for consumers to increase participation.

There is a need to balance convenience with efforts to promote recycling, acknowledging varying levels of commitment among different social groups and the potential for convenience-oriented approaches to enhance recycling rates.



**The general opinion is that the highest recycling volumes is by making it easy. And if you start splitting materials, people have to make more effort, and you get cleaner and less.**

(Head of Business Development, MRF, Participant 121)



**People are inherently lazy, they'll put things in the first bin they come to... but if they're eager to recycle, they'll make extra effort. ...I'd change the bin order around on flat sites.**

(Recycling Officer, Waste Collection Company, Participant 101)

## Too much consumer commitment adds to the problem of ‘wishcycling’

Highly committed and well-intentioned consumers are inadvertently contributing to recycling contamination by including non-recyclable items in recycling collections (a form of wishcycling). This creates contamination problems that need to be addressed later. Our data does not clearly indicate whether contamination is primarily caused by incorrect additions of plastic packaging (e.g. film) or by non-packaging plastics (e.g. toys and other household items). Changes in recycling guidelines over time have left some residents unaware of current requirements, leading to recycling practices based on outdated guidance. As recycling processes aim for superior quality outputs, the significance of material quality within recycling streams has heightened, shifting messaging towards a preference for “less but higher quality” materials. There is a need for clear and consistent messaging and education to address this problem, through various channels, including workplaces and schools. Additionally, there is a need for personal interactions (with waste management workers) to effectively tackle contamination and wishcycling, potentially hindered by resource limitations at the district council level.

“

**Years back, the messaging quite openly that came through [...] was: if you're not sure, put it in, if we don't want it, we'll pick it out at the MRF. That's now completely flipped on its head: if you're not sure, leave it out because it's contamination.**

(Manager, County Council Waste Disposal Authority, Participant 94)

“

**Do consumers know enough? Education can start at work as well as school. Powerful is when businesses/retailers get involved. The advertising group is still too quiet, and businesses still too meek and monetaristic.**

(Strategist, Consultancy - Sustainability, Participant 22)

## Consumers form attachments to waste collection containers

There are complex dynamics surrounding ownership and responsibility for household waste and recycling containers, which often lead to ineffective waste management practices. Despite technical ownership by local authorities, residents often personalise their bins, creating confusion. Moreover, tensions arise regarding maintenance and (re)placement of bins, with unclear expectations between residents and collection crews. The significance of regular interaction between collection crews and residents is often overlooked but holds potential for improving waste management practices. Exploring the ambiguous boundaries of ownership and responsibility could foster collaboration and shared understanding between residents and collection crews, especially crucial in residential flat sites.

“

**Private driveways are difficult, [a member of the collection team] says, because the residents don't bring the bins down and the men have to walk a long way up to get them. Really they should bring the bins down to the end of the street, but you can't ask them to do that.**

(Field Diary, 16 September 2022: Loader, Collection Crew, City Council, Participant 87)

“

**[Waste Officer] says the job is more about communication than about waste qualifications. He needs to talk to residents a lot, or at least he should be doing that but the workload means he keeps being pulled to do other stuff, like the bin rounds.**

(Field Diary, 09 September 2022: Waste Officer, City Council, Participant 66)

## Consumer may be indifferent to ‘closed loops’, ‘upcycling’ and ‘downcycling’

According to PCPP stakeholders, there is a discrepancy in consumer perceptions regarding recycling. While stakeholders prioritise developing higher-quality end uses and closed-loop recycling systems, consumers may not fully understand or appreciate these efforts. Consumers care about plastic not being littered or wasted, but there is uncertainty about their awareness of and concern for the higher-quality end uses of recycled content. Consumers primarily value recycling to prevent plastic pollution in the ocean, but they also appreciate seeing recycled plastic transformed into new products as evidence of its effective reuse. Nevertheless, consumers express dissatisfaction when their recycling efforts seem ineffective, highlighting a desire for tangible outcomes from recycling initiatives.

“

**The key thing, to me as a consumer, I don't care if it's a circular solution, if you tell me and I believe you that it's an environmentally better solution than the previous one, that's fine. But what I want is a service. I don't need to understand it.**

(Executive Director, Resource Use Charity, Participant 57)

Stakeholders noted that consumers often fail to grasp the additional effort needed to achieve closed-loop recycling for food-grade packaging, and they may not fully understand distinctions between different end uses for recycled content and the potential for future circularity. There was also some suggestion that consumers need not be burdened with these details if they trust the recycling process.

“

**If we talked to customers about “This has got recycled content in it”, the view almost back from customers is, “Well that's great but why didn't you do that previously? Why is it only now that recycled content is in there?” Whereas when we talk to industry about it, it's like “OK, well, this is really exciting” because they understand the complexity of the journey that we've had to go through. From a customer perspective it's like “Well, you're turning plastic into new plastic, what's the story?”**

(Packaging Manager, National Retailer, Participant 114)

## Disproportionate focus on the consumer

Participants initially credited retailers and consumers for driving changes in practices, but later stages revealed significant activity without explicit consumer involvement. Limited direct interaction occurred between consumers and reprocessing companies, with some companies hesitant to engage publicly. Despite efforts to support residents, high recycling contamination levels led some to doubt the likelihood of consumer behaviour change. In this sense, the consumer was deemed to be irrelevant.

Alternative solutions to recycling contamination, such as improved packaging design or advanced sorting systems, are proposed due to the lack of significant reduction in contamination levels despite support provided to residents, shifting the burden of solving these issues onto other stakeholders within the value chain, often framed as a moral responsibility.

Collaborations across the value chain, including retailer partnerships with waste and reprocessing companies, aimed to develop closed-loop systems. Participants cautiously anticipated progress in recycling driven by emerging technologies and collaborations. Consumers were often uninformed about these efforts, though claims on packaging about recycled content provided some visibility. Consumers are depicted as lacking trust in recycling processes yet may feel satisfied as long as they perceive efforts to prevent plastic litter, often without full understanding of the recycling sector's challenges beyond litter prevention.



**We did a trial [with residents and a local council...] and we gave them all leaflets of what they were to put in the bag. We did 10 weeks and when we had the material there was everything in there. It was so contaminated. [...] Even though they were all told... people went to the houses, explained what you had to put in the bag, and they still did whatever they wanted to do.**

(Director, Reprocessor/Converter Company, Participant 111)



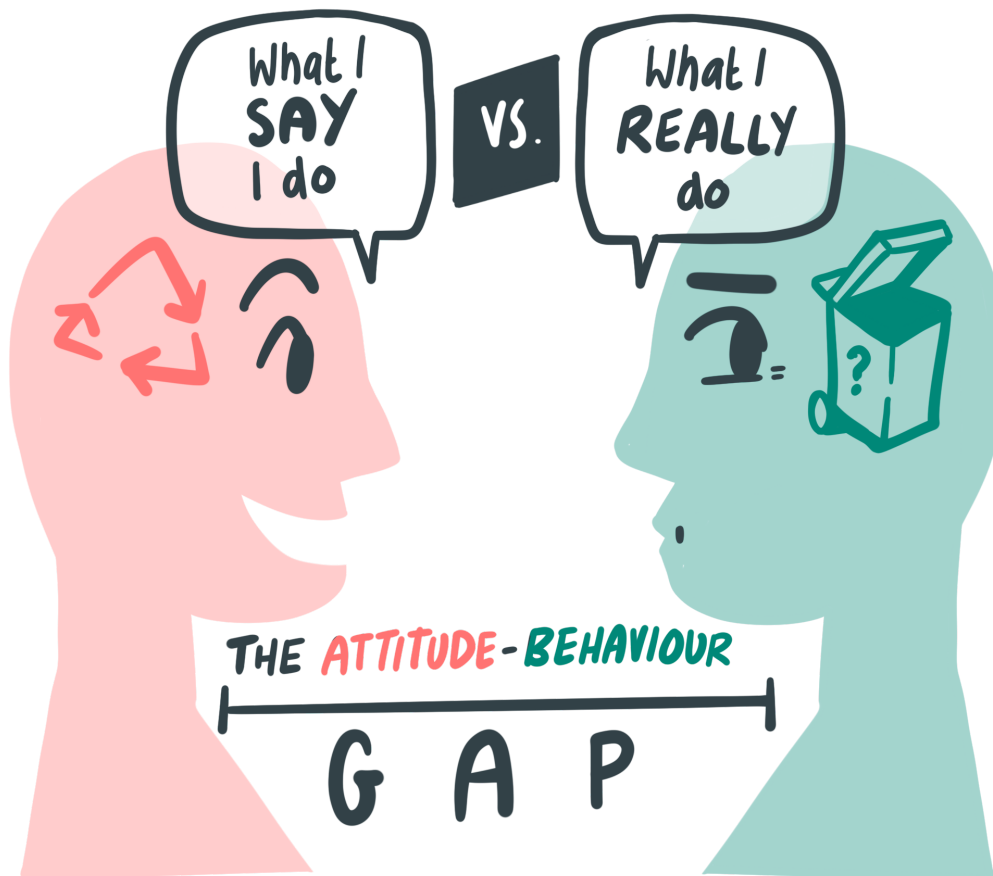
**We see it as an industry challenge, not a challenge for the consumer.**

(Packaging Manager, National Retailer, Participant 114)

# Conclusions

Against a policy backdrop that emphasises higher value outputs from recycling and circular resource use, there is active coordination among reprocessors, packaging producers, retailers, and brands to utilise post-consumer plastic packaging more effectively. This brings an optimism for achieving simpler recycling systems and closed loops for food-grade packaging. However, realising a circular

economy remains a distant goal. Further discussions are needed on to improve relationships and material flows across value chain stakeholders aiming to optimise outputs while minimising environmental and social impacts. Our analysis of how stakeholders view consumers has identified three perceived gaps between consumer attitudes and behaviour.



## Consumer Attitude-Behaviour Gap (1)

### Attitude:

Plastic is bad because it is harmful, therefore moving away from plastic packaging would create less harm.

### Behaviour gap:

Consumers purchase alternative packaging, e.g. biodegradable, instead of plastic, generating new problems for the polymer recycling value chain and not necessarily creating any greater sustainability.

The first gap between consumer attitudes and behaviour is driven by societal narratives surrounding plastic. This leads consumers to perceive materials such as glass or metal as more sustainable, influencing their purchasing and disposal behaviours.

Transitioning away from plastic packaging creates complexities for the polymer recycling value chain. New packaging formats often challenge existing sorting and recycling infrastructures, leading to uncertainties in waste management. Debates surrounding alternative packaging materials obscure important considerations (such as the role of plastic in reducing food waste), prompting the need for broader discussions on the necessity and functions of packaging.

Shifting focus from packaging as a marketing tool to its role in food protection may facilitate standardisation and consistency in packaging, potentially aided by digital technologies.

Addressing tensions between recyclable, compostable, and reusable packaging options requires coordinated efforts across all stakeholders and packaging materials from design through to recapture, reuse and end of life.

Two implications arise from this analysis. First, fostering a broader public debate on the purpose and necessity of packaging could help address consumer attitudes towards plastic and packaging in general, including understanding its role in food protection and safety, as well as its environmental impacts.

This entails questioning current food production, distribution, and consumption systems while exploring alternative options to minimise packaging waste. Second, there is a need to address tensions and incompatibilities between different packaging formats by emphasising stakeholder actions and refining choices within EPR frameworks.

While the current emphasis on recyclable, compostable, or reusable packaging sets up choices, there is a lack of guidance on their interplay and long-term preferences, necessitating comprehensive debates spanning across materials.



## Consumer Attitude-Behaviour Gap (2)

### Attitude:

Recycling is positive and should be increased to prevent waste.

### Behaviour gap:

Consumers do recycle but do not always add the right materials to the recycling streams, and therefore make recycling outputs more difficult to achieve.

The second gap between consumer attitudes and behaviour is influenced by environmental messaging around the waste hierarchy. According to PCPP stakeholders, the message about not wasting resources shapes consumers' perceptions of recycling as a positive action despite negative attitudes towards plastic packaging. However, stakeholders note that indiscriminate recycling practices may lead to contamination and hinder recycling efforts.

Stakeholders believe that consumers add materials that they perceive as recyclable to recycling collections, to prevent waste (a form of wishcycling). But this approach can backfire as adding the wrong items can lead to contamination, slowing down recycling processes and reducing overall recycling rates. Paradoxically, trying to recycle more, may result in less recycling.

An opportunity to address the consumer attitude-behaviour gap is to enhance consumer understanding of polymer distinctions to prevent incorrect recycling. This could involve contextualising messages about recyclability, explaining the conditions necessary for effective recycling downstream in the value chain. Emphasising the distinctiveness of material streams through improved signage and bin design could reduce confusion and contamination. While government reforms

for the 'common sense' approach to recycling promote consistency in material collections, local authorities may need to address container uniformity to further aid consumer comprehension, albeit with potential challenges.

To address this, there is a need for clearer communication on the nuances of recyclability and the importance of sorting materials correctly. Emphasising distinctiveness in material streams through improved signage and container designs could help mitigate confusion and improve recycling practices.

Understanding the reasons behind changes in waste collection and recycling systems is crucial for fostering consumer cooperation. Promoting waste reduction can enhance recycling effectiveness by allowing collectors and sorters adequate time and space to fulfil their duties, aiding consumer understanding of contamination and facilitating re-sorting of mixed collections as needed. Encouraging alternatives to single-use plastic packaging consumption could alleviate pressure on waste management systems. Reduced waste levels could give collection crews more time to educate consumers during daily rounds, necessitating creative thinking from local authorities regarding job roles to address contamination effectively.

## Consumer Behaviour-Attitude Gap

### Behaviour gap:

Consumers recycle (as it is positive).

### Attitude:

Consumers do not fully trust that companies are doing the right thing with the materials that are being recycled.

The third gap is between consumer recycling behaviour and the misalignment with consumer attitudes. Although consumers may recycle, they often feel sceptical and distrusting of waste management and recycling sector, because of reported failures and controversies. This tension arises from the contrast between optimism about the value chain's potential for positive results and mistrust in its actual ability to deliver them. Local authority reporting typically emphasises collection quantities over the end uses of recycled materials, contributing to the consumer behaviour-attitude gap.

To address this, highlighting the end uses of recycled materials could be beneficial by demonstrating their higher value. To build trust with consumers, it is important to show the intricacies and costs involved across the entire value chain, showcasing the complexity and fragility of systems on a broader scale rather than just at

the individual organisational level. By demonstrating the current benefits accruing to consumers and dispelling misconceptions about vested interests, this approach could help overcome barriers to changing consumer attitudes and behaviours, particularly regarding production, consumption, and disposal practices.

Another key opportunity lies in educating consumers about the varying values of different recycling outputs and highlighting the benefits of using materials from recycled flexible plastics for various purposes, for example garden furniture, bin bags, or potential future food packaging. While consumers may currently focus on the avoidance of plastic littering, efforts to make them appreciate higher-value closed loop outputs could help justify the increased costs and labour associated with such initiatives.

# Recommendations

To rethink the consumer attitude-behaviour gaps, and the behaviour-attitude gap, based upon our findings we would make the following recommendations:



## **National Level: Voluntary and Public**

1. Communication campaign to rethink the role of plastic
2. Reframe UK Plastics Pact targets
3. Continue to promote collaboration for wider packaging sustainability

## **Policy: Central Government**

1. Net Zero Future
2. Prioritise waste prevention over recycling
3. Widen simplification and uniformity

## **Policy: Local Government**

1. Communication campaign
2. Optimise community bonds
3. Accompany council tax notifications with news of recycling stream outputs

## **Waste/Resource Management**

1. Future resource use
2. Showcasing polymer recycling

## **Plastic Packaging Producers**

1. Packaging design to include input from the waste sector
2. Protection-orientated packaging
3. Transparency regarding the environment and social
4. Impacts of packaging
5. Waste reduction initiatives

## National Level: Voluntary and Public

**1. Communication campaign to rethink the role of plastic.** Forge stronger partnerships between the public sector and voluntary organisations to launch communication campaigns. These campaigns should aim to clarify misconceptions about packaging sustainability, how solutions work in reality and the fate of plastic waste. These could emphasise the benefits of waste reduction, reuse, and refill systems over traditional recycling, for example. WRAP would be ideally placed to run such a campaign, if supported by Government funding.

**2. Reframe Plastics Pact targets.** The 2018 targets have inherent tensions between reusable, compostable, and recyclable outcomes, and a clearer stance on the interplay between the packaging types and long-term preferences is needed. Collaborative partnerships between WRAP, waste management bodies, land use planning, and innovation funding programs can facilitate capacity-building discussions about infrastructures, complementing work on packaging choices across the value chain.

**3. Continue to promote collaboration to promote wider packaging sustainability.** Promote non-packaging systems and wider packaging sustainability discussion across material-specific trade, advocacy, and other bodies to identify actions beyond any vested material interest. Discussions could shift to the function, replacements, and how Sustainability Life Cycle Assessments can assist with engaging with sustainability on a broader scale to include the social dimensions (skills, employment, communities etc.)<sup>45</sup>.

Stakeholders could include NGOs, professional networks, and think tanks, for example WRAP, IOM3, CIWM, RECOUP, the Consumer Association, OPRL, Ocean Generation, and the Ellen MacArthur Foundation and be supported by Government funding and voluntary contributions for environmental/climate issues.

## Policy: Central Government

**4. Net Zero Future.** Central Government should develop a cohesive government vision that aligns plastics packaging reduction and circular economy principles with the broader net zero objectives. This vision should reflect the systemic changes necessary for reducing reliance on plastic packaging, inspired by historical shifts in consumer behaviour and market structures.

**5. Prioritise waste prevention over recycling.** Central Government should emphasise waste prevention in line with WRAP's guidance. This includes advocating for the elimination of single-use packaging and the expansion of reuse systems, consistent with the goals set in the Environment Act 2021 for waste reduction and recycling.

**6. Widen simplification and uniformity.** Central Government should widen the simpler 'common sense approach' to include national standard for recycling bin signage and colours to support the Environment Act's provisions for consistent recycling across England. While consistency is a longer-term goal, shorter-term strategies could include offering differently coloured stick-on labels for each material type that indicate what should go in each bin/container.

Replacing bin/collection container lids and/or generating stickers could lower cost than purchasing new bins, especially with the envisaged changes and fluctuations in the materials marketplace. To introduce simplification will require government direction and funding.

## Policy: Local Government

**7. Communication campaign.** Local government should run awareness campaigns that could help consumers understand recyclability, contamination, and waste distinctions. This should not compete with the national level campaign and align with the how solutions work and the fate of plastic waste. Local waste collection authorities are best placed to act on this recommendation as they understand their communities and socio-economic demographics.

**8. Optimise community bonds.** Local government should foster community bonds between collection crews and residents to reduce waste and improve recycling to obtain higher quality recycling outputs. Open dialogues can identify recyclable materials, understand disposal practices, humanise the impact of those practices on waste and recycling employees, and reframe waste as a resource. Raising public awareness and implementing clear narratives can help build consumer trust. Allocating longer kerbside collection times and increasing funding to the local authority can help to achieve this to support resourcing these activities. This action is reliant on the Net Zero Future, prioritise waste prevention and simplification strategy being realised.

### **9. Accompany council tax notifications with news of recycling streams outputs.**

Translate and utilise material recycling facilities reporting of sorted and sold material streams to highlight the outputs of recycling and provide consumers with illustrative examples from these streams (e.g. bin bags, food grade packaging, construction materials).

## Waste/Resource Management

**10. Future resource use.** Waste/Resource management should continue to shift focus from waste collection to future resource use, shifting consumer orientations from disposal of waste to secondary resource suppliers and building trust of what happens to household discards.

**11. Showcasing polymer recycling.** Plastic recyclers should showcase polymer recycling to the public, highlighting potentials, what it can and cannot achieve, how polymer markets operate and future plans to increase consumer trust, and understanding of complexities and challenges<sup>46</sup>.

## Plastic Packaging Producers

**12. Packaging design to include input from waste sector.** Packaging designers should include future use and recycling considerations in the design by working with the waste/resource management sector.

**13. Protection-oriented packaging.** Packaging producers should align packaging design and marketing with protection of food products, adhering to the principles of the UK Plastics Pact, which aims to transform the plastic packaging sector by 2025, and beyond.

**14. Transparency regarding the environmental and social impacts of packaging.** Packaging producers should adopt social and environmental life cycle assessments (SLCA)<sup>45</sup> that can be communicated through technological advancements in tracking labels<sup>47</sup>. Offering clear communication and further transparency about potential impacts could gain consumer trust.

**15. Waste reduction initiatives.** Packaging producers and brands should adopt waste reduction strategies that comply with the UK Government's ambitions for reducing plastic waste, as part of the wider *Resources and Waste Strategy*.

## What does this mean for the UK Plastics Pact targets?

The forthcoming UK Plastics Pact targets should incorporate these recommendations, aiming for comprehensive waste reduction and sustainable packaging solutions. Targets should encourage cross-sector collaboration and support the UK's commitment to a Net Zero Future and a circular economy, as outlined in the Government's 25 Year Environment Plan and the Environment Act.

# Future Research

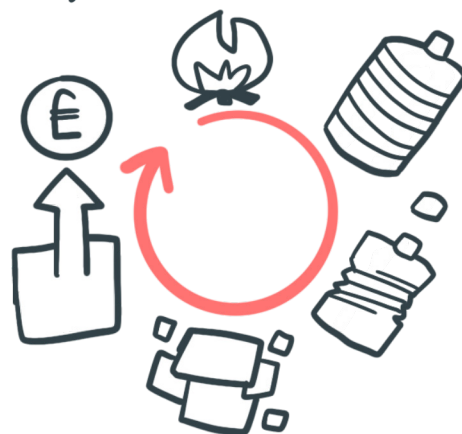
Our research has highlighted two key areas of future research:

## HOUSEHOLD RELATIONSHIPS WITH BINS AND CONTAINERS



Household relationships with bins/containers. This research study could involve residents and local government to explore ambiguous boundaries about who owns and is responsible for waste containers, the condition in which they are maintained, and their location may be a beneficial to investigate further. This study could generate insights about differentiating waste streams and solving issues of contamination through 'bottom up' practices of personalisation and customisation, and/or fostering collaboration and shared understandings between residents and collection crews.

## CIRCULAR MATERIAL FLOWS, FATES AND FRICTIONS



This research would take an in-depth examination of the material and social flows, fates, and frictions of different plastic recycling streams. The aim would be to understand, the efficacy of these material flows, trade-offs (people, planet, profit) and implications for transitioning towards recycles, supporting outcomes for a sustainable world. This study would require a transdisciplinary approach that considered the social, environmental, and economic impacts of different plastic recycling streams.

# Appendix

## Appendix 1: Participant sample

128 participants were involved across two stages of data collection. The table below shows the range of participants across the value chain with an indications of job roles includes in the perspectives provided.

### Participant list by value chain stage

VALUE CHAIN STAGE	NO. OF PARTICIPANTS	RANGE OF JOB ROLES
<b>Waste collection (kerbside)</b>	24	1 head of facilities 6 managers (operations, services) 8 waste strategy/project/recycling officers 7 collection crew drivers and loaders 1 city councillor 1 commercial company CEO
<b>Waste collection (commercial retail pathway)</b>	7	2 national packaging managers 3 store-level managers 2 team members
<b>Waste handling</b> Including waste transfer stations, transportation and logistics	4	1 senior business manager 2 managers (site, compliance - waste transfer station) 1 operative waste transfer station
<b>Waste sorting</b>	3	2 heads of business development 1 logistics supervisor



<b>VALUE CHAIN STAGE</b>	<b>NO. OF PARTICIPANTS</b>	<b>RANGE OF JOB ROLES</b>
<b>Waste management</b> Including waste disposal authority duties, commercial waste & resource management operations (broader than plastics recycling), residual waste treatment	9	1 managing director (SRF) 1 technical director 1 manager (incineration) 2 WDA heads/managers of waste strategy 4 officers (waste management, partnerships, projects)
<b>Recycling</b> Including recycling/conversion in-house operations	16	3 managing directors 4 commercial/division directors 1 head of communications 7 managers (operations, sites) 1 site shift leader
<b>Packaging production</b> Including plastics conversion into new packaging (but without in-house recycling)	12	4 CEO/chair 2 technical/science directors 1 professor 1 manager 1 head of specialist support 3 technologists
<b>Food packaging use</b> Including retailers, food producers who choose & design packaging (including recycled content) but do not directly produce packaging	22	3 heads of sustainability and technical operations 5 managers of purchasing, procurement, supplier relations, marketing, CSR 4 technical officers, sales reps, health and safety officers 8 other roles
<b>Policy</b> Including think tanks, non-profit organisations, charities, strategic consultancies, academics	23	1 executive director 2 directors 7 senior policy leads 5 policy officers/advisers 4 academics 1 technical manager 3 other roles
<b>Compliance</b>	8	1 CEO 2 directors 5 scheme managers/policy, project, strategic leads
<b>Total</b>	128	

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- <sup>11</sup> See PPIPL website for more details, including contact details for the research team: <https://www.lancaster.ac.uk/ppipl/>.
- <sup>12</sup> Throughout the report pseudonyms and anonymised names of companies, sites and other details have been used to protect identities as far as possible and to uphold research ethics agreements. See Appendix 1 for more details of participant sample.
- <sup>13</sup> Plastic at 2.514 million tonnes lies behind paper and card (5.4 million tonnes) and glass (2.581 million tonnes).
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- <sup>21</sup> Bateson is often cited as an originator of the concept of frames. Bateson pointed out that an understanding of 'what is going on here' depends upon some meta-communicative device (or frame) to determine, for example in his original work, whether animals fighting were doing so 'for real' or as play without the prospect of real violence. See Bateson, G. (2000) *Steps to an Ecology of Mind*. Chicago: The University of Chicago Press.
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- <sup>28</sup> DEFRA (2022) Corporate report: Progress report on recycling and recovery targets for England 2020, 5 January. Available at: <https://www.gov.uk/government/publications/progress-report-on-recycling-and-recovery-targets-for-england-2020/progress-report-on-recycling-and-recovery-targets-for-england-2020> (Accessed 13 June 2023).

- <sup>29</sup> A new simpler common-sense approach to recycling requires “all local authorities in England must collect the same recyclable waste streams for recycling or composting from households. The recyclable waste streams include paper and card, glass, metal, food waste, and garden waste. All non-household municipal premises in England (such as businesses, schools and hospitals), must make arrangements to have the same set of recyclable waste streams (with the exception of garden waste) collected for recycling or composting and must present their waste in accordance with the arrangements.” See HM Government (2023) Executive Summary. Consultation outcome 21 November 2023. Available at: <https://www.gov.uk/government/consultations/consistency-in-household-and-business-recycling-in-england/outcome/government-response> (Accessed 10/12/2023).
- <sup>30</sup> DEFRA (2023) Press release: Simpler recycling collections and tougher regulation to reform waste system, 21 October. Available at: <https://www.gov.uk/government/news/simpler-recycling-collections-and-tougher-regulation-to-reform-waste-system> (Accessed 20/12/2023).
- <sup>31</sup> DEFRA, DAERA, Welsh Government and the Scottish Government (2020) Policy paper: Circular Economy Package Policy Statement, 30 July. Available at: <https://www.gov.uk/government/publications/circular-economy-package-policy-statement/circular-economy-package-policy-statement> (Accessed 30/01/2024).
- <sup>32</sup> Schyns, Z. O. G., and Shaver, M. P. (2021) Mechanical Recycling of Packaging Plastics: A Review. *Macromolecular Rapid Communications*, 42. Doi: 10.1002/marc.202000415.
- <sup>33</sup> See Health and Safety Executive (n.d.) UK REACH explained. Available at: <https://www.hse.gov.uk/reach/about.htm> (Accessed 17/02/24).
- <sup>34</sup> HM Government (2021) Net Zero Strategy: Build Back Greener, October. Available at: <https://www.gov.uk/government/publications/net-zero-strategy> (Accessed 08/12/2023).
- <sup>35</sup> For example, see Innovate UK’s programmes: <https://www.ukri.org/councils/innovate-uk/> (Accessed 08/12/23).
- <sup>36</sup> See Ellen Macarthur Foundation (n.d). Looking for the New Plastics Economy. Available at: [www.newplasticseconomy.org](http://www.newplasticseconomy.org) (Accessed 08/12/23).
- <sup>37</sup> WRAP (2023: 4) The UK Plastics Pact Annual Progress Report 2022-2023. Available at: <https://www.wrap.ngo/resources/report/uk-plastics-pact-annual-report-2022-23> (Accessed 17/05/24).
- <sup>38</sup> British Plastics Federation (2021) Recycling Roadmap. Available at: <file://lancs/homes/01/hadleyc1/Downloads/BPF%20--%20Recycling%20Roadmap.pdf> (Accessed 08/12/23).

- <sup>39</sup> Although the reprocessor capacity is 440 kT, the operational output capacity is 230 kT (some C&I will be included in this although outside the scope of the report). The difference between the estimated output and operational output is important as capacity and feedstock availability and flow is never exact; operations change as well as commercial conditions and contract variations, so this does need to be considered. Within this capacity is 65 kT (at the start of 2020) of plastic reprocessing capacity to produce food-grade flake and pellet. This includes 35 kT of food grade PET pellet and 30kT of food-grade HDPE. There is currently no data on film recycling capacity in the UK, and this is an area which needs to be addressed to understand additional capacity needed (p.37).
- <sup>40</sup> RECOUP (2022: 5-9). UK Household Plastic Packaging Sorting and Reprocessing Infrastructure. Available at: <https://www.recoup.org/wp-content/uploads/2023/09/uk-plastic-packaging-sorting-reprocessing-infrastructure-2022-update-full-v11-1667559372.pdf> (Accessed 26/03/2024).
- <sup>41</sup> Eriksen, M.K., Christiansen, J.D., Daugaard, A.E. and Astrup, T.F. (2019) Closing the loop for PET, PE and PP Waste from households: Influence of material properties and product design for plastic recycling. *Waste Management*, 96(1), 75-85.
- <sup>42</sup> WRAP (2021) Market Situation Report 2021: Plastic Packaging. Available at <https://wrap.org.uk/resources/report/plastics-market-situation-report-2021> (Accessed 30/01/2024).
- <sup>43</sup> 'The Blue Planet Effect' or 'Attenborough Effect' are terms that developed after the airing of 'The dangers of plastics in our Ocean' (2017), Blue Planet II, BBC One, episode 7, BBC Natural History Unit. The definition is used to describe raised awareness of plastic pollution triggering consumer attitudes and behaviour to change. However, there are debates as to whether consumer behaviour has changed, see Dunn, M. E., Mills, M. and Verissimo, D. (2020) Evaluating the impact of the documentary series Blue Planet II on viewers' plastic consumption behaviours. *Conservation, Science and Practice*, 2(e280), 1-10.

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- <sup>44</sup> See Competition and Markets Authority (2021) Guidance: Green claims code: making environmental claims. Available at: <https://www.gov.uk/government/publications/green-claims-code-making-environmental-claims> (Accessed 08/12/2023).
- <sup>45</sup> See UN Environment Programme (2009) Guidelines for social life cycle assessment of products. <https://www.unep.org/resources/report/guidelines-social-life-cycle-assessment-products>, Please also see ISO (2006). ISO 14044:2006 Environmental management: Life cycle assessment - Requirements and guidelines. Available at: <https://www.iso.org/standard/38498.html> .
- <sup>46</sup> See South London Waste Partnership tours <https://slwp.org.uk/your-waste/visit/> (Accessed 30/5/2024).
- <sup>47</sup> For example, see On-Packaging Recycling Labels (OPRL)'s website <https://oprl.org.uk> (Accessed 10/03/2024).

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PLASTIC PACKAGING IN PEOPLE'S LIVES