



UNIVERSITY OF  
PORTSMOUTH  
GLOBAL PLASTICS  
POLICY CENTRE



# Making reuse a reality

A systems approach to tackling single-use plastic pollution

Global Plastics Policy Centre

2023

[#BreakFreeFromPlastic](#)

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## Abbreviations

<b>B2B</b>	Business to business
<b>BYO</b>	Bring your own container system
<b>FMCG</b>	Fast moving consumer goods
<b>LCA</b>	Life cycle assessment
<b>NGO</b>	Non-governmental organisation
<b>RFID</b>	Radio frequency identification tags
<b>SIDS</b>	Small Island Developing States



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# Executive summary

**Reuse presents a vital opportunity to move away from the existing linear take-make-waste packaging economy.** Single-use packaging is a major contributor to the global plastic pollution crisis. The linear pathways of production and waste of single-use packaging materials, and their effects on our climate, environment, biodiversity, and health cannot continue. **The introduction of reuse systems offers a transformative solution to single-use packaging pollution** by reducing virgin material use, retaining packaging in the economy, diverting waste packaging away from landfill and incineration, and reducing pollution and emissions.

Although there is no universally agreed definition of a reuse system, this report considers a 'reuse system' to be **a comprehensive system designed for multiple circulations of reusable packaging which remains in the ownership of the reuse system and loaned to the consumer.** To make reuse environmentally worthwhile, reusable packaging must be used more times than its sustainability breakeven point, after which each use of the packaging has less environmental impact than its single-use equivalent. The sustainability breakeven point is a critical measurement of the effectiveness of a reuse system, and must be monitored carefully. An essential part of any reuse system is the return of the item back into circulation. The return aspect is heavily dependent on consumer behaviour, with consumer convenience at the heart of any return system.

The research presented in this report demonstrates that **there is no single universally applicable reuse system.** Instead, reuse systems need to be tailored by business sector and socio-economic context. We propose that the **transition to reuse**, in which reusable packaging becomes the new norm across multiple sectors, requires:

- **leadership and advocacy** for the upscaling of reuse systems is critical. It is important that the current linear economic approach is challenged and an alternative solution is available;
- **recognition that reuse is a systems solution** that requires a coherent policy approach from government, across industries sectors and geographies to provide a favourable environment for public and private sector investment;

- **the introduction of internationally coherent reuse standards** including an agreed definition of reuse and standardisation of packaging. Standardisation should include the size and shape of reusable packaging, labelling, tagging, washing, and required hygiene levels to avoid the development of isolated silos of reuse;
- **an inclusive and collaborative approach** to ensure an accessible, affordable and just transition to reuse occurs, involving all stakeholders and beneficiaries, with equity, inclusivity and transparency as key considerations to ensure no adverse consequences;
- **raising awareness and knowledge of reuse systems** for consumers to support public buy-in and to build population memory of reuse systems, to reduce anxiety or reluctance to engage with reuse systems;
- **the development of reuse hubs** that service the needs of reuse systems through providing collection, washing, replenishment, and redistribution services, along with robust data collection systems to ensure accurate monitoring of reuse system performance. Resource pooling and multi-stakeholder cooperatives can build the capacity and efficiency for upscaling all reuse systems, while providing local employment opportunities, including for informal waste workers.

Our findings strongly suggest that the **transition to reuse systems can begin immediately** in settings that require the least infrastructure change, least new investment, and least consumer behaviour change, such as in closed systems. Complex reuse systems, with multiple end-of-use points will require additional investment in infrastructure. The importance of global reuse standards is critical, as the absence of standards is inhibiting investment, allowing fragmented approaches to persist, and preventing small businesses from engaging in larger scale reuse systems. **The Global Plastics Treaty presents a key opportunity to set out the foundations of reuse systems.** Reuse standards should centre on health and safety, data collection and standardisation of reusable packaging. Furthermore, policy developments should be consumer focused, align with supply chains, and respect the need for a just transition. More broadly, the Global Plastics Treaty can provide a framework for reuse to evolve into a key tool to tackle plastic pollution while building economic, social and environmental resilience.





# 1

# Introduction

## 1.1 Purpose and key findings

This report examines the role and application of reusable packaging as part of a shift away from the current linear plastics economy. **The research explores the case for packaging reuse systems, including benefits to consumers, private sector, workers and communities. We provide a recommended route for the widespread adoption of large-scale reuse systems.** The current barriers and enablers that can unlock the adoption of reusable packaging, and priorities for action, including policy recommendations at global and national levels are highlighted. Our key findings are: 1) reuse is a system not isolated actions or products; 2) tailored reuse systems are needed in key economic sectors as at present there is no single reuse system that can be applied in all scenarios; 3) an environmentally sustainable reuse system only exists once a sustainability breakeven point is exceeded; 4) end-of-use context is critical for the design of packaging return pathways, consumer behaviour, and achieving a return rate of over 90%; 5) national action is needed to support fair and just reuse systems that support local communities; and 6) a global framework

including a shared reuse system vision, agreed standards, definitions and monitoring is needed to drive coherent international reuse system action.

The research was focused on reuse systems in a range of market sectors, the logistical processes involved in the systems and any relevant social and location factors. To gain the general perspectives and experiences of all available stakeholder groups associated with the current global reusable packaging landscape, we explored the barriers and enablers for upscaling reuse systems through consultation with communities and stakeholders involved. Discussions took place about reuse system implementation, future policy recommendations and community engagement methods. The report considers these findings and their contribution to global reuse system applications. The research was unable to examine areas with insufficient data availability such as transport emissions from different reuse systems, or business models for financing and infrastructure. Future research needs are discussed in Chapter 6.

## 1.2 Defining a reuse systems approach

**At present, there is no single agreed definition of reuse for packaging<sub>1</sub>.** The lack of a precise vocabulary results in a confused understanding of reuse systems, how much reuse of packaging takes place, and flawed claims of reuse rotations occurring<sub>1</sub>. Following a review of many different definitions and approaches to the reuse of packaging, we recognise that **reuse should be considered as a system in which reusability is a deliberate objective and in which the packaging item is used multiple times for its originally intended purpose<sub>2</sub>.** Within a reuse system, all packaging is owned and managed by the reuse system provider, not the consumer<sub>3,4,5,6,7,8</sub>. **Refill at home and refill on-the-go do not form part of our definition of reuse<sub>9</sub>** as they

tend not to be part of a designed and comprehensive reuse system and often rely on consumers to use their own packaging, rather than system-supplied packaging. Moreover, actions to prevent unnecessary packaging purchases, such as consumers choosing to refill or repurpose a product's packaging intended to be single-use, should not be considered to be reusable packaging under our definition<sub>10</sub>. The importance of system design is reasserted in the ISO Reuse Standard which indicates that reuse only occurs when the reusable packaging is used multiple times for the **same purpose for which it was conceived** and is designed to provide a minimum number of rotations in a reuse system<sub>11,12</sub>.



A key consideration about reusable packaging is the number of times an intentionally reusable item must be reused before its environmental impact per use is less than a comparable single-use item, a number known as its sustainability breakeven point determined through consequential life cycle assessments (LCAs) (Appendix 1)<sup>13,14</sup>. Our research indicates that, **reuse as an action is only worthwhile once the sustainability breakeven point has been exceeded**, otherwise, there is a negative environmental impact of the reuse activity<sup>13</sup>. **Theoretical estimates of how often a product can be reused are not a suitable measure of the reuse process**<sup>5</sup>. Our definition of a reuse system for packaging is:

A comprehensive system for the multiple rotations of reusable packaging which remains within the ownership of the system and is loaned to the consumer.

### 1.3 Defining refill

Refill is a strategy for reducing packaging waste by allowing consumers to use their own containers multiple times, either through in-store refill systems or at-home concentrate refills. Moreover, refill, also known as a form of 'packaging prevention', does not form part of our definition of a formal reuse system because the packaging is owned by the consumer and not returned to complete a target number of measurable rotations<sup>7</sup>. The lack of tracking associated with refill also creates problems for data collection, monitoring and enforcement, and manufacturers can potentially make false claims about the reusable capabilities of single-use packaging. While refill does not require reverse logistics and transportation, it still has limitations in terms of scalability and standardisation. There are some concerns regarding hygiene, safety, contamination, and transmission of allergens for refill in store and bring your own (BYO) container systems, in addition to the challenges of larger-scale implementation and managing traceability<sup>15</sup>.

A system refers to the process for reusable packaging including all aspects of the reuse operation such as collection, washing, sorting, logistics and the packaging itself.

Return rates need to be in the order of 90% to pass the sustainability breakeven point and be environmentally favourable<sup>7</sup>. The return rate can be enhanced by using incentives such as deposits, fees or rewards. Deposits are a sum paid for the loan of the item, the sum is paid back when the item is returned. A fee is a payment which is taken after the set time for an item to be returned passes. The fee is usually taken on a daily basis until the full cost of the packaging has been paid. Rewards are discounts or other benefits provided to encourage participation with the system and product.

Refill using concentrates at home provides an alternative type of single-use purchase that reduces transport volume and weight by up to 80%, resulting in less packaging and lower transport greenhouse gas emissions<sup>16</sup>. Moreover, this approach can also be affordable for consumers and producers, but current provision with single-use pouches or bottles is not sustainable due to the use of some unrecyclable materials, continuing chemicals of concern. Overall, refill provides a promising strategy for reducing packaging waste, but more widespread refill options require careful consideration of infrastructure, standardisation, and tracking to be scaled up effectively and prevent the reliance on further consumer responsibility. Further barriers, enablers and examples for scaling refill packaging prevention schemes are described in Appendix 2.



## 1.4 Taxonomy of waste prevention

There is considerable confusion caused by the inconsistent use of the terms reuse and refill which can be utilised in multiple ways and for different processes. Effective policy will require clear definitions and use of these terms, as without consistency of terminology, there are multiple opportunities for ineffective solutions, greenwashing and confusion for consumers.

- We propose that the overarching term is **waste prevention** and the term refill should be avoided within the reuse system. The term prefill and refilling should be avoided for reuse systems and terms such as replenishment would be appropriate for the filling processes.
- For **packaging prevention** such as refill stores and zero waste stores, the term reuse should be avoided. The use of reuse for this type of packaging prevention opens the door to claims that single-use packaging is reusable and could count towards reuse targets. The terms refill in store and refill at home (using concentrates) would be more appropriate.
- The phrases informal and formal reuse are not easily defined and could insinuate different meanings. The phrase informal reuse could also degenerate the importance of this type of refill, packaging prevention approach.

The overarching requirement of a circular economy is to reduce waste. Both packaging prevention and reusable packaging are foremost on the hierarchy of waste prevention strategies. To clarify these terms, table 1 shows refill is viewed as a form of packaging prevention shown in the first column and system based reuse to be a separate but equally important approach to waste prevention shown in the second column. Within these two sections, indications of specific terminology for actions and ownership are provided.

**Table 1. The taxonomy of waste prevention strategies**

	<b>Refill</b>	<b>Reuse</b>
<b>Ownership</b>	Consumer owned or retailer loaned containers	System owned containers
<b>Actions</b>	Consumer brings containers, refills the containers and provides washing services	Reuse System provides collection, washing and redistribution of containers Consumer returns containers
<b>Restocking</b>	In store refill or at home concentrate refill	Product replenishment by producer

## 1.5 Research methods

A comprehensive global analysis was conducted to review current reuse system strategies. The analysis involved gathering evidence from various publications and conducting interviews with member networks, organisations, and businesses involved in reuse systems. The analysis of current reuse literature examined academic journals, business policies, NGO reports, and case studies on current reuse systems. The review process helped to inform the research interview questions and provided an evidence-based understanding of the current global reuse systems landscape across different market sectors, environmental and socio-economic contexts. All research findings presented in this report have received appropriate ethical approval.

Semi-structured one-to-one interviews, lasting approximately 45 minutes, were conducted between December 2022 and February 2023. The data from the interviews were transcribed and analysed using a thematic framework approach (Alsaawi, 2014). Approximately 120 people involved in the operation of reuse systems or movements were contacted and invited to participate in the semi-structured research interviews. A total of 55 interviews were completed with interviewees from businesses (small to medium scale), NGOs, multinational corporations, community advocacy groups, waste worker groups and individuals operating in the reuse system and refill space (Figure 1).

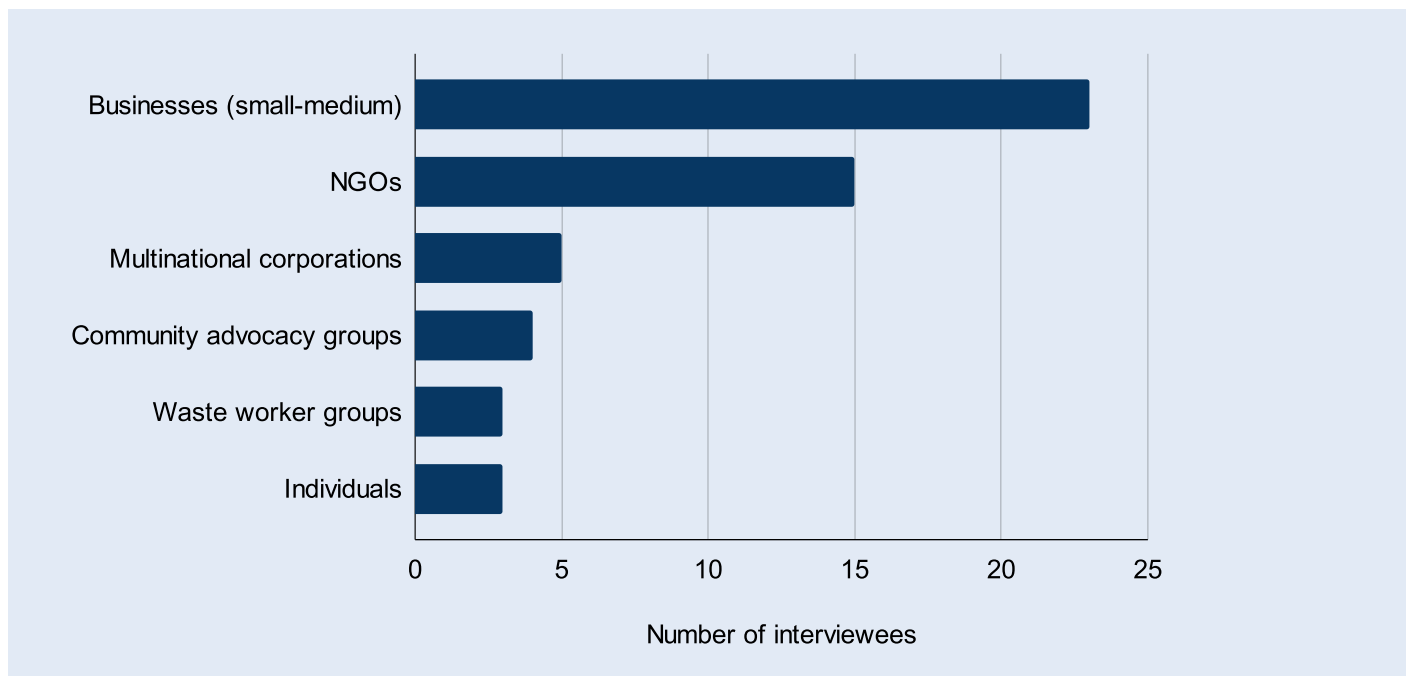


Figure 1. Interviewees by category

The interviewees were equally represented from Global North (57.7%) and Global South (42.3%), covering all continents (Figure 2). In addition, the interviewed companies operating reuse systems (50%) were then also categorised into the following system areas: Food &

Drink on the go, Business to Business (B2B), Fast Moving Consumer Goods (FMCG), Packaging Prevention (Refill), Home & Personal Care, Venues & Events, E-commerce, and Bottled Beverages (Figure 3).

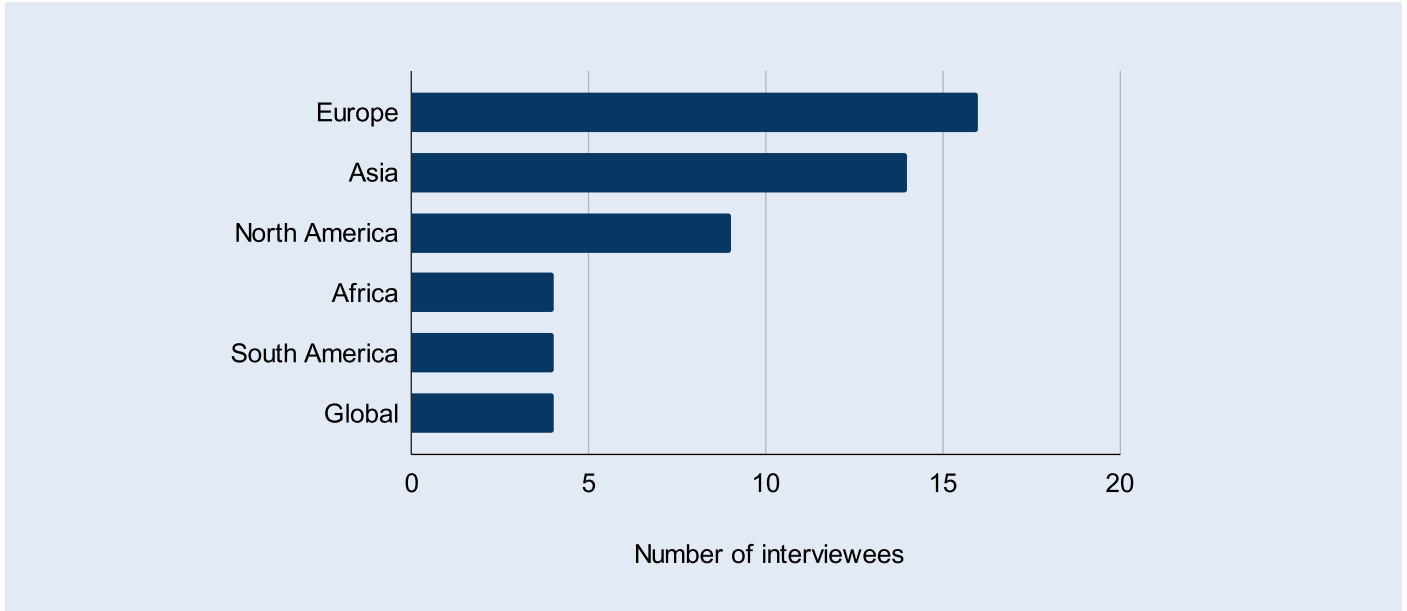


Figure 2. Geographical distribution of interviewees

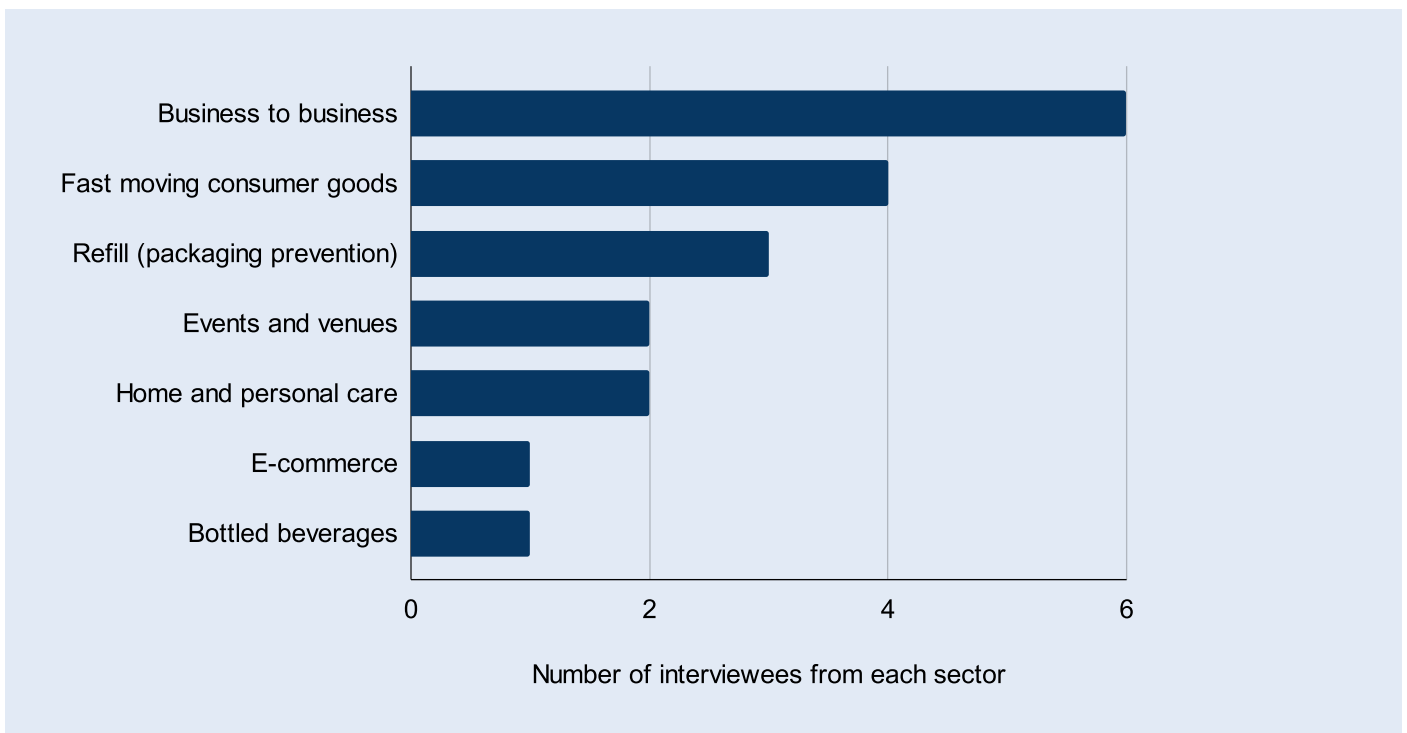


Figure 3. The distribution of respondents operating reuse systems grouped into their relevant sector

## 1.6 Life cycle assessments

Life cycle assessments (LCAs) are used for the systematic analysis of the potential environmental impacts of systems, services or products throughout each stage of their life cycle flow (Appendix 1)<sup>17</sup>. There are many types of LCAs but the distinction is often made between two key types, which are dependent on the system boundaries<sup>18,17</sup>. Attributional LCAs in relation to packaging and materials focus on reporting environmentally relevant physical flows to and from a life cycle and its subsystems<sup>19</sup>. Consequential LCAs aim to go further than attributional LCAs to describe how these life cycle flows may change in response to any decisions that are made, for example the chosen type of packaging or material that is used in a system<sup>19</sup>. Consequential LCAs are the preferred choice in this circumstance for exploring reuse systems, to rigorously assess the impacts of the displacement of single-use items for upscaled reuse systems across system areas<sup>19</sup>.

Studies have shown it is common for LCA results to be misinterpreted<sup>20</sup>. Concerns with LCAs have been raised due to a lack of transparency of data, inaccurate or misleading results for assessments of climate impact and unaccounted for or 'avoided emissions', that fail to represent the real GHG emissions data for some material or service use<sup>20</sup>. For example, LCA studies are often conducted in a narrow geographical area, and can be taken out of context when findings are reported. Therefore, precautionary approaches for decision-making should be taken by any policy makers or stakeholders interpreting climate or environmental impact studies<sup>20</sup>. There is a necessity to take a comprehensive, system specific approach to these types of environmental impact assessments for reuse systems, to avoid the aforementioned misinterpretations. The recent development of a net green approach to LCAs could potentially provide a more vigorous and transparent assessment of the environmental implications of reuse systems in the future, however the evidence for this LCA approach is currently limited<sup>21</sup>.



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## 2 The case for reuse



This chapter examines the problems caused by overproduction and consumption of virgin materials and the linear plastics economy. Reusable packaging is introduced as a solution to many of the problems of

excess consumption of materials. The failure of policy and the development of false solutions is explored. Consumer refill in-store and at home are introduced as packaging waste reduction measures, separate to a reuse system.

## 2.1 The root cause: plastics over-production and a linear economy

The current dominant plastics economy is linear, characterised by extraction, production, and use, followed by disposal, with minimal recirculation of plastics in the economy. Overall, single-use throwaway plastic packaging is not sustainable due to its negative impact on the environment. Single-use plastic contributes to biodiversity loss at fossil fuel extraction sites, and results in the emission of greenhouse gases throughout its lifecycle, including during extraction, processing, production, transport, energy and water consumption, waste generation, and pollution. The linear consumption-based material economy is, in many ways, the opposite of a reuse system economy. The majority of plastic produced (around 85%) ends up in landfills, unregulated dumping sites, or is burned<sup>22</sup>. Additionally, there is a lack of transparent data surrounding plastic waste, with approximately 43% of plastic placed in the EU market unaccounted for at the end of its lifecycle<sup>23</sup>. This means an estimated 22 million tonnes (MT) of plastic are missing and their whereabouts are unknown<sup>23</sup>. In 2020, solid waste production was 78 gigatonnes globally, and projections show it will reach 127 gigatonnes by 2050<sup>24</sup>. **The increase seen in consumption is far beyond the amount that would be expected from population growth and is mostly due to the expansion of disposable goods.** In 2019, an estimated 22 MT of plastic leaked into the environment<sup>25</sup>, which is expected to increase to 20-53 MT by 2030 on the current trajectory<sup>26,27</sup>. Plastic waste

Material production produces 70% of global greenhouse gas emissions, of which 850 MT of greenhouse gas emissions in 2019 were produced from plastic production alone

has outgrown waste management infrastructure and has become a social and environmental disaster in areas with poor or little waste management structure. **Plastic pollution is visible evidence of a broken system**<sup>13</sup>.

Every piece of single-use packaging of any material has used earth's resources, damaged the environment at the extraction site, produced greenhouse gases, used energy and water, and produced waste and pollution. In addition, **material production produces 70% of global greenhouse gas emissions, of which 850 MT of greenhouse gas emissions in 2019 were produced from plastic production alone**<sup>28</sup>. When examining cradle to grave emissions<sup>29,30</sup>, the environmental, financial, health and social costs of our modern lifestyles are vast. There has been a 230 fold increase in plastic production, to 460 MT in 2019<sup>22</sup> and **production is expected to quadruple again by 2050**<sup>12</sup> with predicted greenhouse gas emissions of 1.34 gigatons per year by 2030<sup>32</sup>. Moreover, **single-use plastic is 36% of all plastic production**<sup>22,33,34</sup>. Single-use packaging production has reached overwhelming levels. Currently, **250 billion single-use coffee cups are used globally every year**<sup>35</sup>, and approximately, 2.3 billion plastic sachets are used every day<sup>36</sup>. These sachets are of particular concern as they are difficult to collect and are currently unable to be reused or recycled<sup>35</sup>. The consumption of single-use items increased dramatically

during the Covid-19 pandemic, with the use of single-use plastics increasing by 250-300%<sup>13</sup>. In the USA, online shopping and takeaways increased by 78%<sup>13</sup> and delivery of prepared meals increased 300 fold from pre-pandemic levels<sup>13</sup>. Furthermore, food production, distribution and waste produces 34% of all greenhouse gas emissions and 5.4% of these emissions are from single-use food packaging<sup>37</sup>.

The economic costs of linear use are considerable and yet no economy has disassociated material consumption from economic development<sup>38</sup>. Even in the 1920s, Henry Ford understood the effects of wasteful production, saying **“Picking up and reclaiming the scrap left over after production is a public service, but planning so that there will be no scrap is a higher public service”**<sup>39</sup>. The economic effect of losing 95% of the value of plastic packaging after just

one use is enormous, estimated at \$80 billion to \$120 billion<sup>40,41</sup> which is an economic and resource failure<sup>42</sup>. In addition, the petrochemical industry is looking to expand plastic production, as energy production moves to renewable sources<sup>43</sup>. Plastic usage in the EU and UK is expected to rise by 30% by 2050<sup>23</sup> and currently, 36% of solid waste is single-use packaging<sup>38,44</sup>. Of this plastic waste, 19 MT is landfilled or incinerated each year, creating a loss of material from the economy of €35–55 billion<sup>23</sup>. The UK, Germany, France, Italy and Spain are among the top 13 world consumers of takeaway food<sup>43</sup> and also consume 46 billion single-use beverage bottles annually<sup>43</sup>. Additionally, Globally, sales of bottles in plastic, glass, cans and cartons rose from 685 billion in 1999 to 2 trillion in 2019<sup>46</sup>. Table 2 summarises the main detrimental costs of single-use packaging.

The consumption of single-use items increased dramatically during the Covid-19 pandemic, with the use of single-use plastics increasing by 250–300%

**Table 2. Summary of the financial, environmental and social costs of single-use packaging**

<b>Financial costs</b>	Extraction, processing and production, waste collection and management, pollution remediation.
<b>Environmental costs</b>	Damage to extraction sites, loss of biodiversity, climate change, pollution, greenhouse gas production, land and marine plastic pollution, toxic emissions and releases from recycling, incineration and end-of-life management of plastic waste, microplastics, emissions from degradation of plastic in the environment
<b>Social costs</b>	Pollution affecting fence line communities at extraction sites and waste management sites, litter, flooding exacerbated by plastic in rivers and drainage systems and the health implications of microplastics and toxicants in plastic packaging.

## 2.2 Reuse as a remedy

Moving away from a linear material economy, towards a more circular economy with less reliance on virgin materials is critical to reducing pollution, biodiversity loss

and climate change. **Reusing products and packaging is key to the transition to a circular economy.**

### The benefits of reuse systems

Single-use plastic leakage into the environment could be reduced by 80% by 2040 using systems already available such as reusable packaging<sup>55</sup>, whilst reuse systems can provide a 32% reduction in CO<sub>2</sub> emissions<sup>47</sup>, through reduced material production and disposal, even after accounting for the increased transport and washing required for reuse systems<sup>48,49,50</sup>. For example, in the EU if 50% of packaging was reusable by 2030 for the food and drink on-the-go, e-commerce and household care sectors, this would save 3.7 tonnes MT of CO<sub>2</sub>, 10 billion cubic metres of water and 28 MT of waste per year<sup>10</sup>.

When comparing reusable packaging to single-use, reusable packaging generates fewer environmental impacts:

- Reusable packaging reduces environmental damage, water pollution and emissions through reduced production and material use<sup>51,29,52</sup>

- The health of fenceline communities is disproportionately affected by plastic production. People living less than 5 km from refineries or plastic manufacturing have a 30% higher risk of developing leukaemia than communities with no producers in the locality<sup>53,54</sup>.
- Reusable packaging has been shown to eliminate 80% of the climate impact of single-use packaging<sup>55</sup>.
- Reuse systems reduce waste, prevent overload of waste infrastructure and have the potential to reduce illegal waste practises<sup>56</sup>. Unregulated open burning causes the production of black carbon which has a global warming potential approximately 5000 times higher than CO<sub>2</sub>, along with serious health implications due to toxin release<sup>56</sup>.
- Reusable packaging reduces water consumption, for example, 500 single-use cups use 370 gallons of water for production, compared to 1 ceramic cup, reused 500 times, uses 53 gallons of water for washing<sup>57,48</sup>.



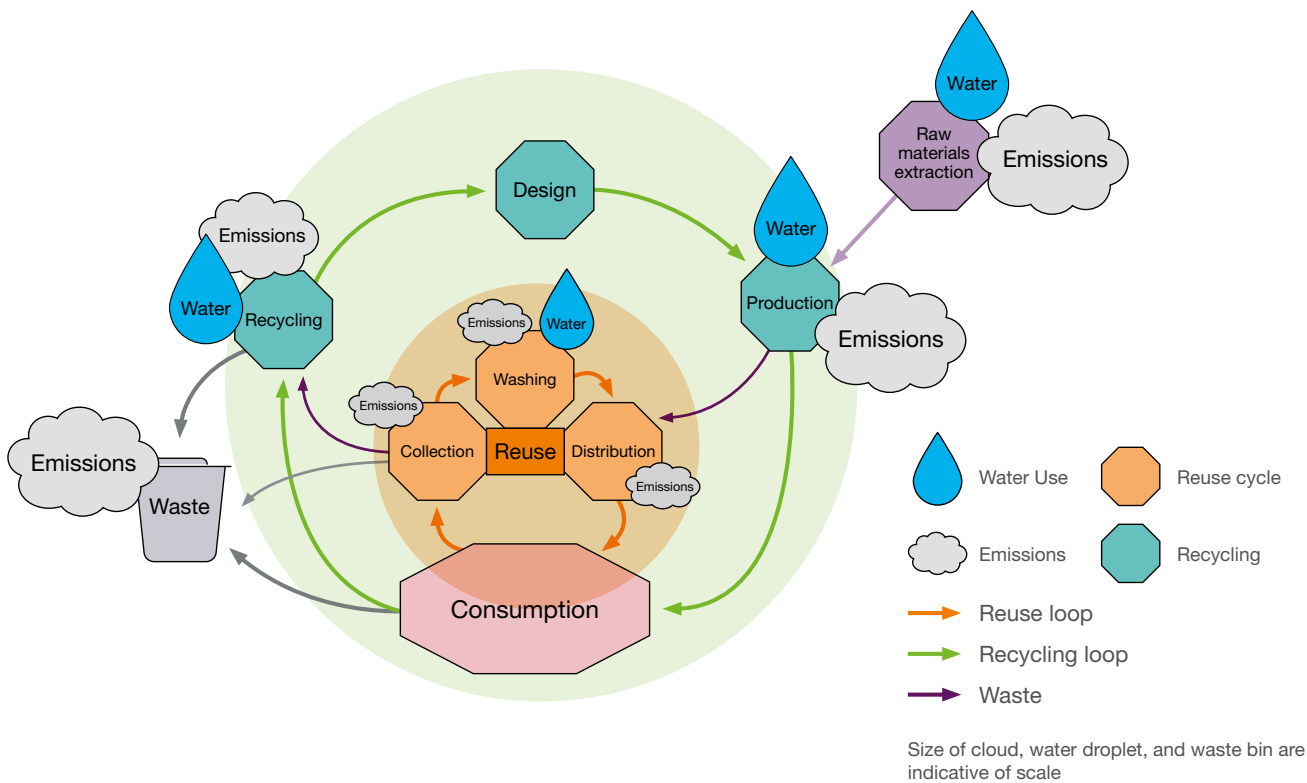


Figure 4. The emissions and water use for reuse systems compared to recycling practices

However, a reuse system is not without impact. The increased durability required for reusable packaging often increases the weight and the amount of material used. In addition, increased transportation and washing also have environmental impacts. In reality, **no material is impact free**, and given the need for long-term durability, the initial manufacturing of reusable packaging is likely to generate greater environmental impacts than single-use items at the same stage<sub>5</sub>. Therefore a key consideration is the number of uses that a reusable item

must undergo before its 'impact per use' is less than the equivalent single-use item, the **sustainability breakeven point**. Every use after the sustainability breakeven point significantly reduces the environmental impact of a reusable item compared to a single-use item, due to the environmental impacts of single-use avoided with every rotation. The sustainability breakeven point should be reached within a small number of rotations and is material dependent as shown in Table 3.

Table 3. Sustainability breakeven point of reuse materials for venues and events

Reusable cup material	Single-use alternative
Ceramic	<ul style="list-style-type: none"> <li>• 10-70 uses to be lower than paper<sub>13</sub></li> <li>• 70 uses to be lower than polystyrene foam<sub>13</sub></li> </ul>
Glass	<ul style="list-style-type: none"> <li>• 36 uses to be lower than paper cups<sub>13</sub></li> <li>• 3 uses to be lower than a PET 0.5 litre bottle<sub>52</sub></li> <li>• 25 uses to be lower than a PET 2 litre bottle<sub>52</sub></li> </ul>
Reusable polypropylene	<ul style="list-style-type: none"> <li>• 10 uses to be lower than single-use polypropylene<sub>13</sub></li> <li>• 20 uses to be lower than paper cups<sub>13</sub></li> </ul>
Stainless steel	<ul style="list-style-type: none"> <li>• 35 uses to be lower than paper and polyethylene cups<sub>13</sub></li> </ul>

The environmental impact is also far less if the reuse packaging is made of recycled material and can be further reduced if the item is recycled at end-of-life. When comparing environmental aspects of single-use and reusable packaging, there is a lack of transparency and data, especially in the material extraction and production stages<sup>38,49</sup>. In addition, the externalities of packaging such as environmental impacts of extraction and production, transportation and waste mismanagement are not fully understood or accounted for; in the cost of materials or adequately accounted for in life cycle analyses<sup>58</sup>.

More positively, reuse systems can increase consumer engagement, brand loyalty and satisfaction<sup>59</sup>. Reusable packaging generally feels higher quality, can provide value for money for consumers, as packing is not purchased, and reduces reliance on single-use items. Consumer behaviour data can be collected from the packaging tracking data and improves knowledge of consumer preferences and product use rates. QR codes and tags can provide valuable information on the distances travelled and return rates of reusable packaging, making them essential metrics for evaluating the performance of reuse systems. Additionally, using coded or tagged packaging and Apps can enhance brand value by providing a personalised approach, which can further support customer loyalty and return rates can be boosted through rewards and incentives. The addition of App based technology can encourage customers to participate in reuse systems and promote sustainable practices<sup>13,38</sup>.

The introduction of reuse systems requires businesses to make initial investments, but can provide new revenue

streams, local job creation, and long term cost savings<sup>60</sup>. The cost of switching to a reuse system for a business is highly variable, and depends upon the logistics involved, scalability, standardisation, return rates, cleaning methods, and labour requirements<sup>57,38</sup>. Overall, many of these costs can be reduced by using centralised pooling and through national or international system standardisation. Furthermore, reuse systems can reduce the costs of waste management, with opportunities generated for public-private partnerships for reuse infrastructure and job creation. Reuse systems can create local economic uplift as imports are reduced and there is less reliance on global supply chains<sup>60,24</sup>. For example, Upstream<sup>13</sup> found that in the USA, \$24 billion is spent by food outlets on single-use items each year and \$6 billion is spent on solid waste management, yet **switching to a reuse system can create savings of between \$3,000 and \$22,000 per year for small businesses**. In the USA,

In the USA, \$24 billion is spent by food outlets on single-use items each year

the implementation of reuse systems could result in an 80% reduction of the 1 trillion single-use foodware items, effectively reducing plastic waste by 7.5 MT out of the 14.5 MT of plastic waste produced in 2018<sup>61</sup>.

This, in turn, could prevent 17 billion pieces of litter<sup>61</sup>. Apart from the environmental benefits, reuse systems can create local employment opportunities, and retain value in the local economy<sup>40,55,62</sup> and contribute to building more sustainable and healthy communities, which are less affected by pollution, global economics, politics, and disruption to global supply chains<sup>62,55</sup>. Moreover, the reduction in pollution, due to reduced material extraction, production and waste is particularly significant for fenceline communities, small islands and areas with little waste management, leading to an increased quality of life<sup>62</sup>.

## 2.3 Flawed linear solutions for plastic waste

**Current approaches to addressing plastic pollution tend to focus on end-of-pipe solutions, such as recycling, incineration, and composting.** However, these approaches do not address the root causes of overproduction and consumption, energy use, and the greenhouse gas emissions associated with the extraction and production of virgin materials<sup>63</sup>. A narrow view of the plastic problem as a waste management issue has resulted in downstream policies that primarily focus on end-of-life solutions, leading to a deflection of blame onto consumers while producers fail to take responsibility

for their single-use linear pathways, and continue to increase production exponentially<sup>42</sup>. In 2016, 41.6% of plastic waste was incinerated, resulting in the release of 2.9 kg of CO<sub>2</sub> per kg and toxic emissions into the air, environment, and groundwater, which disproportionately affects fenceline communities, who are more likely to experience adverse health effects<sup>64</sup>. Furthermore, mixed or contaminated waste is still exported, and there is a lack of traceability for how much of this waste is recycled, burned, or dumped.

### Substitution

**Substitution of one single-use material for another is not a solution.** For example, substitutes such as bio-based plastics, rely upon high levels of fossil-fuels during their agricultural phase, create water pollution, dead zones, and monoculture<sup>65</sup>. Bio-based plastics are at least partly derived from non-fossil fuel feedstocks, although they can be up to 80% fossil-based, due to the addition of polymers and additives. Bio-based and biodegradable plastics sometimes have lower life-cycle greenhouse gas emissions than traditional plastics<sup>65</sup>, but not always, as biodegradable plastics can release twice as much CO<sub>2</sub> when in a marine environment compared to non-biodegradable plastics due to biodegradation of both the bio-based and fossil-based content<sup>66</sup>.

Other substitute materials such as aluminium and paper also have environmental aspects to consider. Mining for

aluminium releases perfluorocarbons which are 9200 times more damaging for the climate than CO<sub>2</sub>, creating greater air pollution at extraction and processing sites. Recycled content is often only 73% in aluminium products<sup>67</sup> and non-recycled content has five times higher carbon and perfluorocarbon emissions than plastic. In addition, paper production requires logging of more than 2 billion trees per annum<sup>68</sup>, causing biodiversity loss and soil erosion, which degrade resilience to climate change. Furthermore, paper production has higher greenhouse gas emissions and water usage than plastic. Whilst recycled paper requires up to 57% less energy than paper mills<sup>69</sup> and recycling paper causes 35% less water pollution and 74% less air pollution than new paper production<sup>70</sup>, recycling paper still requires energy for pulping and centrifuges and the use of water, soaps or surfactants and bleach for white paper.

### Recycling

Although plastic and other waste is collected for recycling in most countries, the actual amount of material that is recycled and remanufactured into the same or similar products (closed-loop recycling) is very low, for example, only 2% of plastic waste is recycled in a closed loop and not downcycled<sup>24</sup>. Recycling is unable to keep pace with the rapid increases in packaging production<sup>71</sup> and most recycled material is downcycled into other products or is recorded as recycled, but is exported with little traceability of recycling occurring. Globally, only 6–9% of plastic waste is actually recycled<sup>46,13</sup> for reasons such as low demand

for recycled plastic due to artificially low prices of virgin plastics, a lack of transparency about additives in plastics lowering confidence in the safety of recycle, plastic products not designed for recycling such as multilayer materials, and contamination with food<sup>72</sup>. Some materials such as glass can be recycled infinitely, but most plastic can only be recycled twice<sup>72</sup>. Furthermore, plastic recycling processes are not all equal, plastic-to-plastic pyrolysis (sometimes called “chemical recycling”) emits nine times more greenhouse gases than mechanical recycling, at 2.91 tonnes of CO<sub>2equ</sub> per tonne of recycle

output<sub>73</sub>. Plastic-to-plastic thermal and solvent-based processes are both very carbon and toxics-intensive, and

perform very poorly with post-consumer plastic waste due to their low tolerance for contamination<sub>74,75</sub>

## Incineration

Incineration is a costly and environmentally damaging waste management strategy, producing significant amounts of greenhouse gas emissions and toxic pollutants<sub>29</sub>. The energy offset produced from incineration does not sufficiently compensate for the emissions generated. Moreover, investment in incineration infrastructure creates high levels of lock-in and can take up to 20 years to recoup the infrastructure costs, influencing waste management decisions for an extended period<sub>40,76</sub>. For example, incineration of one tonne of plastic releases 1.43 tonnes of CO<sub>2</sub>, even when accounting for emissions savings from electricity production<sub>29</sub>.

The trend towards waste-to-energy incineration as a substitute for landfill is perpetuating the linear use of materials, particularly plastic which is a high-energy source. The processing of plastic waste into fuel, usually through pyrolysis or solvent-based processes, presents similar high carbon and toxic emissions, and the resulting fuels are too contaminated to comply with many fuel standards, including aviation<sub>77,78</sub>.

## Composting

The terms “biodegradable” and “compostable” create confusion for consumers, and packaging is often disposed of incorrectly. Biodegradable packaging may decompose in the environmental conditions they were designed for (specific temperature, humidity, terrestrial or marine conditions), but compostable packaging typically requires industrial composting facilities<sub>79</sub>.

Compostable and biodegradable packaging are often made at least partly from bio-based feedstocks that have significant environmental costs and impacts, such as greenhouse gas emissions, land occupation, water usage, use of fertilisers and pesticides, and eutrophication<sub>13</sub>.

## False solutions

Some national policies focus on reducing single-use plastic packaging by providing target percentage reductions using reuse, recycling, or composting. However, providing alternative single-use options for fulfilling these targets often results in substitution with unsustainable materials, rather than implementing design changes to promote reusable packaging. For example, reuse system pilots are underway for only 11%

of signatories of the Ellen MacArthur Foundation Global Commitment<sub>80</sub>. Whilst single-use bans can be effective at targeting highly littered items in specific geographies, this can also lead to substitutions which only shift the environmental burden<sub>81</sub>. Overall, linear methods such as chemical recycling, composting, and bioplastics all have environmentally unsustainable aspects<sub>82</sub>.





Image © Glassia

3

**Reuse:  
A systems  
approach**

This chapter asserts that reuse must be considered through a systems approach. Reuse is divided into systems based on business sectors, as one reuse system is not suitable for all sectors. The importance of each aspect within reuse systems will be provided as reuse is not just a product's packaging, reuse is an entire system of processes. Reuse systems will then be examined through end-of-use as a crucial aspect of the return system. The end-of-use location will be used as a method of defining the method of return. The chapter ends with a section about suitability of certain materials for packaging.

Based on the information gathered through the entire research process, we propose that **the transition to reuse systems should reflect the differing needs of diverse sectors through sector specific systems**. The systems approach takes into account a variety of businesses and end-of-use scenarios, recognising that reuse extends beyond packaging and involves the collection of used packaging, washing, sorting, replenishing, transportation, redistribution and data collection. Since there is no one-size-fits-all solution for reuse, different types of reuse systems will face different logistical challenges and

priorities, depending on their product sectors and end-of-use return scenarios. Therefore, we will describe a range of product sectors and distinguish between open and closed systems, as reuse system requirements can vary considerably. End-of-use scenarios will also be discussed, with a focus on three location-based return systems. It's important to note that not all products are immediately suitable for reuse systems, and that reuse systems will evolve over time. Therefore, **we suggest that the development of reuse systems should begin in settings where the transition to reusable packaging requires minimal infrastructure change, workable investment, and consumer acceptability**.

Each sector will have requirements for different levels of standardisation, tagging, and pooling and a hub approach will be beneficial to some sectors but not all. Standardisation of software, labelling, tagging and packaging will be required within most systems and packaging may be fully standardised or have to align with specific sizes to coordinate with infrastructure. A reuse fulfilment hub may operate for one system or may provide operations for multiple systems.

## 3.1 Reuse systems: sector by sector

### System 1: Venues, events and onsite dining

Single-use packaging is commonly used in high-traffic settings such as stadiums, festivals, concerts, on-site dining restaurants, food courts, government and community buildings, transport hubs, theatres, cinemas, and museums, where purchase, consumption and disposal take place on the same site. Due to the large quantities of single-use packaging sold in these locations, a shift to reusable packaging is a high priority. These are closed systems as the packaging does not leave the site,

making collection relatively straightforward. In addition, many of these locations have washing facilities on-site, or can use third-party suppliers. For instance, food court venues play a significant role in many cultures and produce large quantities of single use waste, but could be an area for early reuse system implementation. Although reusable cup systems are being introduced to events in many locations worldwide, there is little standardisation of the format<sub>83</sub>. Some cup designs are too desirable or

feature images of the event, making them collectable for the consumer and are removed from the reuse system. These consumer actions turn the reusable cup into single-use with a worse environmental footprint than the single-use equivalent. To address this issue, return systems can use deposits, fees, or incentives, with fees through apps being an effective method of securing high levels of return.

Gatwick Airport has introduced a reusable cup trial called Cup Cup and Away for the airport hub and include cup “check-in points” at terminals.<sup>45</sup>



Image © Huella Verde — Reusable cups used in food courts in Ecuador

## System 2: Bottled beverages

The bottled beverage sector, including sodas, water, juices, milk, and alcoholic beverages, holds significant potential for transitioning from single-use to reusable bottles. Achieving high levels of standardisation, as seen in the beer and soda industry, is crucial to enable centralised supply and the infrastructure changes required for washing and replenishing. Deposit Return Schemes (DRS) can be highly effective in facilitating bottle return, with some schemes achieving collection rates above 95%, and this system could be adjusted to collect reusable bottles instead of recycling.<sup>43</sup> However, implementing such schemes for beverages, which have end-of-use both on street, at home and venues requires extensive collection networks, making implementation more challenging. Refill systems (packaging prevention)

are also suitable for the bottled beverage sector. For example, onsite refill options for bottled beverages could be made available in venues and hospitality environments, such as restaurants, hotels, and supermarkets. Reusable bottles still exist in many rural and urban locations and are within the population's memory of reuse, making bottled beverages a viable and desirable option for reintroduction or implementation.

Genossenschaft Deutscher Brunnen (GDB) provides a reuse system for mineral water bottles using standardised bottles supplied to manufacturers.<sup>164</sup>





Image © Huella Verde — Returnable bottle system

### System 3: Food and drink on-the-go

Food and drink on-the-go comprise of hot and cold drinks, street food, take-out food, and takeaways, and are significant sources of single-use packaging waste and littering. This sector operates in an open system with end-of-use typically occurring on the street or at home, presenting a challenge for implementing reuse system solutions<sup>5</sup>. Standardisation and collaboration are crucial to avoid confusion for consumers and disengagement caused by multiple drop-off requirements. For maximising consumer engagement, any return system must be convenient for the consumer and return on-the-go or return-from-home are closer to current systems of e-commerce return and waste collection from litter bins, requiring fewer adjustments to daily habits<sup>37</sup>. Economic incentives for packaging return, such as fee-based systems or subscription models were found to be more effective than deposits for the companies interviewed in this sector, as deposits can be a significant access barrier. Overall, the development of third-party provision through centralised infrastructure with standardised packaging provides a scalable, economic system that could become the norm for reuse in this sector. In addition, rentable packaging offers smaller enterprises a viable option to participate in a pooled approach and community cooperatives can also work well for this

sector. Collaboration of local enterprises using nationally standardised packaging can create multiple drop-off points and a community centric development, but should align with national standardisation to prevent 'city island' isolated systems developing.

The Plastic Waste Free Islands project has developed new business plans around the Caribbean to reduce single-use packaging. Reusable packaging has proven to be affordable and valuable to consumers in Small Island Developing States (SIDS) due to limited resource availability. Returns are encouraged using vouchers or a deposit system via an automated app<sup>85</sup>. In Mumbai, the Dabbawala organisation offers a low-cost, successful operating system for deliveries and collections of meals, providing jobs and a low-emission alternative transport<sup>86</sup>. A number of other meal delivery services have also started providing meals in tiffin stainless steel stackable food containers, such as Dabba Drop<sup>87</sup> in the UK, and Planted Table<sup>88</sup> and in San Francisco<sup>89</sup>.



## System 4: E-commerce

E-commerce such as on-line shopping sites, takeaway and subscription has experienced significant growth in recent years, with the sector increasing by 31% between 2019 and 2020, and the Covid-19 pandemic accelerating the adoption of online retail<sup>90</sup>. Return systems already exist within this sector as online purchases are regularly returned, and some subscription services include collection for recycling when delivering<sup>5</sup>. The logistics for reusable packaging in this sector are mostly in place already, with delivery, collection, and central hub provision already well established<sup>40</sup>. E-commerce delivery packaging has the greatest potential for initial standardisation as there is little requirement for differentiation of outer protective delivery packaging.

Takeaways provided online or via app ordering can also operate through e-commerce reuse systems, but the storage of takeaway packaging for days or weeks until the next order may be problematic for some customers.

Repack has developed a mailing package that can provide delivery and then be folded for ease of return in the post by the consumer<sup>91</sup>. Consumer data from pilot projects in Germany showed high levels of willingness to pay for reusable packaging in e-commerce<sup>3</sup>.

## System 5: Home and personal care

The development of reuse systems for the home and personal sector will require infrastructure and supply chain changes, similar to the FMCG sector. However, the development of reuse systems through on-line, e-commerce subscription supply can be a method of providing early implementation of reusable packaging in this sector. While reuse systems develop, home and personal care products can be supplied through packaging prevention models such as refill at home, or refill in-store<sup>5</sup>. Innovation in the home and personal care sector could produce refill-at-home containers that can be dropped back at the store and returned to manufacturers as part of a reuse system. The containers could be lightweight, small and would be easily carried by the customer to a central collection point.

The Bower Collective provides an e-commerce based subscription service for some household and personal care products and as of April 2023 has saved 43,201 kg of plastic waste<sup>165</sup>.

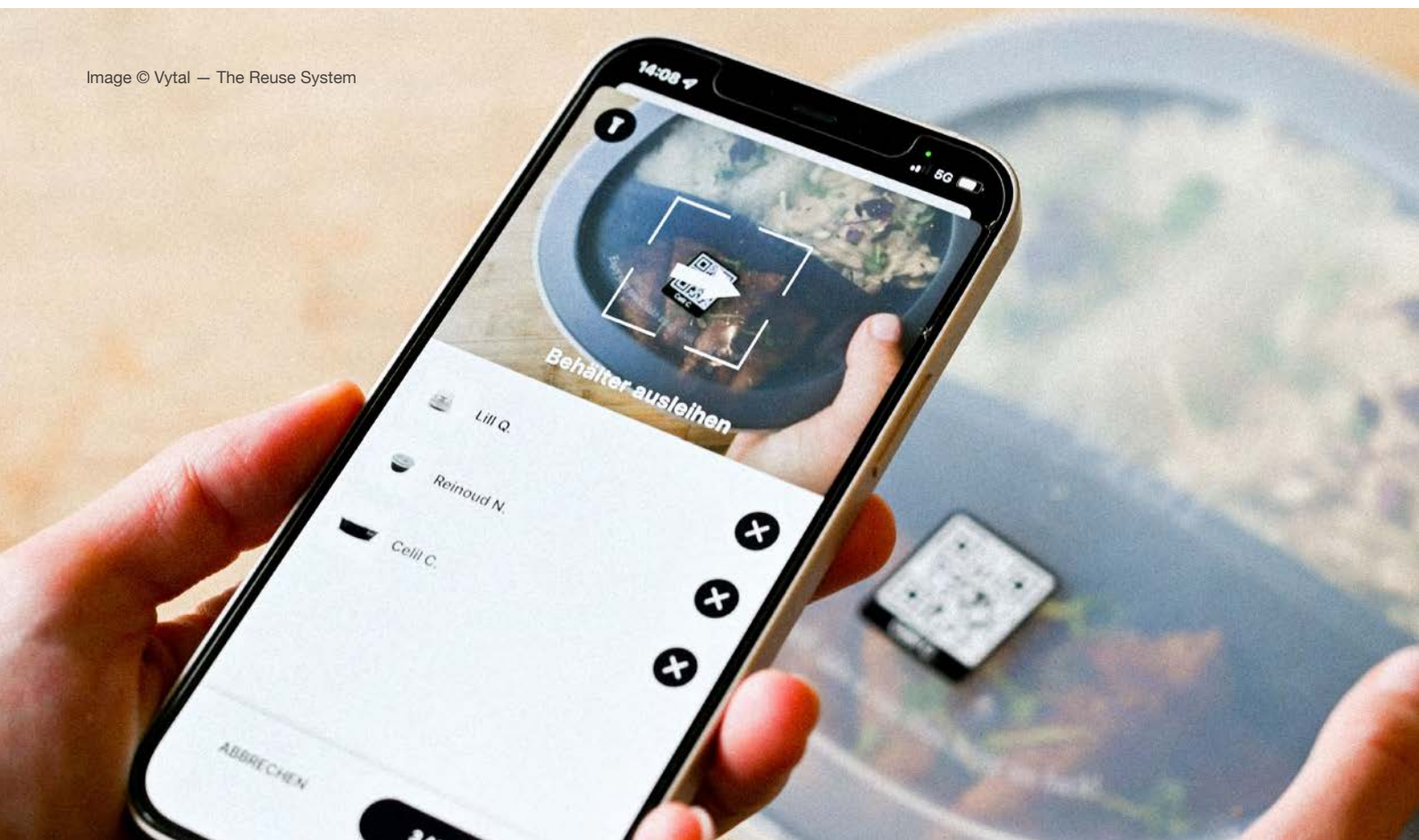
## System 6: Fast-moving consumer goods (FMCG)

The FMCG sector is a major source of single-use packaging. The FMCG sector is an open system that would require global standardisation to align with international supply networks. Reuse system development for this sector is likely to take some time due to infrastructure changes, meanwhile, packaging prevention strategies such as refill in-store could provide an alternative, while these reuse systems are evolving. Refill can be an interim measure or may be a more suitable long-term solution for some contexts, providing flexibility, low prices, and local provision. Removal of unnecessary packaging is an immediate priority while standardisation for reuse systems is developed. End-of-use for the FMCG sector generally

occurs at home, and therefore local waste collection may provide a return method in some contexts, while community drop off points may be more suitable in other regions. Packaging for food preservation is fundamental as the environmental costs from food waste are substantial due to agricultural practices, transportation, and warehousing. A transition to reuse system packaging in this sector requires significant infrastructure changes and agreed common standards.

Loop provides reuse systems as a third party service for the FMCG sector and retailers, providing collection, sorting, washing and distribution to producers in this sector<sup>84</sup>.

Image © Vytal — The Reuse System



## System 7: Business to Business (B2B)

Standardisation already exists for many aspects of B2B packaging<sup>93</sup>, including crates and pallets, but expanding to other B2B packaging will require infrastructure changes for producers and retailers. B2B packaging is a fairly closed system with packaging rotating in specific circles, but the level of a closed system depends on how widely the packaging is distributed<sup>92,93</sup>.

The Svenska Retursystem<sup>94</sup> operates in the Swedish food industry supply chain and uses a reusable pallet and crate system. The Svenska Retursystem developed as a cooperative by FMCG retailers and producers and is an excellent example of what can be achieved through non-competitive collaboration.

### 3.2 Reuse return system: The end-of-use point

The point at which reusable packaging stops being used is crucial to the design of a reuse system. This is described as the End-of-Use point and is an integral part of a systems approach to reuse. Some sector products have multiple end-of-use points, and each of these affects the return mechanism. Broadly, in reuse systems, end-of-use occurs in three settings: 1) on site of purchase; 2) in the home; or 3) on the street. The return system includes return by the consumer, collection, backhauling (using returning empty vehicles), washing and sorting. Consumer return can be enhanced by using deposits, fees, or incentives to achieve over 90% return rates often required to achieve the sustainability breakeven point. Deposit Return Schemes can enhance return systems, but deposits can be unpopular and exclude those unable to afford multiple deposits. In closed systems, incentives may not be required, and a fee-based system can work well for quick return items such as cups and takeaway packaging. These incentives require tagging or QR codes to monitor the flow of the packaging and these labelling mechanisms can additionally enable automated sorting. End-of-use collection and return increases transportation costs and emissions, but backhauling can minimise these additional environmental and financial effects. In addition, a hub and spoke distribution model with centralised pooling reduces transport distances and increases the efficiency required for reuse systems at scale as shown in figures 5 and 6.



Image © Muuse



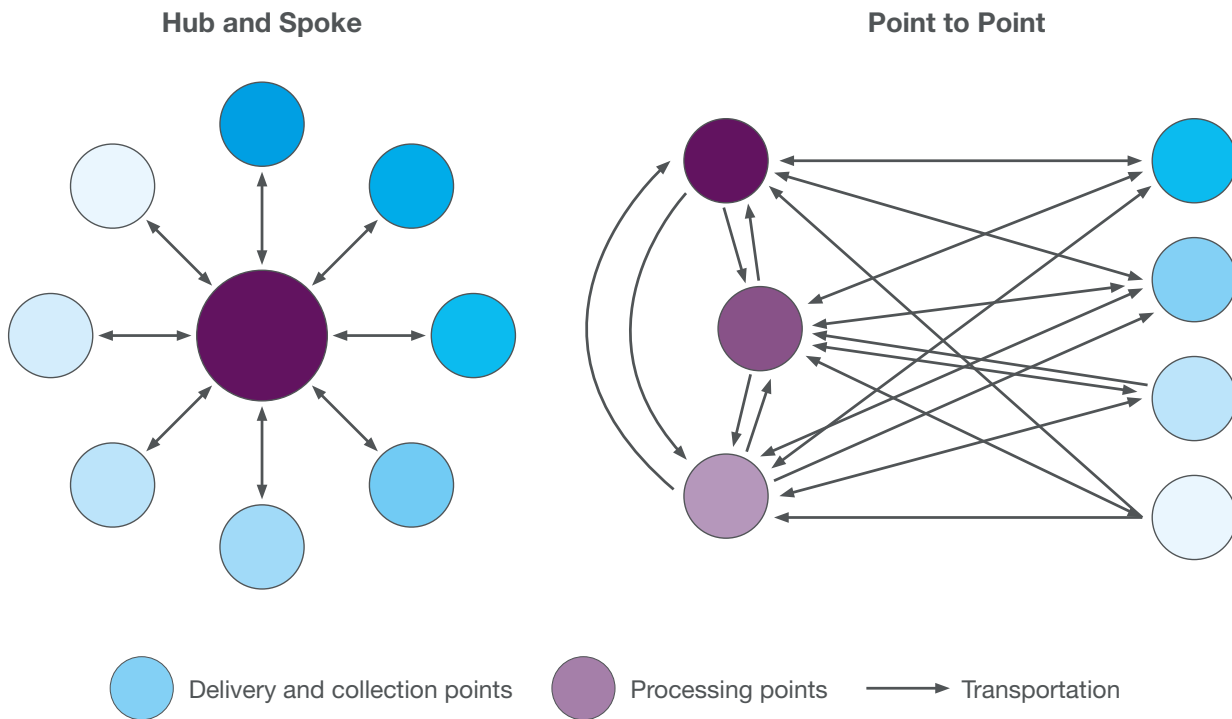


Figure 5. Hub and spoke distribution diagrams adapted from Kachook (2022)<sub>5</sub>

The end-of-use point is a critical factor for how any reuse system performs. **The focus for the design of any reuse return system should be the end-of-use point of the reusable item** as the system for collection and return depends on this point. Once working at scale, these systems can function efficiently and conveniently. Initially, development of the return infrastructure will take time and is likely to be less convenient for consumers, but by using current logistics and infrastructure as much as possible this could ease the transition for reuse return systems. Furthermore, data collection and analysis of the entire reuse system is essential to calculate the sustainability breakeven point, to determine the social, environmental, and economic effects of reuse system introduction. Data should be collected on reuse cycles completed by packaging through the system, return rates, breakage/damage rate, and recycling rates, creating a packaging passport for each item.

### End-of-use on-site of purchase

End-of-use “on-site of purchase” offers the most straightforward return system as the item remains on site. On-site end-of-use occurs in places such as venues, schools, hospitals, events, food courts and many other locations which are closed systems. The reuse system process can be provided on site, avoiding transport emissions or third party provision could be used. A crucial

aspect of the reusable packaging is that it must be easily distinguishable from single-use, but should not be so attractive as to become collectable. In addition, tagging or QR codes can track packaging and return rates can be increased by using a fee system or incentives along with clear signposting and instructions from staff. These sectors can rapidly transition to a reuse system and can provide an introductory pathway to increase knowledge of reuse systems for consumers, increasing education and population memory.

### End-of-use in the home

End-of-use “in the home” is similar to current waste generation placed in general waste bins or recycling bins. “Return from home” may be imparted by a third bin for reusable packaging separation and collection by local authorities, third party providers or by e-commerce. E-commerce has the potential to provide return of reusable packaging from the home through current supply and return logistics as end-of-use at home occurs in a different location to the purchase, an additional system for return is required. The growth of e-commerce offers opportunities for new reuse system approaches, benefitting from established logistics and transportation networks well-suited for end-of-use home collection. The sustainability aspects of e-commerce including last mile supply will require further research<sub>95,96</sub>. The integration of



reusable packaging end-of-use collection into domestic waste collection, where this exists, could provide a simple and familiar approach for consumers. An alternative can be for the consumer to return the reusable packaging to retail hubs at supermarkets, as occurs in a similar way to bottle banks alongside the development of local community collection cooperatives.

### **End-of-use on the street**

End-of-use can occur “on the street” which refers to any location away from the purchase location or home. The end-of-use may occur in shopping centres, public spaces and while using transportation, along with many other locations, and mainly relates to food on-the-go and beverages. End-of-use collection “on the street” poses challenges due to the various drop-off points and potential for the mismanagement of the reusable item. To address this, it is essential to standardise the collection system and provide multiple drop off locations, such as

public collection points in high-traffic areas and in retail settings. In addition, convenience stores, petrol stations, and other similar locations could be utilised as collection points. Local authority services could support these collection points in some regions, potentially using the revenue saved from lower waste disposal requirements. The development of community based operations could be a major enabler for this end-of-use collection in many contexts. Overall, collaboration and standardisation is essential for on-the-street end-of-use return.

The end-of-use return processes and differences are shown in figure 6. The hub which supplies sorting, washing, pooling and redistribution can operate for a single end-of-use system or single sector system, or can provide for multiple types of reuse systems. Further research is required to establish the sustainability benefits of e-commerce return compared to consumer drop-off<sub>97</sub>.

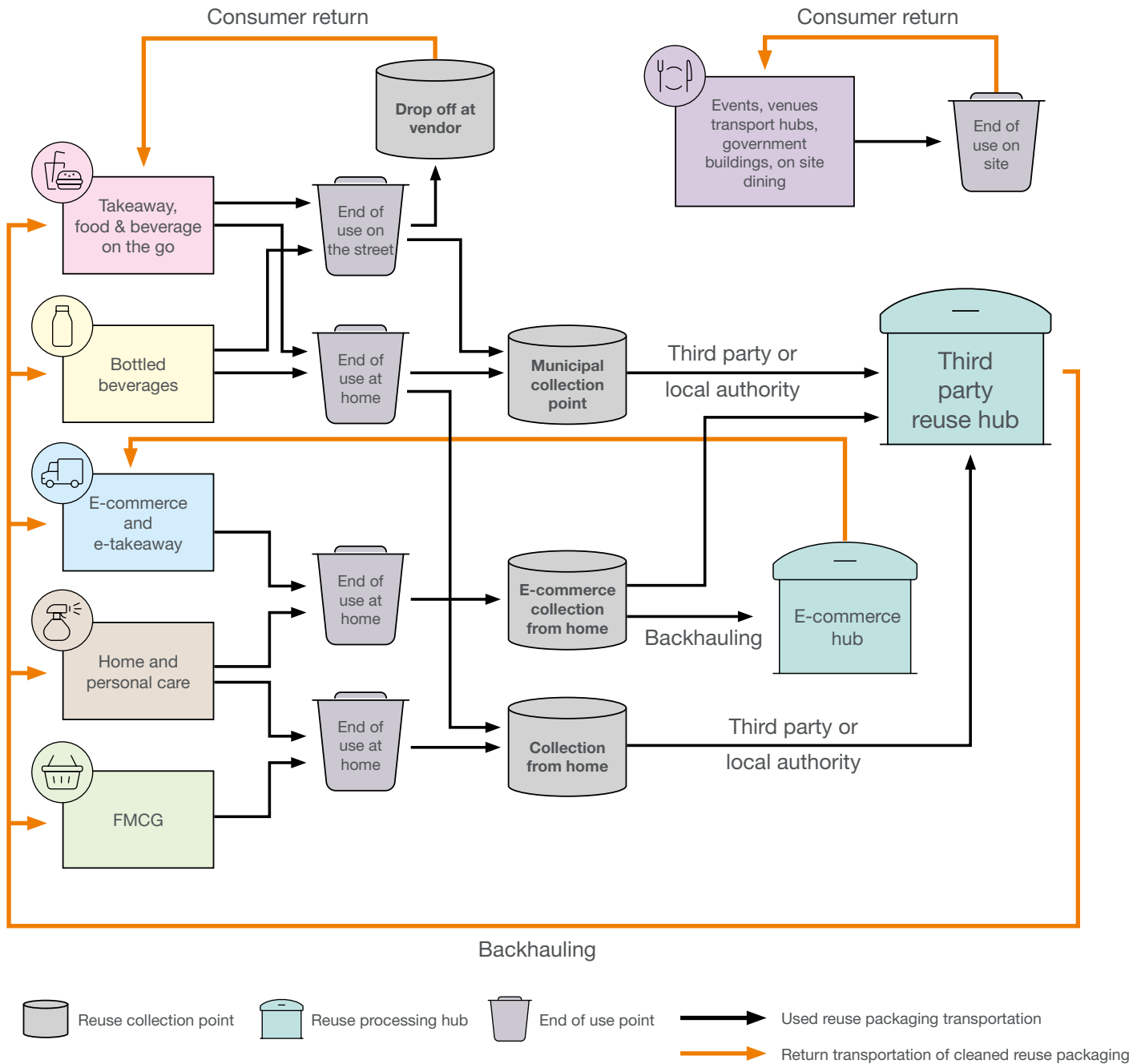


Figure 6. End-of-use as a determinant of the return method

### 3.3 Materials for reusable packaging

Reuse is a system, not packaging, but the packaging itself is significant for the environmental footprint of the reuse system. Material choice for reusable packaging is complicated by the need to be durable, lightweight, and recyclable, have low toxicity, hygienically protect goods and be suitable for multiple washing sequences at high temperatures<sup>40,98,38</sup>. **Chemicals of concern are found in many food packaging materials and the transfer of these chemicals requires further investigation**<sup>99</sup>. Environmental impacts should be measured at all stages of the reusable packaging life cycle including water, emissions and energy use. The measurement of damage and loss rates, return rates and repeat participation in the reuse system by consumers will provide the data required to determine the full environmental cost of reusable packaging<sup>100</sup>. Reusable packaging should use recycled material where possible, due to the emissions caused by virgin material extraction, processing and production. However, unidentified toxicants within recycle can be a problem for the use of recycled material for food packaging<sup>101</sup>. In addition, the packaging material should be recyclable to the same or similar type of product, not downcycled, at end-of-life. Overall, packaging should avoid toxicants, mixed materials, non-recyclable content and multilayering<sup>29</sup>.

**Reuse systems should be material agnostic.** There is no ideal material for reuse systems, the choice should be based on the system requirements. If used beyond its sustainability breakeven point, any material can be beneficial compared to virgin plastic production. A part of any material selection is a life cycle assessment which needs to take into account all stages of the life cycle, including extraction, processing, production, use and end-of-life. The end-of-life data should include the effects of pollution, dumping and burning, to properly compare single-use with reuse systems<sup>102</sup>. Table 4 shows the findings of advantages and disadvantages of the example material options for reusable packaging. Upstream has developed Chart Reuse<sup>103</sup>, which allows food service providers to calculate the impacts of single-use and reusable packaging options, enabling a comparison of the economic and environmental costs of switching to reusable packaging. The Netherlands Institute of Sustainable Packaging<sup>104</sup>, in collaboration with KIDV, has created a tool that calculates the CO<sub>2</sub> emissions of reusable packaging materials compared to their single-use equivalents, to determine the sustainability breakeven point for reuse system packaging. SUM'D<sup>105</sup> have developed Score Card which is a tool to assess the environmental and human health consequences of packaging in contact with food.

**Table 4. Examples of material options for reusable packaging**<sup>35</sup>

Material	Advantages	Disadvantages
Plastic polypropylene reusable	<ul style="list-style-type: none"> <li>• Lightweight</li> <li>• Malleable</li> <li>• Can be coloured</li> <li>• Recyclable but limited times before degradation</li> </ul>	<ul style="list-style-type: none"> <li>• Transmits heat</li> <li>• Microplastic release</li> <li>• May contain toxicants</li> <li>• Pollution of areas surrounding extraction and production sites</li> <li>• High emissions of carbon dioxide, sulphur oxides, methanol, nitrous oxides, and other volatile organic compounds</li> <li>• Can potentially contain over 4000 chemicals, some of which are hazardous to human health</li> <li>• Plastic can deteriorate in high heat, humidity, and with UV exposure which affects durability</li> </ul>
Stainless Steel	<ul style="list-style-type: none"> <li>• Very durable</li> <li>• Feels high quality</li> <li>• Thermally insulative if double layered,</li> <li>• Recyclable</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive to purchase,</li> <li>• Extraction and production emit high levels of GHG</li> <li>• Attractive - leading to low return rates.</li> <li>• Not microwaveable</li> <li>• Contamination of environment at iron ore extraction sites</li> <li>• High energy for production</li> </ul>
Glass	<ul style="list-style-type: none"> <li>• Attractive to consumers,</li> <li>• Inert</li> <li>• Endless recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Resource intensive to produce,</li> <li>• High GHG emissions from production</li> <li>• Energy intensive for production</li> <li>• Heavy to transport</li> <li>• High breakage levels</li> <li>• Silica removal damages ecosystems</li> </ul>
Ceramic	<ul style="list-style-type: none"> <li>• Familiar</li> <li>• Inert</li> <li>• Can be broken down to ceramic rubble but not recyclable</li> </ul>	<ul style="list-style-type: none"> <li>• High breakage levels</li> <li>• Unsuitable for many reuse systems</li> </ul>
Aluminium	<ul style="list-style-type: none"> <li>• Thermally insulative if double walled</li> <li>• Endlessly recyclable</li> </ul>	<ul style="list-style-type: none"> <li>• Not microwaveable</li> <li>• Bauxite strip mining damages environment</li> <li>• High energy use</li> <li>• High GHG emissions</li> <li>• Perfluorocarbon emissions</li> </ul>



Material choice needs to take into account many factors, such as consumer preferences, transportation, environmental impacts, recyclability and contamination factors. The environmental aspects of any virgin material production and environmental aspects of recycled materials used in a product, including emissions, toxicity, water use and land use effects should be explored. The material has to be fit for purpose, which may require the packaging to be microwaveable, stackable and heat proof. Suitability for the consumer should be assessed,

as the packaging will have to be carried for return, making weight and breakage risk a significant factor. In addition, staining, scratching, denting and retaining smells affect the longevity of use of the material and consumer acceptance of the reusable product. Overall, the weight of the material is highly significant due to the increased transportation required for reuse systems and selecting the material most appropriate for the specific use is essential as no single material is suitable for all operations.







Image © Vytal — The Reuse System

4

Drivers for  
breaking the  
linear model

This chapter will define the barriers and enablers to the uptake of reuse systems that were identified during the interview process. Key aspects such as standardisation, consumer insights, transportation and logistics, and economics are examined in more detail. The part multinational suppliers need to play, is explored as an

enabler for global reuse systems as a new norm. At the end of the chapter the importance of a just transition and the involvement of the informal waste sector is discussed along with the opportunities provided by reuse system development involving all stakeholders through community engagement.

## 4.1 Enablers and barriers to the adoption of reuse systems

The transition to reuse systems requires a shift from product and packaging sale to a product-as-a-service model where packaging is rented or loaned. Currently, the true cost of single-use packaging, which includes the time and labour required to manage stock, logistics, and waste, is underestimated by businesses. These cost miscalculations result in reusable packaging appearing to be less economically favourable<sup>13,38</sup>. However, if companies were to factor in the full cost of single-use

packaging, including waste and environmental costs, the differential could potentially be negative or significantly reduced<sup>46,30</sup>. Although the infrastructure costs for collection, sorting, and cleaning of reusable packaging may be prohibitive for a single business, the use of cooperatives and third-party companies offering rental services for reusable packaging and processing through multiple outlets are likely to provide cost-effective and convenient solutions.

### Business enablers and barriers

Information collected during the research interviews revealed a lack of a shared view or overarching vision for reuse systems as a new norm, which interviewees considered necessary to enable the transition to scalable reuse systems. The development of reuse systems requires significant logistical infrastructure which interviewees felt to be beyond the scope of individual businesses, but which could be developed through collaboration, potentially led by logistics companies. In addition, interviewees considered reuse systems to be a significant business opportunity, but emphasised the need for collaboration, co-partnering, and pooling. The specific enablers mentioned by interviewees focused on finance and standardisation as some reuse systems require significant infrastructure changes and the cost of these changes was mentioned as a barrier by 81% of

interviewees. While businesses are investing in reuse for some systems, it is difficult for a single business to risk investing in an area that requires extensive infrastructure changes without the introduction of a nationalised reuse system framework. Furthermore, the ongoing investment in recycling was also mentioned as a barrier as this diverts government funds away from reuse infrastructure development. Some interviewees noted that recycling is promoted as a sustainable action to consumers, reducing the desire to engage with reuse systems.

Standardisation was seen as both a barrier and an enabler by interviewees, with concerns expressed that standardisation of packaging would result in a loss of brand identity. Standardisation was mentioned by 77% of respondents as crucial for many aspects of reuse systems

such as the implementation of centralised hubs providing pooling of reusable packaging for multiple companies, mentioned as a means of reuse system provision by 68% of interviewees. The development of reusable packaging standardisation could be conceived as working from the already standardised shipping container, through to reusable pallets and crates which align with these containers and then to primary packaging forming a grid of packaging formats that fit within these constraints, while still allowing for packaging innovation.

The additional transportation required for the return of reuse packaging was mentioned by 33% of respondents, highlighting the need to consider increased transportation costs, complexity, and emissions associated with any reuse system. Moreover, interviewees stressed the importance of backhauling for reducing these additional emissions for return. Scalability of systems was viewed as a significant factor by 35% of interviewees and the economy of scale was seen as a substantial barrier for the early stages of implementing reuse systems. The establishment of a framework of reuse systems and standardisation increases scalability and reduces the risks for the considerable investments required to transition businesses to a reuse system format. The implementation of reuse systems is likely to start in urban areas initially, as rural locations will require more complex logistics and transportation organisation. However, some noted that global supply chains reach many of the remotest areas, so the capability exists for return, backhauling, and replenishment. Some interviewees wanted to see the development of knowledge hubs to enable the advancement of reuse system frameworks and there was considerable desire to collaborate and learn from each other.

Interviewees discussed the need to level the playing field with single-use materials as the unfair competition of single-use packaging was seen as a substantial barrier. The need for policy to create the level playing field was mentioned frequently, with the lack of specific reuse system policy mentioned as a barrier by 37% of interviewees. Many respondents mentioned that complete replacement of single-use with a reuse system in a distinct sector was necessary, otherwise consumers would choose the easier, familiar option of single-use. There was a strong desire for more national government involvement with reuse schemes, in the form of public-private partnerships and the introduction of pilot trials for specific sectors. Safety concerns were also raised by

28% of interviewees, including the need for clear washing and packaging standards mentioned by 68%.

Health and safety for consumers was considered a barrier for packaging prevention in the form of refill in-store, with concerns about cross-contamination, allergies, spills, and the use of inappropriate or contaminated containers<sup>106</sup>. A study in 2017<sup>107</sup> recorded unsafe food handling by consumers which included inappropriately handling produce, putting produce back on the shelf, and tasting foods, in addition to practising poor personal hygiene. In addition, produce scales were unclean in a majority of observations<sup>107</sup>. Legalities of claims against companies for illness caused by contamination were mentioned by some interviewees, as there is no clear line of responsibility or data collection, especially for refill in-store. Concerns have often been ameliorated via intuitive labelling, product information and safety guidance in refill-in store retail outlets<sup>108</sup>. Further research is required into the food safety aspects of both refill in-store and reuse systems.

In general, interviewees were material agnostic, stressing that the reusable packaging should be identifiable and differentiated from single-use, but the material should be based on the application requirements. Whilst only 11% of interviewees specifically mentioned identifiable packaging, many stressed the importance of clear labelling and a reuse logo. The level of desirability of the packaging was found to be a challenging area. The packaging and the system should be desirable for consumers, but if the item is too desirable it may be retained by the consumer, leaving the reuse system and becoming a single-use item. For example, some reusable cup providers for events mentioned that if decorated with the word "reuse," they are mostly returned, but if they have the band or team on them, they become collectable, are removed from the system, and at that point become single-use with a higher environmental cost than a normal single-use cup. Rotations of reusable packaging items are essential to achieve the sustainability breakeven point.

Any commercial reuse system should be based around the consumer, and needs to look and feel as close to the current provision as possible. Communication was identified as a critical factor in increasing awareness of reuse systems, with 68% of respondents mentioning this as an enabler, and 61% highlighting the importance of consumer engagement. The increased staff requirements and training to gain consumer participation were



mentioned, and the importance of staff interaction with consumers was highlighted by 51% of interviewees. Furthermore, staff were seen as the promoters of reuse systems, with the opportunity to educate and inspire customers to switch to reusable packaging. The requirement to achieve a return rate of at least 90% was mentioned frequently, and some businesses used incentives to realise the required return rate. Incentives for return were surprising, with many respondents abandoning the use of deposits, and only 30% suggesting they were an enabler.

There was a move towards fee-based systems for fast turnover sectors, with a fee per day after a set time. **Businesses operating reuse systems in these fast-use sectors had found that fee-based systems produced higher return rates and that deposits were a substantial barrier for consumers.**

## Consumer enablers and barriers

Consumer demand has a significant influence on businesses and is critical for the replacement of single-use packaging systems with reuse systems. Increased costs were deemed to be a significant barrier for consumers and was mentioned by 51% of interviewees. Convenience for consumers was also considered one of the most important reuse system enablers, with 68% of interviewees mentioning this aspect. In addition, some interviewees noted that consumers are busy, not lazy and that reuse systems should fit seamlessly into their lives, with the system changes happening behind the scenes.

Interviewees noted that to increase public acceptance of change, reusable packaging needs to be normalised and become part of the population memory (knowledge of an action occurring in the past, within a population). The introduction of reusable packaging into closed systems, such as venues, can help to build this population memory and facilitate the transition to more extensive reuse systems. Consumer behaviour change was identified as a challenge by 74% of the interviewees, with 68% emphasising the importance of education to overcome this. Fear of the new was also mentioned by 26% of the interviewees, highlighting the need for clear reuse system

Data collection was mentioned by 59% of interviewees, and many saw apps as an important facilitator of reuse systems, providing a means of data collection through tagging, incentives and communication with consumers. Additionally the need for apps software to be standardised was also mentioned in interviews, as a means of avoiding consumers having to load multiple apps and learn multiple systems. Open-source or white-label software was recommended as a method of providing single-platform access. Moreover, app-based systems can generate customer loyalty and provide promotional opportunities and data collection on use rates and habits, enabling further system adjustments. Some interviewees also highlighted the opportunities provided by e-commerce for subscription reusable packaging with the option of automatic reordering and collection.

**Interviewees suggested that barriers for businesses required collaborative solutions rather than single business approaches, which tend to produce a niche, uncoordinated, siloed approach that ultimately restricts scalable development.**

signage, instructions, and well-trained staff to reduce consumer anxiety and encourage engagement. The development of multiple different systems with dissimilar apps, return methods, and incentives was also seen as a major barrier that could cause disengagement among consumers. Therefore, to encourage consumers to return reusable packaging, return systems must be as low effort as single-use disposal.

The weight of reusable packaging, particularly if made of glass, was seen as a significant barrier for some consumers depending on local context and transportation methods. Additionally, a number of interviewees considered the promotion of recycling as a sustainable solution had created a psychological barrier for consumers to engage in reuse systems. Some interviewees remarked that recycling is favoured by businesses as a method of not disturbing the current supply chains and systems.

Multiple respondents believed that in the early stages of reuse system introduction, collection rates for reusable packaging would be lower than the ideal 90%, but would build as behaviour changes and new habits developed. Some interviewees suggested using less

durable packaging and planning for fewer reuse cycles initially. The sustainability breakeven point can then be achieved with fewer rotations, avoiding over-design and

excessive material use during the early introduction of reusable packaging.

## Policy enablers and barriers

The lack of government vision and direction for reuse systems was identified as a significant policy barrier by many interviewees. The current linear approach of policy, with a heavy focus on recycling policy and investment, was seen as a considerable challenge, causing frustration amongst stakeholders. Interviewees suggested that legislation should be more focused on tipping the economic scales in favour of reuse systems by incorporating the full costs of single-use packaging, including waste and environmental aspects. Many interviewees expressed a strong desire for a clear and consistent reuse system policy framework (34%) and the establishment of reuse system standards (49%).

Investment and government subsidies in waste management solutions, such as recycling and incineration for energy, have created economic lock-ins that perpetuate a linear approach, which interviewees believe should be refocused on the application of the waste hierarchy and circular solutions. Interviewees discussed the externalisation of waste and environmental costs and how this creates a barrier for reusable packaging, making single-use packaging appear cheaper than the true costs to the environment and society. The major barriers for businesses included costs, financing, and infrastructure changes and money was mentioned by 82% of interviewees (Figure 7). Investment by national governments and the use of green procurement were seen as significant enablers and had benefits beyond just funding. These investments help to give gravity and substance to the system, which can lead to venture capital investments and expansion. Furthermore, national governments can also determine the strategy and framework for reuse systems locally while basing this development on national or global standardisation.

Many interviewees emphasised the importance of reuse systems being introduced as a full replacement of single-use, rather than running alongside whenever possible. Interviewees commented that if consumers are given a choice, they will choose the single-use route of low friction and high convenience, which is currently dominant. The introduction of specific reuse system targets to support the transition to reuse systems was mentioned as a policy

enabler, but some interviewees noted that targets with far-off deadlines can delay the transition. The importance of tax incentives and disincentives was expressed by 46% of interviewees, along with single-use bans, mentioned by 51%. Moreover, aligning the economic aspects of single-use and reusable packaging was seen as essential for reuse systems to function at scale. Extended Producer Responsibility was specified by 46% of respondents who discussed the ways this type of policy helps to align reusable and single-use packaging costs.

Some interviewees discussed the need for clarity of ownership, which will become a necessity as centralised systems develop. In addition, 49% of respondents noted the need for clear standards and regulations for health and safety aspects of reuse systems, especially for washing, food safety and the removal of chemicals of concern. There was also a desire for fairness and transparency, with 46% of interviewees emphasising the importance of enforcement of regulations, data collection and monitoring requirements. The lack of transparent data for the single-use industry was addressed in some interviews, along with the challenges with life cycle assessment comparisons. Furthermore, enforcement of policy was mentioned by 46% of respondents, and highlighted that in some countries, enforcement of existing legislation was problematic. Surprisingly, deposit return schemes were considered a less important aspect, with only 23% mentioning this policy approach, which may be due to the problems experienced by some businesses with deposit-based reuse systems.

Overall, the solution to many reuse system barriers is the implementation of standardisation and a level playing field for environmental and system costs. Green procurement for reuse system infrastructure can be very effective and adds community benefits such as increased local employment and reduced waste. For instance subnational government partnerships can also provide knowledge-sharing and collaboration opportunities, as seen in Seattle<sup>109</sup>.

## Reuse Seattle an example of standardisation

Reuse Seattle is a collaborative public-private partnership within the city of Seattle to enable a coordinated, systematic and standardised approach to reuse. Sports and entertainment venues, restaurants and coffee shops have signed up to be part of this reuse system. PR3 designed the standardisation protocol and provide a clear method of reuse introduction. At the start of 2022, Reuse Seattle introduced the r.CUP which is a reusable beverage cup to venues and includes washing and logistics systems as part of the r.CUP introduction to create a turnkey process that businesses can quickly implement.

The general barriers and enablers for reuse systems were identified by all interview respondents, as shown in figure 7 and 8.

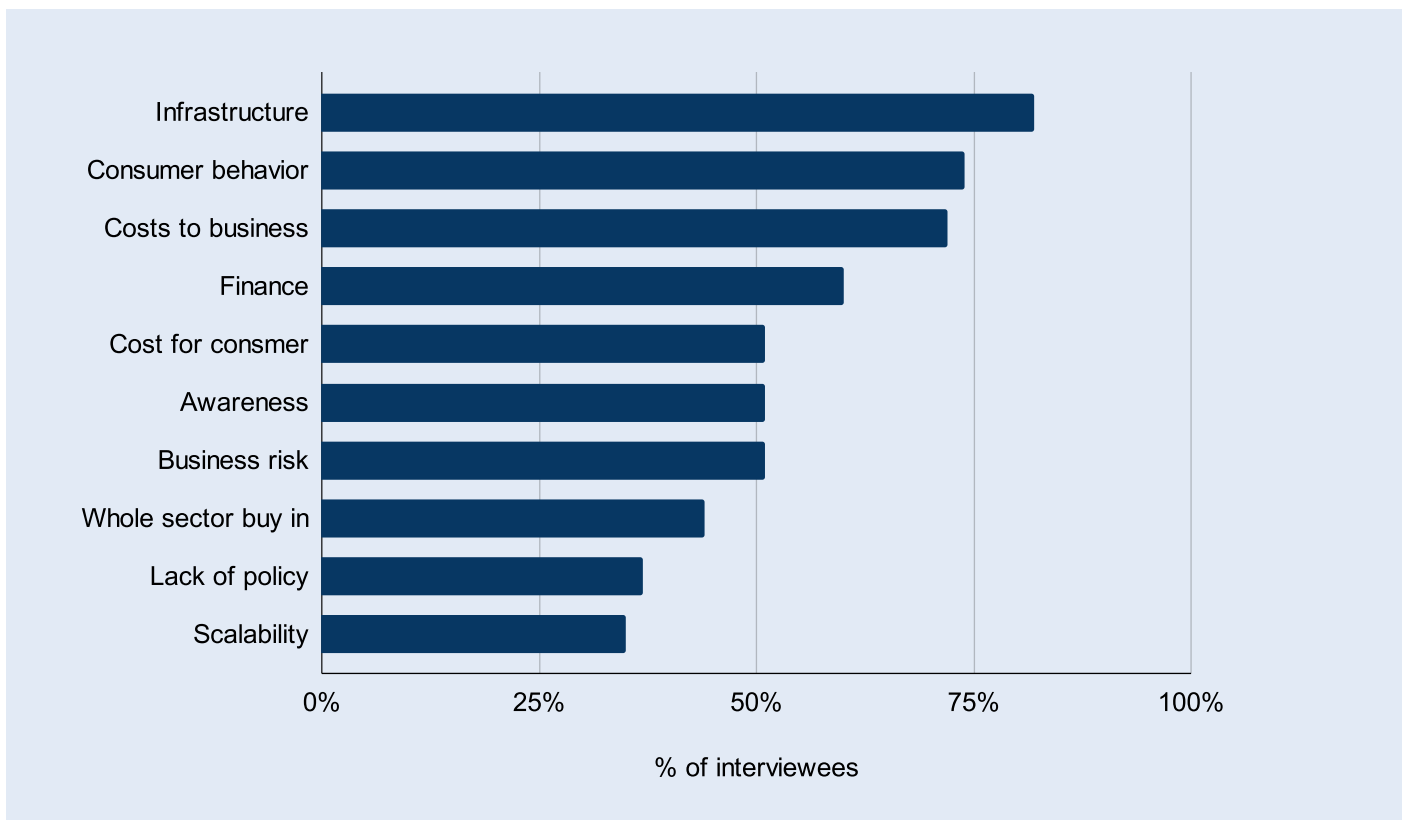


Figure 7. The key barriers for reuse systems identified in the interviews, showing the distribution from all respondents (n=55).

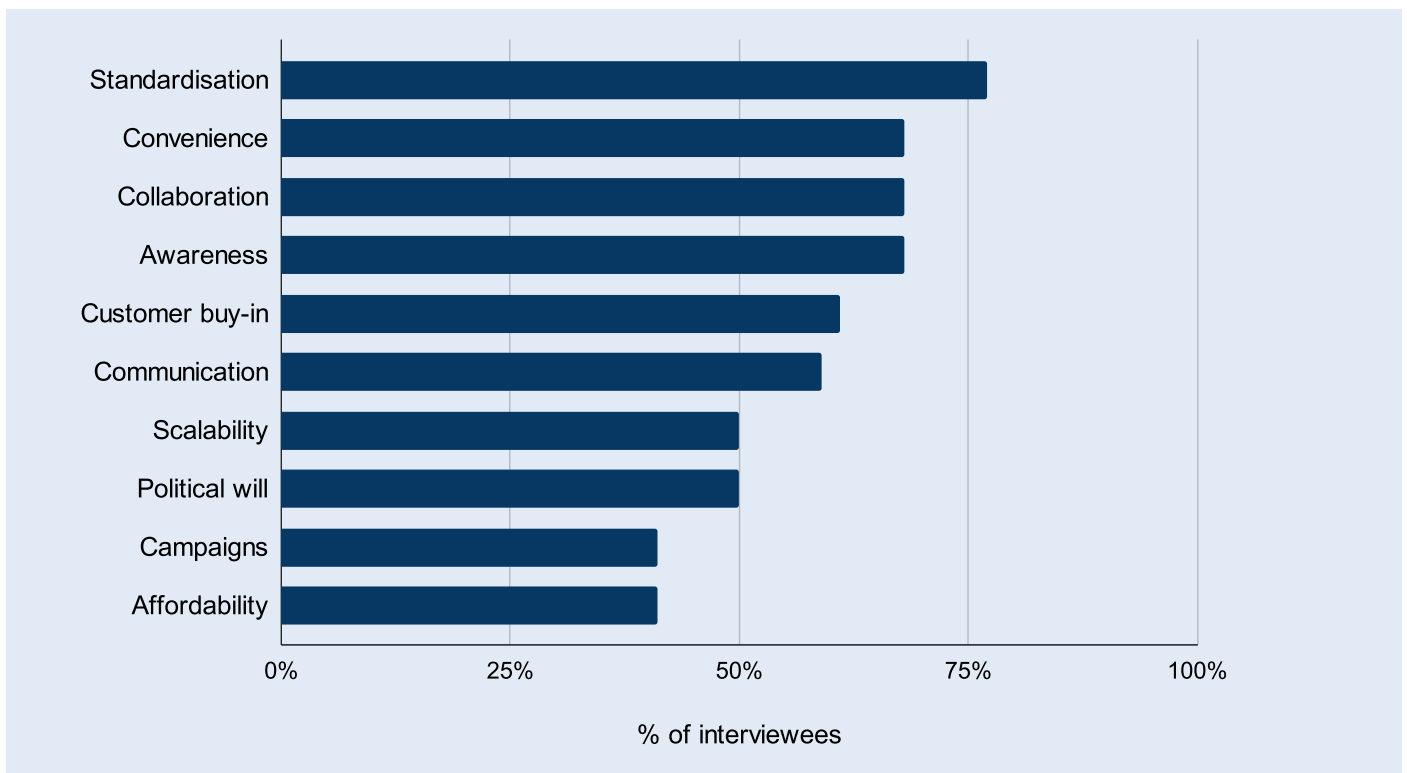


Figure 8. The key enablers for reuse systems identified in the interviews, showing the distribution from all respondents (n=55).

## 4.2 Multinational companies as enablers of reuse systems

The interviews provided the opportunity for discussion around current supply chains in different countries and the role of multinational companies. The interviews highlighted considerable similarities in shopping methods, product producers and the products on offer, demonstrating the far-reaching and complex supply networks within which multinational companies operate. While multinational companies have contributed to significant plastic pollution and greenwashing, they are potentially central to facilitating the coordination and implementation of regional and global reuse system infrastructure and logistics for international supply chains. Nonetheless, continued greenwashing remains a major barrier to the implementation of reuse systems, diverting time, money, and resources to false solutions requiring less infrastructure change. In addition, misleading ‘greenwashed’ messaging can create consumer confusion, disengagement, and habits that are not sustainable. While there have been some reintroductions of reuse systems by soda and water producers, these only tend to be the reimplementing of abandoned reuse systems that were previously replaced by single-use plastic bottles. Overall, interviewees emphasised the role that multinational companies must play for reuse systems to become the norm, establishing new forms of supply chain management and systems, and enabling access to larger reuse systems for smaller companies.

The interviews also illustrated that multinational companies have the ability to supply products into rural locations, developing economies, and remote island nations. Interviewees revealed that supply chain context is less important than expected, with remote populations and difficult-to-reach locations; used as an excuse not to roll out reuse systems everywhere. The supply chains which are already in place could function in reverse to support reuse systems, and claims otherwise should be countered by examining the capability of the global supply networks in these areas. Ultimately, the position, power, and finances of global companies make them well-placed to develop the system changes required to transition to reuse systems at scale by developing the digital standards, distribution networks, and standardisation required, while benefiting from the establishment of a globally consistent structure. Furthermore, major e-commerce suppliers are also well situated to develop reuse system pathways with convenient return systems for consumers by using existing delivery networks and backhauling. The development of reuse systems by these large suppliers could provide infrastructure and logistics for smaller companies to engage with.





Image © Muuse

## 4.3 Key findings

Some key aspects of reuse systems were mentioned frequently in the interviews and are explored in more detail.

### Standardisation

Standardisation of packaging, software, tracking, and labelling was mentioned as a key enabler by 77% of the interviewees. Moreover, global or as a minimum national system interoperability was felt to be a significant element of reuse as a new norm. Standardisation is not a new concept, having existed for decades in business-to-business packaging such as crates, pallets, and shipping containers<sup>37</sup>. Other areas of packaging standardisation are present throughout the food and drink industry in the form of cans, bottles, and clam shells of standardised shapes, sizes, and designs. The economy of scale has driven uniformity and is likely to spur standardisation of reusable packaging. **Interviewees asserted that system-specific standardisation is a vital part of a systems-based application of reuse**, enabling multiple companies to engage with one system in a pooled hub approach.

An ideal reuse system has standardisation at its core

An ideal reuse system has standardisation at its core. To achieve an economically viable system and reduce friction for consumers, there needs to be a sufficient number of collaborating businesses engaged in a standardised system to create cost effective packaging and operations whilst providing consumers with frequent convenient return points. Similarly, pooling and third-party provision through hub and spoke logistics systems require high levels of standardisation so that one hub can support multiple businesses<sup>5,38</sup>. Introducing a standardised collaborative format could potentially reduce greenhouse gas emissions by up to 80%, reducing carbon emissions by 9.5 to 15 gigatons by 2050, which is 2% of the global climate budget<sup>110</sup>. In addition, standardisation reduces risks for businesses and sets out a clear pathway for the provision of scalable

reuse systems while allowing innovation and certainty for investors and a clear framework of operation for the foreseeable future. Nonetheless, brand differentiation can still occur through labelling and colour, providing marketing opportunities within set guidelines that align with pooling infrastructure.

Global standards provide system interoperability for multinational supply chains and a framework within which national policy can be administered. There is a window of opportunity for this level of standardisation, as reuse systems are beginning to develop in small niche ways which prevents global integration and expansion<sup>24</sup>. A standardised system allows the development and evolution of the reuse ecosystem as a whole instead of siloed operations which are unable to connect and evolve. Whilst standards need to be stringent enough to align the entire system, they should allow for development and

innovation. Moreover, global standards for a reuse logo (Figure 9) and international labelling standards increase confidence and engagement with the system, and avoid trade barriers developing.

The level of standardisation required in each system area will vary. For example, venues, being a fully closed system, may not require standardisation. However, there is an urgent need to set standards for the takeaway, and food/beverages on-the-go as these are high turnover areas creating large volumes of single-use packaging waste and littering, but these sectors require high levels of harmonisation to function cost effectively and provide acceptable levels of consumer convenience<sup>10</sup>. The introduction of standardised reusable delivery packaging for the e-commerce sector could create an area for early implementation of reuse systems through the adaptation of current return systems and backhauling.



Figure 9. Example of a proposed reuse logo design by PR3<sup>111</sup>

## Insights on consumer behaviour and transitioning to a reuse system

According to interviewees, changing consumer behaviour is one of the most challenging aspects of transitioning to a reuse system, as new habit formation is required. When developing any type of reuse system, it is important to remember that people buy products for physical, emotional, financial, and lifestyle-related reasons. Therefore, to provide a system that is accepted and engaged with, there must be a combination of functionality, convenience, cost, variety, and desirability. Moreover, sustainability is low on the list of reasons for purchasing. The development of supermarket-style shopping, e-commerce and reuse of shopping bags demonstrate that over time, consumers can adapt to new systems<sup>112</sup>. Furthermore, the introduction of any reuse system must be with minimum change for the consumer and changes should occur behind the scenes, creating minimal disruption in consumers' busy lives. Fundamentally, implementation should be context appropriate to align with consumer's lives and take into account the local community through active stakeholder engagement.

Plastic producers, manufacturers, and product producers are responsible for the exponential generation of plastic pollution whilst consumers are faced with a lack of

choice of packaging types when purchasing products, but are blamed for the waste and litter generated. In low-income locations, repair and reprocessing materials are often already part of the culture, but this kind of activity can be heavily influenced by company advertising which promotes unnecessary plastic packaging and sachet style purchasing. Nevertheless, within some societies, spiritual and cultural aspects, such as the giving of water, could make the transition to reuse systems more straightforward. In areas with limited waste collection, the effects of single-use plastic pollution can be seen everywhere, and persuading these communities to change to a different system is likely to be well-accepted.

The promotion of recycling as a sustainable solution to consumers was mentioned frequently in the interviews. Some interviewees commented that once a consumer has placed an item in recycling, their conscience is put at ease. In addition, more effort is required for reuse than recycling making the transition to reusable packaging more difficult to achieve if recycling continues to be heavily promoted as a sustainable option. Combating these assumptions will require education, awareness, and clear communication to facilitate the transition to

reuse systems as the new sustainable norm,<sup>113</sup> and to allay consumer concerns such as those relating to hygiene, motivation, cost, and convenience. Successful consumer engagement strategies can include social media, news outlets, schools, and local communities networks. Furthermore, other essential aspects for the promotion of reuse systems include a clear in-store presence with well-trained staff, conspicuous and informative labelling, messaging that provides reuse system instructions and the environmental benefits of engagement.<sup>100,114</sup> The importance of communication and signage was emphasised by interviewees, who also mentioned that consumers are unlikely to engage with something new if they feel overwhelmed or confused by the process.

## Transportation and logistics

During the interview process, it was found that the location context for logistics was less significant than expected. The responses showed that the supply, shopping methods, and influence of multinational companies were similar globally. Multinational supply chains operate in most locations, providing the means for reuse systems to function through existing reverse logistics. Initially, there may be a rural/urban divide, but as reuse expands into more systems, reuse fulfilment hubs could form through community cooperatives even in rural locations. Some locations, such as island nations, could engage with local suppliers to enhance the local economy and reduce reuse system transportation distances. Interviewees discussed the increased emissions from transportation due to the reverse logistics required for reuse systems and proposed options for reducing these emissions by using electric vehicles, backhauling, and centralised collaborative hub-and-spoke systems. In addition, the logistics systems should ideally collect data at all points along the reuse loop, and the concept of a digital passport for each reusable packaging item was suggested.

Interviewees mentioned using third-party logistics, noting advantages such as scalability, collaboration, and reduced infrastructure and packaging costs for individual companies. In addition, pooling of packaging provides flexibility and can manage changes in demand more efficiently. Collaboration is important in this area, as developing reuse system logistics requires knowledge sharing across many stakeholders who are currently operating in silos with little understanding of processes outside their area of responsibility.

The importance of cost for consumers and the need for clear pricing was mentioned by 51% of interviewees as price is a major driver when choosing products. The benefits of app based systems were mentioned for tracking and recording returns and offering incentives. However, apps were also mentioned as a barrier in some contexts and for some age groups, but the importance of incentives and achieving at least a 90% return rate was highlighted by respondents. Ultimately, if reuse systems start to become the widespread norm, there would be some level of social pressure to engage with the systems.<sup>92,115</sup> Moreover, creating product and system attachment along with desirability was also perceived by interviewees as vital for engagement with reusable packaging as a whole.

Public-private partnerships can help finance infrastructure and some interviewees operated within systems where subnational governments were involved. Interviewees discussed the benefits subnational government involvement provides beyond just funding, such as a sense of authority to the system and the importance of setting the intention. Furthermore, joint involvement can also help establish knowledge hubs and provide the future scoping required to develop reuse ecosystem frameworks, allowing coordinated reuse systems which can evolve over time. A cross-value chain, collaborative approach is essential as scaled reuse systems are likely to develop as co-packing, provided by third-party logistics companies. Different reuse systems have enough similarities to operate through centralised reuse hubs which could be developed as community cooperative ventures. In addition, software platforms for reuse systems should be established so that all sectors can operate within these shared platforms, and multiple companies can use the same facility. Currently, reusable packaging is being introduced in a piecemeal manner with little coordination between businesses, making reuse systems difficult to scale to an economically viable size. Moreover, 'City island' solutions are emerging, where standardisation is evolving in a citywide manner, but with little alignment with nearby developments. The formation of global and national frameworks is necessary to avoid a segregated approach.

The importance of tracking and traceability of the packaging was mentioned by 32% of interviewees, as reusable packaging data and consumer activity data

were considered vital. Data collection can be linked to an app and a tracking system that can be accessed by both businesses and consumers. The tracking systems used by businesses who were assessed during the research, used Radio Frequency Identification Device tags (RFID), barcodes, QR codes, or Near Field Communication chips (NFC). Tracking provides the opportunity to send consumers offers or reminders to return packaging and a passport of reusable packaging cycles information. The data collected should include return rates, repeat customers, and the actual number of reuse cycles before the removal of the package from circulation, as these are the measures of the system's success. Additionally, data should also be recorded on the number of packaging items in the reuse system, the number sent for recycling at end-of-life, the time for the reusable packaging to complete a system lifecycle and the time the packaging is not in use. The information collected provides a picture of reusable packaging movement in the system and informs pool management. Furthermore, breakage and loss rates assess the durability of the packaging and whether the material is the best choice, but also include consumers keeping packaging that is too desirable.

The most commonly used tagging methods were QR codes and RFID tags. QR codes have the advantage of being low cost, have a very low environmental footprint, can be printed or etched with laser, do not interfere with recycling, and can provide access to websites and product/ system information. Their disadvantages are the requirement for consumers to have mobile phones with cameras or must be individually scanned with a reader or by staff, potentially increasing staffing levels and expense. QR codes must be scanned separately, which is time consuming and could cause consumer disengagement and errors in the scanning process.<sup>116</sup>

RFID tags have the ability to record their location, have memory capabilities, can be used for inventory control, automated sorting and the return is automatically recorded when a reusable packaging item is returned to a smart bin (a bin containing an RFID reader), leading to automatic deposit return or application of incentives.<sup>117,118</sup> Returning packaging in bulk, such as multiple bottles, takeaway containers, grocery, FMCG packaging requires fast recording of the return, and RFID has the capability to scan multiple items at the same time. For instance, smart bins at events would allow consumers to drop off cups as they leave without delays at the exit. Critically, minimal disruption for consumers is essential to maintain engagement with the system. RFID can

provide traceability, tracking through washing and sorting facilities and supply data for health and safety monitoring.

In addition, RFID tags can reduce food waste by enabling monitoring and tracking of individual packaging and can enhance recycling by providing identification of the materials within a product along with automated separation.<sup>116</sup> RFID readers on bins at supermarkets or other drop off points would be beneficial over QR codes, enabling multiple packaging items added in bulk to be recorded, making return quick and error free. Furthermore, the RFID device can also signal when the bulk deposit location requires emptying, enhancing collection efficiency. Research has shown that RFID tags reduced CO2 emissions by 3.2 % when introduced into Walmart, due to well informed logistics supply chains, traceability and inventory management, resulting in fewer trips by distribution trucks.<sup>119</sup> Overall, RFID has the potential to be one of the methods for addressing climate change, improving energy efficiency and controlling waste.<sup>120</sup>

RFID disadvantages are associated with the tag cost and the difficulty with recycling. The tag is made of multiple materials: copper, aluminium and silver compounds, silicon and adhesives and plastics which could potentially leach chemicals during washing or contaminate recycling. Therefore, removable tags are required to avoid downgrading recycle. In addition, the environmental impacts of silicon chips during the production stage are significant due to pollution, water and energy use, but the reuse of tags as part of the reuse systems where the item is used multiple times, reduces these impacts due to lower production requirements. If RFID tags were added to single-use packaging, the number of tags required would be approximately 2 trillion per year and most would end up in landfill despite having a life of around 5 years. In comparison, reuse of these tags when part of reuse systems reduces impacts significantly and the tag provides the large amounts of data required to implement efficient reverse logistics, optimal route planning and automated sorting.<sup>121,116,122</sup> Concerns such as the leaching of silver particles from RFID tags if they are not encapsulated is less likely to be a factor for reuse as the tags would have to be encapsulated in PET to provide durability for the washing process.<sup>123</sup> Further research into the level of leaching of particles from encapsulated tags would be beneficial as part of assessing the overall environmental impact of reuse systems.



The return system is a critical engagement point for consumers and the convenience of returning items is directly related to the overall success of the reuse system. Interviewees emphasised the need for easily accessible drop-off points that are relevant to where End-of-Use occurs. The system should acknowledge the return, which can be efficiently done through code or tag readers or by staff. Notably, many of the businesses interviewed had switched to a fee-based rental system, with a rolling payment per day to encourage speedy returns until the item cost is fully recovered. The return points should be clearly identifiable with a reuse logo and instructions and should be located in highly accessible areas. In addition,

hygiene and security are also essential at collection points, as reusable packaging items have intrinsic value. The importance of pooling and centralising hub provision was a recurring theme in the interviews, with the ideal of a single hub for multiple businesses and sectors operating with standardised packaging, mentioned by many. The hub based approach enables the development of cost efficient, low emission reuse systems using shared logistics, back hauling and centralised cleaning<sup>124,38</sup>. Moreover, products could remain bulk and concentrated for longer, being packaged at local reuse hubs consequently reducing the volume for transportation throughout the supply chain<sup>124</sup>.

### Stakeholders involved in reuse systems:

<sup>35,125,43,101,62,38</sup>

- Material suppliers, producers, retailers, businesses staff
- Reusable packaging companies
- Informal waste reclaimers
- Logistics providers, washing companies
- Consumers
- Local authorities



Image © Glassia

## Hub and spoke system for reuse pooling

Hub and spoke reuse systems can supply single or multiple sector reuse systems. Reuse hubs may initially supply a specific sector, but are likely to evolve over time to supply multiple sectors with similar collection

systems as shown in figure 10. Logistics operators, with distribution centres for national supply, are well placed to develop reuse hub supply at a regional level while community cooperatives may operate in more local areas.

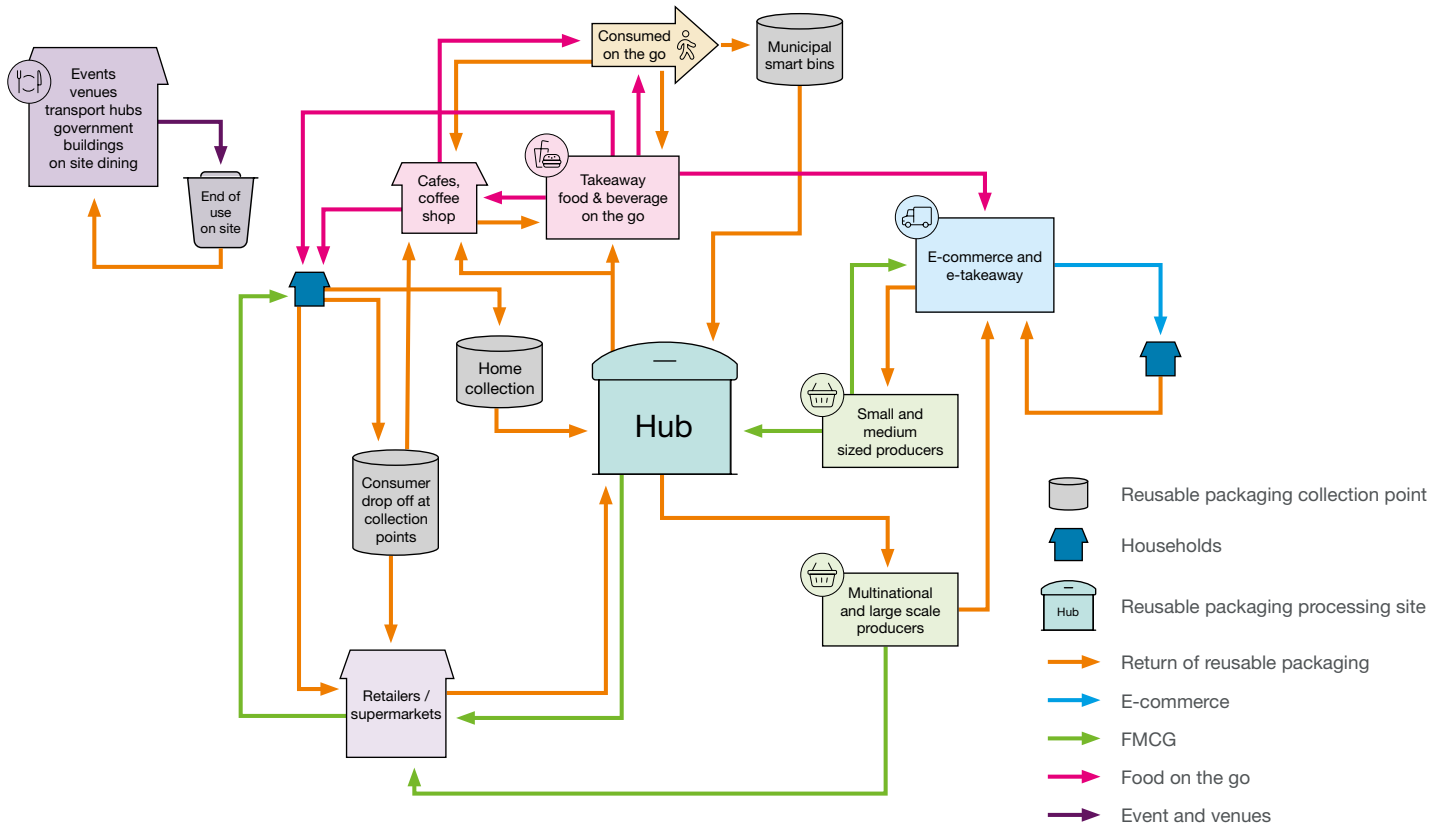


Figure 10. Diagram of the recommended hub and spoke system for reuse system pooling

## Washing systems

The washing process is vital to provide food-safe packaging and to reassure consumers that the reusable packaging item is safe for them to handle. Covid-19 saw the removal of many reuse systems as consumers rejected reusable items due to safety concerns<sup>126</sup>. Industrial washing processes have been demonstrated to be safe and within food standards regulations and adequately address the problems associated with Covid-19<sup>127</sup>. Furthermore, these standards have been applied and tested in restaurants for many decades and are suitable for application to a reuse system. Washing systems can be provided cost effectively by a third party operator who would then take on the liability aspect of this process. Third party provision of reuse systems through logistics hubs is an efficient method of providing

transportation and washing for reusable packaging as they can supply and sort for multiple establishments with a standardised packaging. When considering plastic for reusable packaging, microplastic formation from the washing process must be taken into account. Giese et al. (2021)<sup>128</sup> found that reuse of plastic bottles increased the microplastic formation from 131 microplastic particles per litre (MPP/L) with one use to 242 MPP/L with 11 uses. Another study<sup>128</sup> found an 8 fold increase in microplastics for reusable bottles indicating wear and leaching are prominent. Furthermore, microplastic release is increased by high temperature, the age of the material and mechanical stresses<sup>129</sup> and all of these are increased by reuse systems. The microplastic and toxics release from reuse washing systems requires further investigation.



Image © Huella Verde — Eco Spot's washing system for food court reusables

## Financial considerations

Money was a recurring topic in every interview and the cost implications of transitioning to a reuse system were considered to be substantial. Interviewees believed that the risks for many businesses were too high and that competing against single-use products was virtually impossible. They felt that financial incentives and a level playing field through policy, regulation, and government standards were essential to de-risk reuse systems as

a business opportunity. Furthermore, reuse systems require funding for infrastructure, capacity building, and training for job transitions in local communities. In addition, respondents required a clear vision with a coordinated, collaborative approach to attract investment and for national governments to engage in public-private partnerships as their involvement defined the foundations of the approach.

Interviewees emphasised the importance of a reuse system fully replacing single-use within a sector, as introducing reuse systems alongside single-use is fraught with problems. When providing a combined approach, consumers fail to engage, marketers see reusable packaging as a sales opportunity, and reuse as a process becomes uneconomic and unsustainable. In general, finance was mentioned as a key factor in the success of reuse systems, with 82% of interviewees reporting infrastructure and business costs as a concern. Interviewees wanted a low-cost entry for businesses and opportunities to scale. They noted that reuse systems as a sustainable option cannot run without profit or be more expensive for the consumer. In the long term, reuse systems can be economic as less material is required, but currently, the risks are too high for many companies to accept. Overall, reuse systems must be designed to create minimum disruption to business by aligning with existing supply chain systems and also cause minimal disruption and inconvenience to consumers. In addition, interviewees indicated that the delay in payback for reuse systems is a problem for business and investors. Therefore, policy needs to bring externalities into the price of single-use packaging to help reuse systems to be economically competitive, viable and cheaper in the long term.

Interviewees mentioned the business benefits of reuse systems were also gains for the regional economy as employment is provided locally, imports are reduced, and there is enhanced consumer loyalty to a brand or product. Businesses also mentioned the benefits of consumer information gathered via tracking of the packaging through apps, which can lead to improvements in the system and enhance just-in-time supply. Significantly, reuse systems can mitigate single-use supply chain shortages as seen during Covid-19, as the supply chain is localised and less affected by fluctuating oil prices, global events, and political situations.

Currently, most reuse system or reusable packaging companies, including some of those we interviewed, are start-ups, and the barriers for expansion are infrastructure, consumer engagement concerns, and restrictive policy. **The lack of an overall vision and knowledge sharing are major barriers to developing the system foundations.** Businesses interviewed indicated that venture capital investment is affected by the current lack of direction, scalability, and vision for reuse systems. **Setting out standards at a global and national level and national government investment can ameliorate the lack of a defined pathway and provide a clear framework for reuse system networks to develop.**



## Just transition and the informal waste sector



Image © James Wakibia

**A just transition leaves no one behind and benefits both society and the environment. It occurs with transparency, inclusivity, and equity for nations, individuals, and communities<sub>10</sub>.** The informal waste sector, which forms up to 2% of the global population (12.5–56 million people), can play a critical role in reuse systems and must be actively involved in a just transition to reuse systems<sub>29</sub>. The informal waste sector has knowledge and skills which are invaluable for informing the transition to reuse systems<sub>10</sub>. UNEP<sub>130</sub> found that three billion people live in cities with no solid waste management system, creating an environmental and social pollution crisis, and the informal waste sector is a fundamental part of the solution. During interviews with informal waste sector groups, the concerns and benefits of reuse systems for these groups were discussed. A just transition to reusable packaging is important in maximising the social and economic opportunities for a community and reducing the challenges and barriers faced by the key stakeholders and groups that will be directly impacted. Furthermore, a just transition to reuse systems must provide improved working conditions and training opportunities<sub>10</sub>. There will be new local employment opportunities in collection, sorting, washing, return, transportation, and logistics, but reduced employment in the collection and sorting of recyclables<sub>10</sub>. Automation is likely to develop in reuse systems processes, but manual

employment will still be present, and reuse hubs have the potential to provide new healthier opportunities in the workplace<sub>10</sub>. Training will be required for the sorting and washing system and also for collection of reusables providing gateways for upskilling<sub>10</sub>.

The informal waste sector interviews highlighted the importance of flexibility for many groups within communities, with some requiring self-employment and others wanting flexible hours for family commitments. These groups could envision the benefits of reuse systems for developing local supply chains and for providing alternative, healthier employment to waste picking, for more stable and higher-value livelihoods. The transition to reuse systems can be supported by communicating these opportunities and providing training to waste workers and others whose livelihoods are impacted. Furthermore, the informal waste worker groups had extensive knowledge of the waste and pollution issues in their communities and understood how reuse systems could be part of the solution. Nonetheless, waste workers have expressed concerns that they would be left out of the development of reuse systems. However, their wealth of information and experience makes the informal waste sector key stakeholders with a valued role in the transition to reuse systems, but the loss of carbon and plastic trading income was a factor mentioned by

some of these groups. Essentially, a just transition to reuse systems requires financial and social protection for vulnerable communities and a move away from relying on carbon and environmental offsets and carbon trading<sup>82</sup>.

In addition, some groups interviewed saw benefit in local material recovery centres run by the informal waste sector,

currently sorting items for recycling, ultimately becoming potential centres for reuse systems. The informal waste worker groups highlighted the importance of community champions, such as customers, youth groups, lifestyle influencers, public figures, and community groups, to spread awareness of reuse systems to the community.

### Essential components for a just transition to reuse systems:

- Identify and address impacts on waste workers
- Social protection for any job displacement or relocation
- Cross sector collaboration
- Training and upskilling through enterprise policy
- Sustainable public procurement
- Educational resources, awareness raising and knowledge sharing
- Accessible financial support
- Research, development and innovation
- Social dialogue

### Leave no one behind: Transparency, inclusivity and equity



Image © Huella Verde





5

# Policy options for reuse





Image © Revolution Plastics

This chapter will set out the policy options for a transition to reuse systems. Policy can be applied at a global or national level, and the importance of policy at each of these levels is discussed. The missing data transparency for virgin material extraction, production and manufacturing is highlighted. Recommendations are made for areas of early policy application and for action at a global level through the Global Plastics Treaty. At the end of the chapter, there is an endorsement of the concept of the **World Reuse Organization**<sup>131</sup> as a method of setting standards and providing a coordinated approach, along with a knowledge sharing, cooperative hub.

The use of single-use plastics continues to dominate despite the known environmental impacts of this material, meanwhile, reuse and refill systems are underutilised and not widely implemented. Evidence from the interviews indicates that policy changes are essential to facilitate the transition to reuse systems. Interviewees asserted that **targeted policies are needed to tip the economic scales in favour of reuse systems and away from single-use plastics**. Policy change is a necessity to drive change for businesses, as the status quo of single-use plastics poses a lower business risk and requires

less investment. Overall, robust legal frameworks are needed to encourage businesses to transition to reuse systems. The low prices of single-use plastic products are deceptive, with the entire cost being much higher than the purchase cost due to waste disposal, health impacts, reduced revenue from tourism and fisheries, ecosystem impacts, and clean-up costs. Thus, policy should mandate that single-use plastics account for their full economic and environmental costs at all stages of consumption, production, and end-of-life. **A transition away from single-use requires a system change driven by aligned policy at all levels.** Overall, there is an urgent need to set out a transition from a linear approach sooner rather than later, as infrastructure investment creates lock-ins to systems for twenty or more years<sup>29,76,49</sup>. **Policy focus needs to be on sustainable systems, not materials or products** through a suite of policy measures to change the economic landscape enabling a just, rapid and cost effective transition to reuse systems with an overall aim to reduce single-use production and linear consumption (figure 11)<sup>132,43,24</sup>. Suggested policy measures are virgin material production caps and taxation, landfill and incineration taxation and binding reuse system targets.



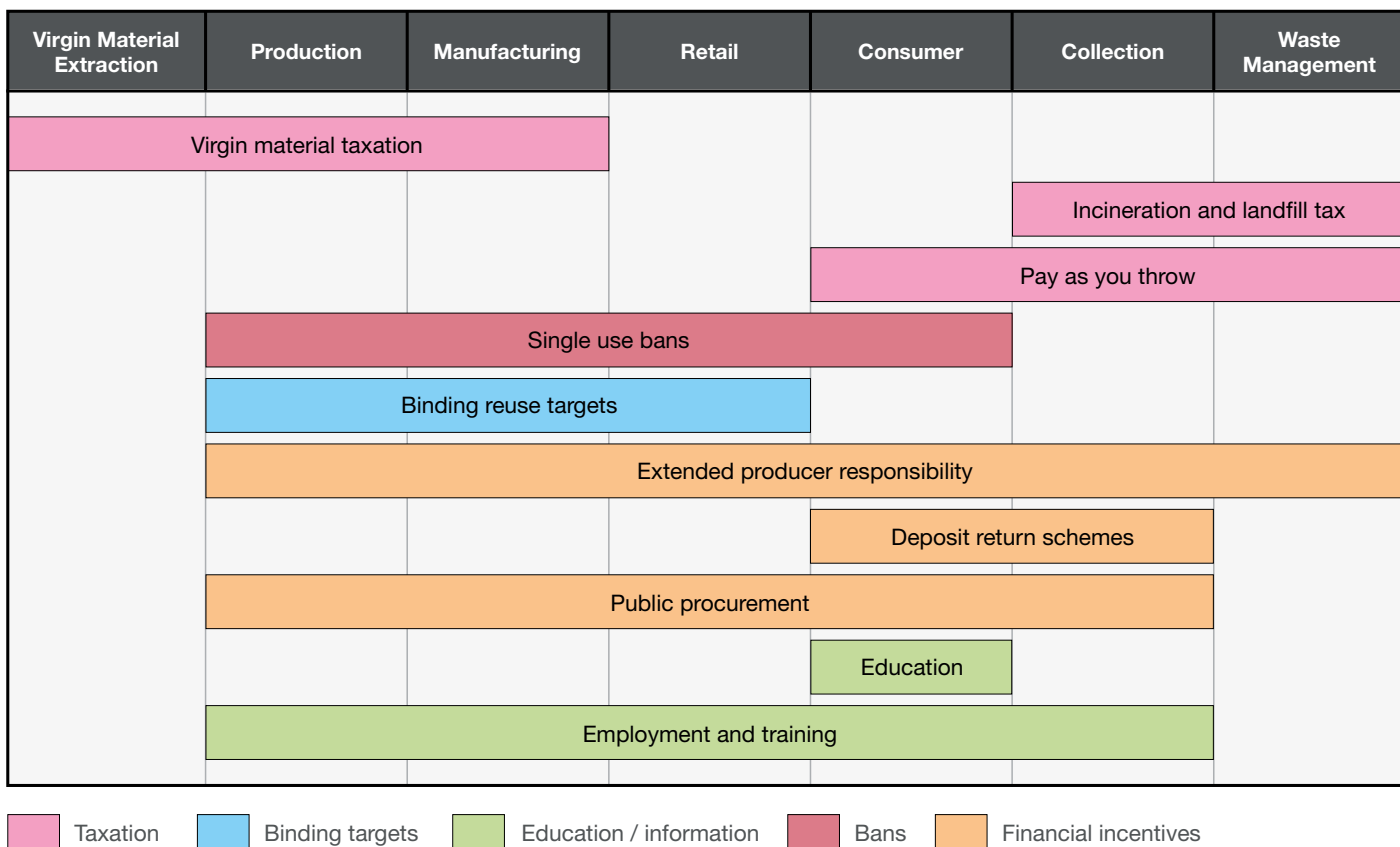


Figure 11. Policy implementation recommendations addressing the different stages of the plastics lifecycle

## 5.1 Policy options to support the transition to reuse systems

Plastic policies are most effective when they are coordinated nationally and ideally internationally, rather than implemented in a piecemeal or fragmented manner, such as isolated product bans or taxes. Individual policies are not sufficient to catalyse the scale of change needed across the entire plastics lifecycle. Overall, there is a clear need for a suite of policies that work in a concerted way, aligned with a shared goal, yet very few plastics policies meet these ideals, resulting in limited effectiveness or traceable impact. Whilst several different policies have the potential to support the transition to a reuse system economy, none can achieve this shift alone. In addition, benefits may be gained by the introduction of reuse system policies into a limited number of sectors initially to build public and private sector confidence, for example, reuse system policy could be introduced earlier to closed reuse systems such as events and eat-in dining. For instance, a report by the Rethink Plastic alliance<sup>43</sup> has recommended early policy implementation in food service, packaging including e-commerce, FMCG, and beverages.<sup>133</sup>

The global footprint of the plastics economy means that policies to transition to reuse systems must have a global component. The process to develop an international legally binding agreement to end plastic pollution, (the ‘Global Plastics Treaty’), initiated by UNEA Resolution 5.2 (5/14)<sup>134</sup>, provides a potential framework to accelerate the uptake of reuse systems at the global scale<sup>65,132</sup>. The Global Plastics Treaty should set out a structure for international policy, as plastic pollution obeys no borders, and supply chains operate through global networks<sup>7</sup>. The Global Plastics Treaty provides an opportunity to set clear definitions for reuse systems and systems requirements, data collection, standardisation, washing protocols, and packaging requirements. Reuse systems could then develop in a coordinated, connected, and scalable format on a worldwide basis, rather than the siloed, isolated approach which is starting to be seen with “city island” and business by business implementation. Operational guidelines set at a global level through the Global Plastics Treaty would guide the performance of reuse systems throughout worldwide supply chains. In this section, we examine a suite of policies, all of which can contribute to the transition to a reuse system economy.

## The Global Plastics Treaty

Interviewees saw the Global Plastics Treaty as a key opportunity to mainstream reuse systems, and recommended the following components of a reuse system to be included in the Treaty process:

- The development of globally accepted clear definitions of reuse systems and packaging prevention systems and terms used within these areas.
- System requirements<sup>7,124,136</sup>
  - Infrastructure to provide reverse logistics, washing, sorting, replenishment and redistribution
  - Minimum return rates and collection of above 90% to achieve the sustainability breakeven point
  - Durable, safe materials, avoiding toxicants and fully recyclable back to the same product at the end-of-life
  - Standardisation including open access software, packaging, data collection, labelling and a worldwide Reuse Logo
  - Ownership and responsibility boundaries including data gathering, costs due to loss from the system and return rate responsibility, particularly required for collaborative pooled provision.
  - Health, safety and hygiene standards including operation guidelines, washing protocols, packaging requirements and avoidance of chemicals of concern<sup>10</sup>
- Policy requirements
  - Reduction targets for virgin material production
  - Reuse and reduction binding targets
  - Sector specific reuse yearly percentage targets
  - Sector single-use bans with reusable packaging replacement<sup>124</sup>
  - EPR to fully cost single-use materials

## A globally agreed definition of reuse systems

Interviewees commented that a consistent definition of a reuse system applied globally is essential to drive coherent policy. The definition must ensure reuse occurs in practice and not just in theory<sup>7,133</sup>.

The transparent disclosure of data related to plastic production could also be addressed through the Global Plastics Treaty so comparable measures of single-use and reusable packaging can be made. Open source data should include:

- Greenhouse gas emissions, water use and fertiliser use for bio-based plastics
- Toxicity of plastic materials
- Microplastics production
- Recyclability including the number of closed-loop cycles possible before downgrading.
- Establishment of robust criteria for consequential life cycle analyses<sup>132,14,135</sup>

The need to share knowledge on reuse systems was a common theme amongst interviewees. To facilitate this, the proposal by PR3 for the establishment of the **World Reuse Organization**<sup>131</sup> was identified as a significant facilitator, and could take place under the umbrella of the Global Plastics Treaty. The World Reuse Organization<sup>131</sup> would create a knowledge hub and forum for non-competitive collaboration and technology transfer, bringing together governments, communities, businesses, workers and consumers.

We recommend that **reuse should be defined as a system, not a material or an item, and must provide both a stated breakeven point and a minimum number of reuses thereafter**. Without setting a numeric target for reuse, manufacturers can claim a single-use product is capable of further uses and is therefore reusable<sup>13</sup>.

## Extended producer responsibility

EPR was mentioned by 46% of interviewees as an essential policy tool to enable the transition to a reuse system as this type of policy places financial responsibility onto the producer for the environmental impacts of their production, design and end-of-life<sup>137,138</sup>. Critically, this moves responsibilities for waste from taxpayers and consumers to the producers, applying the polluter pays principle<sup>139,24</sup>. The interviewees viewed EPR as a method of fully costing single-use to create a level economic playing field for reuse systems. Eco-modulation through an EPR fee based system can provide a method of funding reuse system infrastructure during the earlier phases when requirements for funding and development of the new reuse system foundations are extensive and single-use production is still occurring<sup>126,140</sup>. In the long term, as single-use packaging options are phased out, the reuse system infrastructure is likely to be well established and the requirement for EPR is reduced<sup>24,139,38</sup>. A frequent aspect of EPR policy is the requirement for producers to take back their product at end-of-life, which has led to the development of Producer Responsibility Organisations to provide methods for companies to fulfil this requirement<sup>141</sup>. Potentially, if EPR included reuse system targets, cooperative groups and hubs could develop in a similar fashion.

The requirements of EPR policy can be defined at a global level and should include reduction targets and fee modulation for enabling reuse system development<sup>142</sup>. A linear economy can be perpetuated through EPR with recycling requirements, but if these recycling requirements are changed to reuse system targets, EPR could be one of an essential group of policies for the transition to reuse systems in the short to medium term. In addition, EPR can provide funding for reuse system infrastructure enabling

upstream solutions whilst the expensive downstream fixes become incapable of addressing the flow of waste material<sup>138,143</sup>. Notably, EPR schemes have generally not produced the packaging design changes that were expected, yet addressing design aspects through policy can affect both reusability and end-of-life impacts, with 80% of the environmental impact being determined at the design stage<sup>144,132</sup>.

Research has shown that reuse was not featured in EPR and stakeholders did not mention this as an option, meanwhile recycling was still a major focus<sup>145</sup>. The funding of reuse systems requires active eco and fee modulation and binding reuse system targets within the EPR policy to encourage reuse system funding and environmental design<sup>146</sup>. Nonetheless, ERP schemes cannot provide funding for a circular economy in the long term, at the point where little packaging does not become waste<sup>146</sup> and therefore EPR should be viewed as an early and intermediate method of funding the development of reuse system foundations and infrastructure until the transition to reuse systems is sufficient to make EPR a redundant policy. Furthermore, EPR policy is one of many aligning policies that are required to achieve a transition to reuse systems and should not be viewed as a fix all solution.

In France, recent policy introduction has mandated a 20% reduction of single-use plastic packaging by 2025 with 10% of this requirement through reuse and 2% of EPR fees will be used for the implementation of reuse systems<sup>147</sup>.

## Economic incentives and/or disincentives

In our research, 46% of interviewees considered taxation on single-use products as a priority policy to establish a fair market for reuse systems. Several economic instruments can be employed, such as virgin material taxation, taxation on single-use packaging, waste prevention taxation (including pay-as-you-throw, landfill, and incineration taxation), green procurement (including subsidies for reuse system infrastructure), tax incentives

for local employment and training, national government subsidies, and public/private partnerships for reuse system investment<sup>7,10,62,132,36,148,133</sup>. Green procurement and the involvement of national governments has been demonstrated to facilitate city-wide reuse systems, thus expanding the local reuse system economy whilst benefiting the local community<sup>109</sup>.

## Single-use plastic product bans and reduction targets

Single-use plastic product bans were mentioned by 51% of interviewees as a useful approach to reducing the leakage of specific highly polluting items into the environment and for sector conversion to reusable packaging. Restriction measures are a tested method and have eliminated or significantly reduced single-use bags in many countries through the introduction of charges or complete bans. The EU has made further progress by introducing a new Single-Use Plastics Directive focusing on banning some of the most polluting plastic items such as straws, stirrers, cutlery, and polystyrene beverage cups<sup>38,149</sup>. Nonetheless, product bans require specific reuse system targets or this type of policy can lead to the substitution of other single-use products with little reduction in pollution or greenhouse gas emissions, whilst continuing a linear flow of material<sup>7,5,60,55</sup>.

Ideally there should be complete replacement of single-use products with reuse in a system to avoid reusable packaging running alongside, merely adding to the production volume with a lack of reuse system intention by producers. In addition, prevention and reduction targets can incentivise progress towards better design, use of materials and incentivises a transition to reuse system formats. Plastic reduction targets are around 25 years behind carbon emission targets, however the knowledge gained from carbon emissions targets could be rapidly applied through the Global Plastics Treaty<sup>150</sup> as reduction targets focused on material extraction and virgin production could disrupt the linear economy creating an environment which economically favours reusable packaging.



Image © Claudio Schwarz



## Reuse system standards and design requirements

Reuse system standards create a defined framework and provide an environment for secure investment such as public/private partnerships. Over a third of interviewees mentioned the need for nationally consistent and properly enforced policies. Furthermore, standards also facilitate the development and innovation of businesses and establish a vision for where and how investment should take place in a coherent manner. A recognisable system reassures the public and removes the fear of the new, making the system commonplace and normal. Development of clear labelling and an international reuse symbol would aid in the identification of reusable packaging and highlight return points. In addition, nearly half of the interviewees mentioned the need for clear food, health and safety standards for workers, users,

and food packaging aspects such as cleanliness and toxins. Consumer protection and reassurance were considered vital. Additionally, packaging material should avoid the use of chemicals of concern, especially when in contact with food<sup>40</sup>. The Covid-19 pandemic has had an impact on reuse and refill projects, further highlighting the importance of clearly defined mandates in this area. However, refill-in-store poses additional complications, with some of the companies interviewed expressing concerns about cross-contamination, allergies, and bring-your-own container cleanliness. Clear legislation is necessary to establish responsibilities in this area, but unclear boundaries for refill-in-store could result in legal complications.

## Deposit return schemes

Deposit Return Schemes have been shown to be highly effective for PET bottle return, with average return rates of 85%, with rates in Germany up to 98%<sup>43</sup>. By 2025, it is estimated that half a billion people will live in areas with deposit return schemes, however, deposit return schemes focused solely on PET bottles for recycling continue a linear flow and may reduce incentives for reuse practices. Therefore, it is essential to extend this type of policy to the reuse system sector to avoid deposit return schemes for single-use, acting as an incentive for further development of single-use packaging. In addition, reverse vending

machines could be utilised for many reuse systems to provide the return of reusable packaging. Surprisingly, deposits were less popular with interviewees than expected, with many seeing deposits as a barrier, and only 23% of interviewees mentioning them at all. Some interviewees had moved away from deposits, developing fee-based systems instead. Incentives of some sort were considered a beneficial way of achieving the required return rates and could help to create brand loyalty through reward based inducements.

## Reuse system targets

Binding targets are useful for providing a set date for achieving a policy aims, however, caution should be exercised when introducing targets with a future date, as this can delay companies' actions, resulting in last-minute implementation. Nonetheless, this issue can be addressed by introducing phased yearly percentages. Greenpeace's 2020 report<sup>151</sup> suggests that 50% of single-use packaging could be removed by 2025, and at least 25% of the 50% reduction can be achieved by transitioning to reusable packaging. Ideally, targets should be understandable by the public and directly

reflect the change they are advocating, rather than being too abstract or opaque. Reuse system targets are only effective if combined with single-use reduction targets, otherwise the introduction of reusable packaging alongside single-use can lead to additional production and reusable packaging acting purely as an additional purchase option. Moreover, reuse system targets should be sector specific to drive rapid change such as in closed system areas such as venues, and eat-in dining which should be an area for early implementation.

## Information instruments

Transitioning to reuse systems requires consumer behaviour change and can be influenced by removing options through single-use bans, and additionally through information instruments and building capacity to act differently<sup>12</sup>. Introducing system-wide change to reusable packaging in certain sectors such as events and venues can provide sensitisation opportunities and increase population memory of reusable packaging. Information

instruments are only effective when combined with other policy tools, as consumer behaviour alone does not have the weight to drive the transition of businesses to a reuse systems economy. Interviewees mentioned the importance of staff for the promotion and instruction of reuse systems and that they are pivotal for removing fear of the new for consumers.

## Monitoring

When comparing the environmental aspects of single-use and reuse systems, there are many variables and externalities to take into account. However, there is a lack of transparency of data, especially for the extraction, production stages, and waste management of single-use, which are not adequately accounted for in costs for producers or in life cycle analyses<sup>38,49,58</sup>. The lack of transparent data creates a distorted data field and an imbalance in the true costs of single-use packaging compared to reusable packaging. The use of consequential life cycle analysis is required as often life-cycle-analysis does not adequately account for the end-of-life of single-use packaging, along with insufficient account of pollution, climate impacts and human health implications<sup>13</sup>. The lack of accounting for end-of-life aspects affects the perceived benefits of reuse systems, which would compare favourably with single-use plastics if these facets were taken into account. Furthermore, life cycle analysis also focuses on the impacts of a single product, but does not give a systemic view of implications for overall production and consumption patterns and associated impacts. The use of consequential life cycle analysis goes some way to addressing these issues, but a defined standard for this type of analysis is required.

Overall, to properly compare single-use and reuse systems, transparent baseline data is required. However, our research found that many reuse system companies do not disclose some basic information about their systems, including return and replenishment rates, instead often only quoting the theoretical use cycles. Of the reuse systems companies interviewed during the research, only 32% stated their return rate publicly (which was an

average of 71%), 19% stated their 'actual' number of reuse rotations through the system, and 45% stated the ideal number of reuse rotations of the packaging through their system. Standardised collection of data in this area is necessary to demonstrate whether the reuse system is surpassing the sustainability breakeven point, requiring the recording of actual, not ideal, reuse rotations.

The collection and reporting of consistent data is essential to avoid greenwashing and unsustainable practices<sup>152</sup>. The lack of a clear definition of reuse systems affects data collection and how this measurement takes place, making comparisons complex. Tracking and data collection were considered important by businesses interviewed, and of these businesses, 16% used RFID and 21% used QR codes. Nonetheless, data distortions are problematic for making comparisons with single-use as areas such as recycling percentages can be distorted due to plastic waste exports<sup>153</sup> and there is a lack of data for damage to ecosystems and human health from virgin material production<sup>133</sup>. To understand the best policy drivers for reuse systems, data and transparency are required to assess their effectiveness compared to single-use. However, there is currently a lack of baseline data for reuse systems. The development of legislation for reuse systems should include standardised data collection and reporting obligations, and this must be enforced to ensure transparency<sup>40</sup>. The need for enforcement of policy was mentioned by 46% of interviewees, indicating that in some areas, legislation is not effective due to a lack of compulsion. The policy recommendations identified by the interviewees for supporting a transition to reuse systems are shown in figure 12.

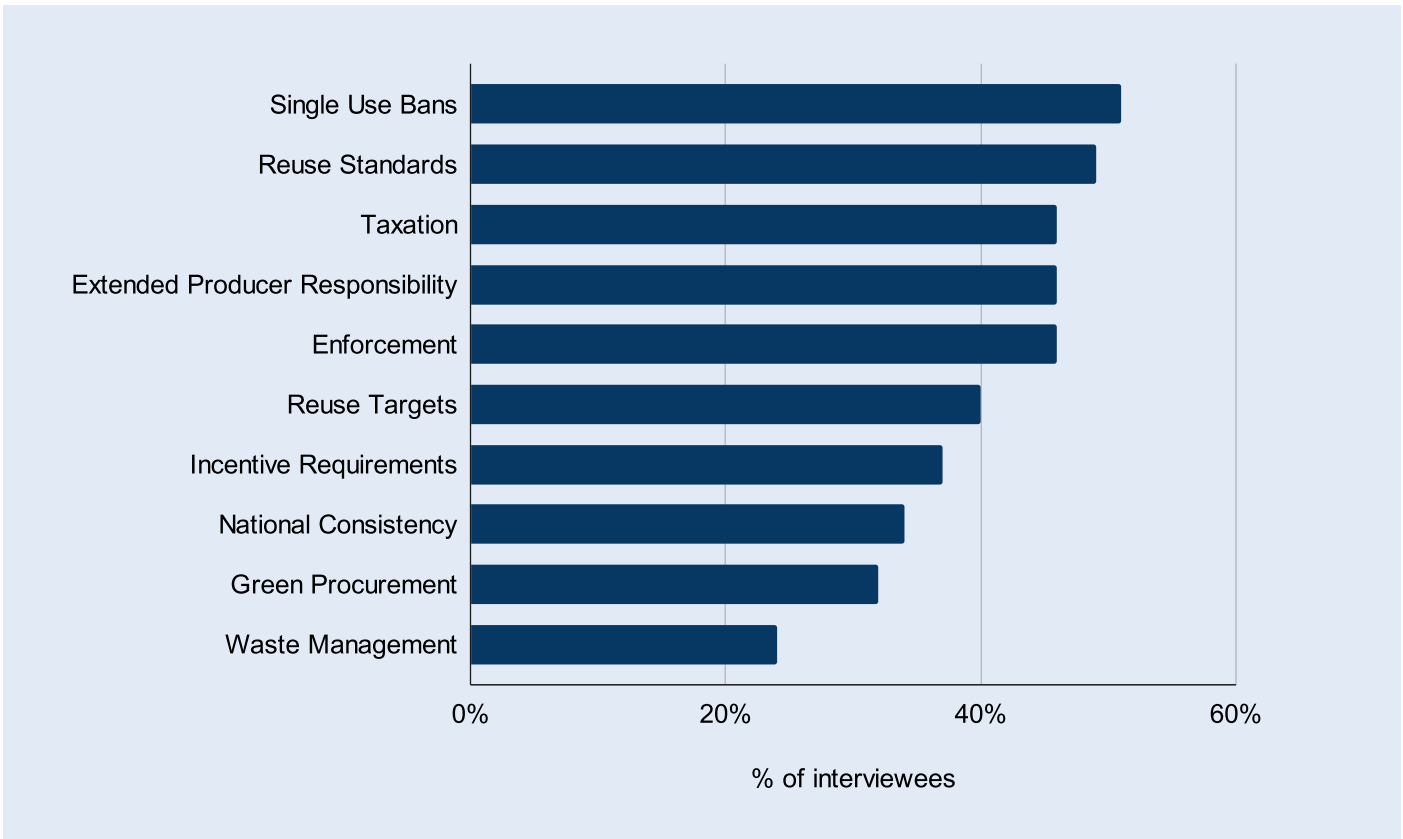


Figure 12. The policy recommendations for enabling a transition to reuse systems identified in the interviews, showing the distribution from all respondents (n= 55).



Image © Vytal — The Reuse System

# 6

# Implementation and conclusions



This chapter brings together essential elements from the background research and interviews to develop key principles and criteria for reuse systems. The transition to a reuse system is discussed and a stepwise process towards reuse systems is developed. Areas for early implementation are highlighted while acknowledging the sectors where major infrastructure changes are required will be slower to transition. The conclusions are

summarised, emphasising the importance of the system approach to reuse and the End-of-Use approach to return systems. The necessity of policy application is noted and the opportunity the Global Plastics Treaty presents for creating a new global reuse system norm is emphasised. Our vision for reuse systems is defined and the steps required to establish this vision are set out.

## 6.1 Summary of key findings

The transition to a reuse system economy is contingent on a system that is both economical and scalable while being acceptable to consumers and environmentally beneficial<sub>100</sub>. A systems approach, as outlined in Chapter 3, is critical to creating scalable solutions that operate in each sector. A one-system approach is unworkable as each sector has different distribution networks, requirements, and levels of standardisation needed. However, at present, the introduction of reusable packaging is happening in a piecemeal manner with little coordination between businesses, creating significant barriers and challenges for scaling up to an economically successful size<sub>60</sub>. Moreover, the small-scale introduction of reuse systems with no national or international standards may ultimately create a barrier to reuse system development rather than enable its implementation. To introduce a

reuse system, single-use should be entirely replaced within a sector<sub>5</sub> to avoid the production of more packaging alongside single-use. Additionally, if single-use co-exists with reusable packaging, return rates are reduced as consumers can choose single-use with no penalty if they forget to return the packaging at a collection point. Furthermore, reusable packaging is considerably more likely to become single-use in these circumstances and can become a form of greenwashing by companies who view reusable packaging as a marketing opportunity<sub>24</sub>. Therefore, the complete replacement of single-use with a reusable system within a sector is crucial to the success of the reuse systems economy.

The key findings of this research are as follows:

### The sustainability breakeven point is the key measure of a reuse system's success

For reuse packaging to be considered part of a functioning reuse system, it must be reused beyond its sustainability breakeven point. A sustainability breakeven point should be specified for all reusable items to avoid greenwashing,

with a second target for additional reuse cycles through the system, over and above the sustainability breakeven point specified.

## End-of-use system design is critical

The end-of-use point and return of a reusable item is a critical design consideration for the successful function of a reuse system for consumers. A sector-appropriate collection method and standardisation level should be determined by considering the likely and most convenient end-of-use context. The return process should aim to be similar and as convenient as the current system's recycling

collection or e-commerce product return practices. Local authority waste management and waste worker groups are likely to be essential facilitators for home or street reusable packaging collection, and e-commerce could use back hauling opportunities to reduce transportation distances.

## The consumer is the key to successful reuse systems

Consumer convenience is an essential component of effective reuse systems. Friction points should be minimal in order to maximise behavioural adoption by consumers as the normalisation of reuse systems requires a significant shift in consumer actions. Furthermore, the system must be accessible, inclusive, well-communicated, similar

to current practices, encourage population memory of reusable packaging, provide clear environmental benefits and have high hygiene standards. The price of reusable packaging for consumers should be similar to, or lower than single-use alternatives whilst offering rewards, incentives, and discounts to encourage returns.

## Location and context are not excuses for inaction

The extent of global supply chains minimises the impact of location and context on the implementation of reuse systems. However, it is still important to consider these factors as the local physical, social and infrastructure contexts are highly significant. Early involvement of all stakeholders in the development process lays the groundwork for the implementation and evolution of a context appropriate reuse system. In some areas, packaging prevention systems such as BYO refill in-store and refill at-home may be more feasible intermediate

solutions while reuse systems develop while larger conurbations and areas with more infrastructure may be better suited for early implementation of reuse systems. However, context should not be used as an excuse for inaction, as universal standardised systems can operate effectively across diverse locations and contexts<sup>125,43</sup>. Crucially, the approach to reuse system development should be flexible and adaptable, while still maintaining the necessary standardisation to ensure scalability and economic feasibility.

## Financial considerations are critical

Financial considerations were consistently mentioned as a theme in the interviews. Economic aspects included concerns about increased costs for consumers, including deposits, and the expense of infrastructure for producers and retailers. Financial risk for producers, retailers, and logistics suppliers was a major concern, despite many studies showing that reuse systems can be profitable<sup>13</sup>. Overall, the economics need to be tipped in favour of reuse systems over single-use through a suitable policy mix to provide reuse systems which are not financially exclusive for most people. Nonetheless, reuse systems need to be

financially viable, efficient, and make business sense, which may sometimes result in slightly higher costs for consumers. This was seen as a particular challenge for many refill/bulk purchase options, as they are difficult to scale, low profit, and niche yet sustainability options for consumers should not be exclusive, expensive, or unjust. Reuse systems should be available to all consumers, but the initial introduction into urban locations will inevitably be faster than rural areas due to infrastructure development and economies of scale.

## Collaboration will unlock scaling

Collaboration is an essential part of the scalable and cost-effective introduction of reuse systems. The use of standardised collaborative platforms among all stakeholders provide a simplified and economic network that would become understood by consumers. Public-private partnerships could drive collaboration, supply funding and provide gravitas to the concept while ensuring its longevity for investors. Collaboration by multinational companies could be a major driving

force for a transition to reuse systems and would allow smaller companies to adopt the systems put in place by these global producers and retailers. Furthermore, without collaboration and standardisation between software systems, consumers will be faced with multiple incompatible apps, each with different multiple methods to learn, leading to frustration and accessibility issues as already seen with parking and electric car charging apps

## Tracking and data collection has multiple benefits

Effective tracking and data collection, facilitated by QR codes, RFID tags, and other tagging technology, is essential for the successful implementation of reuse systems. This allows for monitoring of collection and return rates, fee allocation, and reuse cycles. Measuring potential reusable packaging rotation is not enough; actual reusable packaging rotation rates must be

collected and analysed to determine if the reusable packaging is reaching sustainability breakeven point and the return on investment. Furthermore, effective tracking can also support a positive consumer experience through reuse scorecards, incentives and rewards, which in turn drives brand loyalty.

## Materials matter

Reuse systems can be implemented regardless of material type, and every material has a degree of consequential environmental and human health impacts. Regulations should allow for the use of any material that is the best fit for the specific reuse system, the environment, and human health.

Failure to do so may be counterproductive to the development of some reuse systems at this stage and may slow down the implementation considerably. Further research is required to determine the best functioning and environmentally appropriate materials for each system and product.

## Centralisation supports cost-effective reuse systems

Minimisation of transportation distances can reduce greenhouse gas emissions and transport costs which are sometimes increased with reuse systems. The use of centralised sorting and cleaning services in a hub-and-spoke format, as well as the use of backhauling, can help to achieve this goal. A central actor or actors are needed to provide scale to the network in the development of a reuse ecosystem. Overall, multinational companies, whether

they are producers, retailers, e-commerce platforms, or logistics providers, are well placed to provide centralised hub services. Informal waste workers should also be actively engaged early in the development process, as they possess extensive specialist local knowledge and can help with the design and delivery of reuse systems and provide community based reuse hub provision.

## A platform for knowledge sharing about reuse systems is needed

The development of standardised, scalable reuse systems requires non-competitive collaboration and knowledge sharing. The creation of a World Reuse Organization<sup>131</sup> could bring together multinational companies, governments, and agencies to develop reuse systems in a coordinated, connected format.

Local authorities also play a significant role in establishing reuse system frameworks for development and venture capital investment. Meanwhile, the local authority benefits from cost savings from reduced waste disposal and increased local employment.

## Coherent policies are needed to support reuse systems

No single policy will catalyse the transition to reuse systems, however, a tailored policy mix, focused across the plastics life cycle is critical. Policies should particularly focus on reuse system standards alongside reducing the

attractiveness of single-use items potentially through taxation and bans. In addition, coherent international policy will prevent the development of a muddled, multi-system, uncoordinated approach.

## 6.2 Conclusions

The research emphasises that **a system approach is essential for the success of reuse**. These systems should be managed by centralised hubs that can cater to single or multiple systems. Collaboration between businesses and local authorities is crucial for enabling, supporting, and financing reuse system infrastructure, and can result in local employment opportunities and reduced waste provision. Designing end-of-use management for reusable items to facilitate return is critical and must be tailored by sector and location and social context.

**Standardisation plays a vital role in mainstreaming reuse systems**, but it can also become a barrier, as some producers are unwilling to use identical (albeit distinctively branded) packaging to their rivals. However, the level of standardisation required is often overestimated, and currently there are high levels of standardisation in retail, B2B, and other sectors to keep costs low. Smaller companies are likely to use standardised rented packaging, whilst larger companies are more likely to develop their own packaging aligning in size and shape with the infrastructure of the hub. Economic viability is crucial for reuse systems, and any development must be scalable, align with current systems, and be available to both large and small businesses, provided through regional and local hubs.

**A coherent policy mix is necessary to make reuse systems the new norm.** Policies should define reuse

systems, set standards and standardisation of the system, and provide clear targets. Financial incentives should create a level economic playing field for reuse systems, and reuse system targets should be separate from any recycling and composting targets to avoid greenwashing and false solutions. A just transition to reuse systems should be outlined in policy and involve all stakeholders, including local communities, providing flexible, fair, and safe employment and training. Standardised data collection is crucial to demonstrate sustainability, as environmental savings do not start until reuse cycles through the system reach the sustainability breakeven point. Consumers require support to understand reuse systems, and well-trained staff are best placed to provide this. Consumers should find that reuse systems create minimal disruption to their lives, with reuse systems looking similar to single-use, with system changes behind the scenes.

**Reuse systems are opportunities not risks if we are ambitious.** Our vision is for reuse systems that can generate positive environmental, social and economic outcomes for all. The pathway to reach this point is relatively clear. We need: 1) globally agreed definitions of reuse systems, standards and targets; 2) the creation of a global organisation as a knowledge exchange for reuse systems; 3) national financial incentives that favour reuse systems over linear single-use production and consumption patterns; 4) diversion of investment



from recycling and other false solutions to focus on the development and scaling of reuse systems; and 5) urgently set up reuse systems in areas which are closed systems to normalise reusable packaging. These actions can be housed within national reuse systems transition strategies which are aligned with global priorities.

We are at a unique moment in time where reuse systems development can happen with a globally coordinated approach or can grow in a haphazard, disconnected, unscalable manner. There is an urgent need for a coordinating body to provide the non-competitive

collaboration required to develop the initial framework and set out the path for reuse systems to become the new norm. The Global Plastics Treaty negotiations are a window of opportunity for creating this global vision for reuse systems, setting the standards, framework and requirements along with the creation of a collaborative reuse body. Priority should focus urgently on reducing extraction and production, through packaging prevention formats such as refill in store and refill at home and the introduction of reuse systems for all sectors and products where sustainability breakeven point can be reached within 10–15 rotations.

## Research gaps

To further support the process of transitioning to a reuse economy, several research gaps need to be filled. Firstly, there is an opportunity to explore how we can efficiently measure the environmental impact of reusable and single-use packaging, and how we can ensure that the sustainability breakeven point of reusable packaging is exceeded. Developing comprehensive reuse life cycle assessments will help to assess the implementation and monitoring of reuse systems. For example, obligatory data collection about transport emissions from reuse systems. There would be great value in examining the sustainability of centralised hubs for distribution, washing and collection. Research into lifecycle impacts will contribute to emerging research exploring the planetary boundaries in relation to production of plastic packaging, the sustainability breakeven point of reusable systems and environmental costs of transportation and other reuse system logistics.

Future studies would benefit from the greater involvement of certain sectors and groups, including e-commerce, retailers, logistical providers, local and national government, as well as community groups. These perspectives would help build a greater understanding of the logistical challenges of upscaling reuse systems. Further investigation could also be conducted on reuse systems that have involved national and subnational level coordination effectively.

A **reuse readiness assessment** would be a useful tool to develop to determine the preparedness of a sector, city, or country to begin the transition to reuse. The current research assessed operating reuse systems using a set of common criteria to identify the potential gaps, barriers, and enablers to scalable reuse systems. Based on this research, reuse systems worldwide could be further assessed for their readiness across four key categories, for example, technical feasibility, business viability, user desirability, and scalability. In addition, research to support the development of clear definitions, sector-wide standards, and data collection protocols are crucial for the development of reuse solutions<sup>100</sup>.



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## 6.3 Making reuse a reality

In this section, we outline four broad stages needed to make reuse a reality, from the first steps to establishing the conditions for reuse systems to become the new norm. The stages are derived from the evidence presented in the preceding chapters of this report. The stages represent a pathway towards the widespread adoption of reuse systems across multiple sectors. The precise ordering and speed of the transition to reuse will vary between countries and sectors, according to local conditions and priorities. The four stages are 1) Laying the foundations for reuse; 2) Growing reuse systems; 3) Acceleration and scale-up of reuse; and 4) Reuse as the new norm.

### Stage 1. Laying the foundations for reuse

The journey to reuse systems becoming the new norm starts with developing an agreed definition of a reuse system to ensure an understanding of reuse, underpin consistent monitoring, and avoid greenwashing. **Government action** is needed to reduce virgin material production and single-use packaging. The focus of many governments has, to date, been on recycling as the solution to linear production and waste. Refill and reuse systems have not been prioritised. Without government action, the dominance of single-use packaging will continue. Government commitment towards the widespread adoption of large-scale reuse systems will provide, at least in part, the assurance needed to unlock private sector investment. Therefore, a collaborative approach involving government, investors, businesses, community organisations and consumers in developing reuse systems is vital.

#### Policy

Reuse requires clear government leadership, including legislation, to have a chance of becoming the new norm. Policies to reduce the attractiveness and convenience of single-use packaging and level the economic playing field, making single-use packaging less economically attractive, are critical. Policies that can support the introduction of reuse systems include single-use packaging bans; binding reuse and return rate targets; taxation on virgin material used in packaging; the adoption of extended producer responsibility schemes to financially incentivise reusable packaging; the development of agreed definitions of key terms, including reuse and refill (packaging prevention); global standards for health and safety, the suitability of materials, and handling processes; and defined ownership and legal responsibility within reuse systems and refill (packaging prevention).

## Implementation

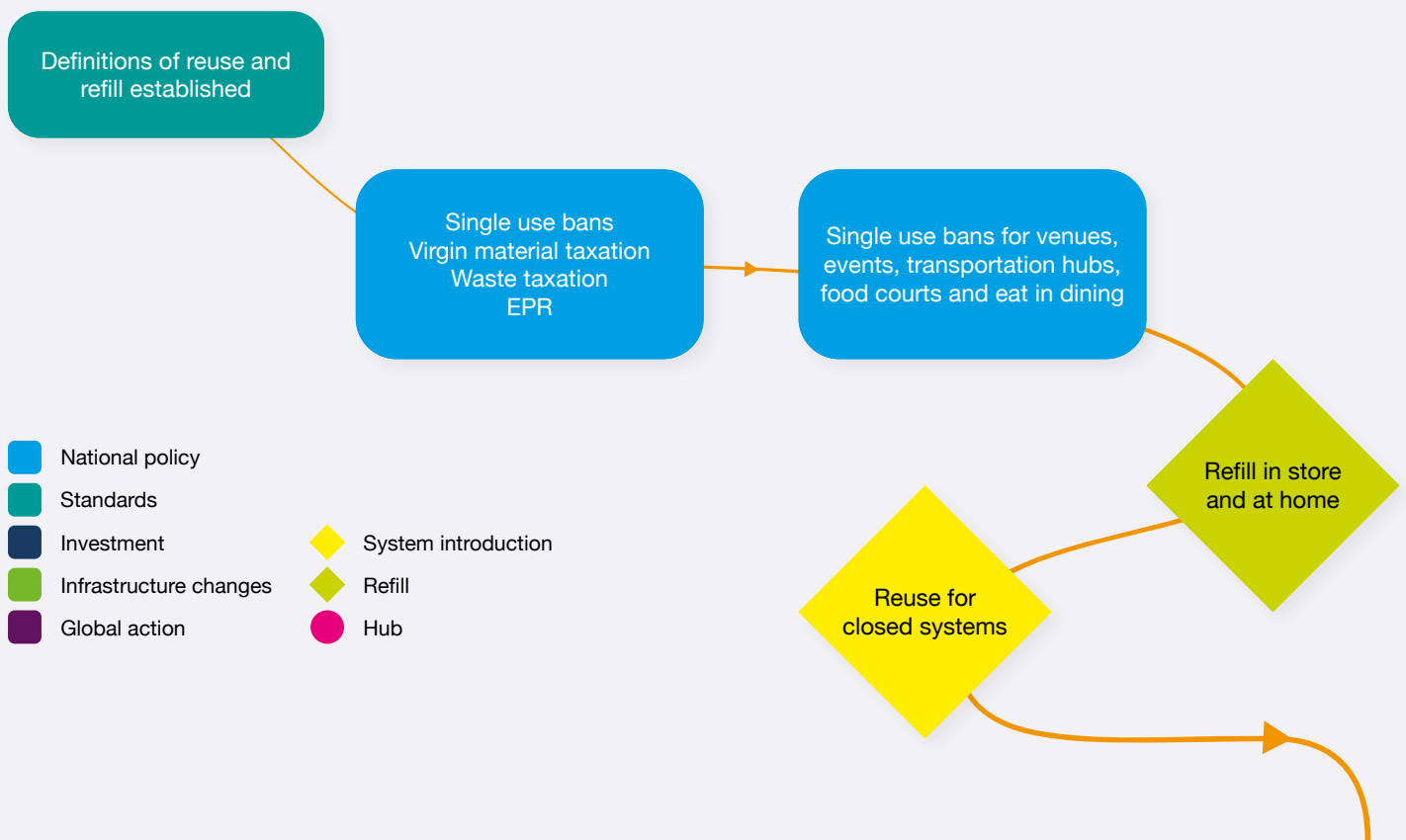
**The early introduction of reuse systems will be easiest to achieve in closed systems** such as venues, events, eat-in dining, food courts, transport hubs, museums, galleries, hospitals, schools, universities, care homes and offices. The barriers to closed reuse systems are less onerous than in other sectors as they are mainly concerned with the cost of reusable packaging and washing equipment. The significant advantage of the introduction of a reuse system in this sector is that end-of-use collection occurs where the product was bought, with no requirement for complex return systems.

## Standardisation

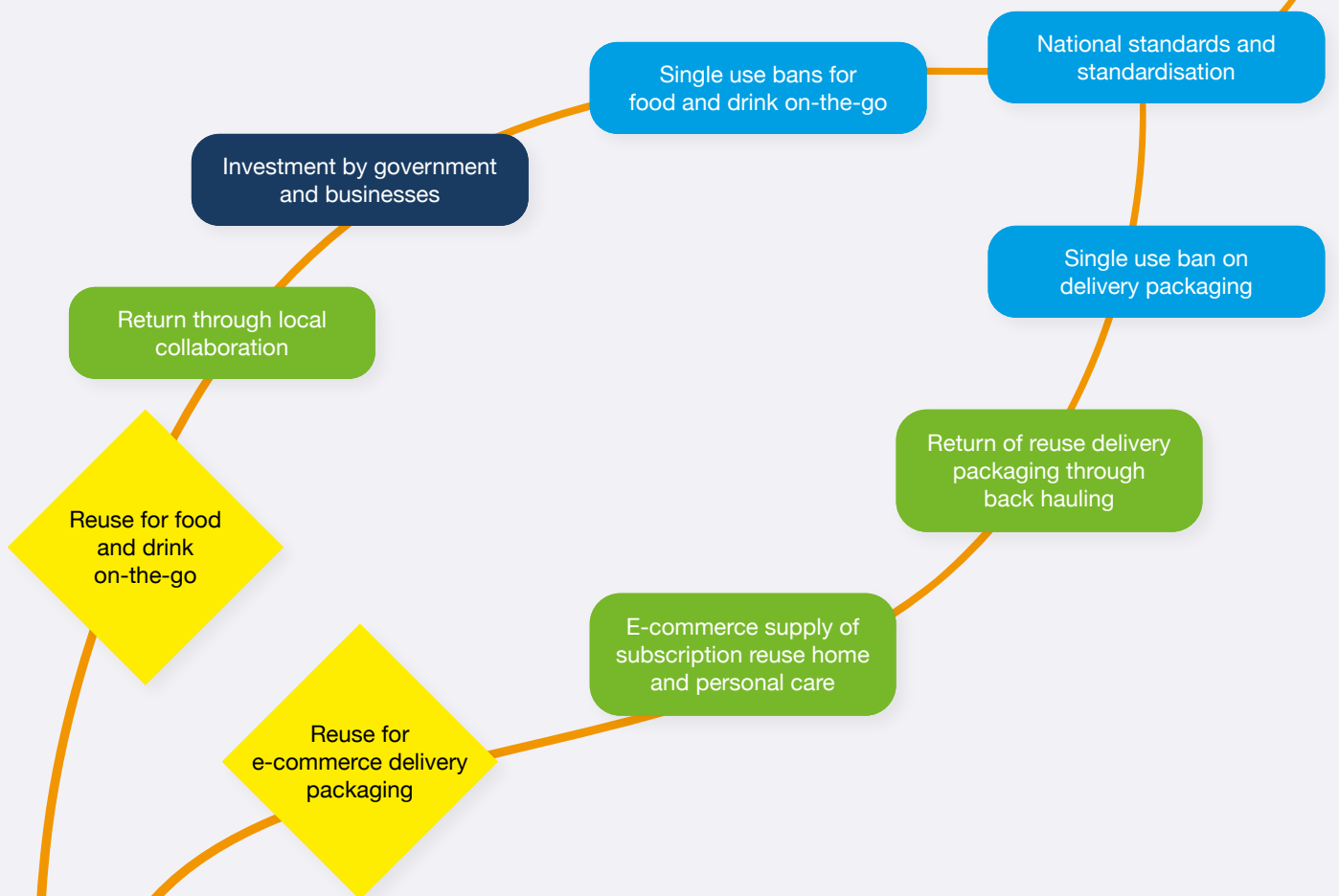
**The early development of standards will support a coordinated approach to the introduction of reuse systems.** However, introducing reusable packaging into closed systems such as events, venues and eat-in dining, should not be delayed by the introduction of reuse standards, as closed systems operate independently and therefore can be implemented easily and locally without the requirement for standardised packaging.

## Stage 1

- Early adoption of reusable packaging in closed systems provides a cost-effective method of introduction
- Reusable packaging in closed systems increases consumer acceptance of reuse systems in other sectors
- Policy to ban single-use in closed system locations removes single-use as a choice and leads to full sector change to reuse for closed systems.




## Stage 2. Growing reuse systems



**Closed system reuse paves the way for introducing reuse systems in other sectors.** The early introduction of reusable packaging in closed systems, such as venues, increases population memory and understanding of the notion of reuse systems and reduces consumer anxiety over reusable packaging and systems. **The food and drink on-the-go sector is highly suited to early implementation of reusable packaging.** Food and drink on-the-go outlets often replenish the food and drink at the point of sale and would require minimal change to infrastructure. Highly localised reuse systems, such as food and drink on-the-go and takeaways, operating collaboratively within a neighbourhood reduces product transportation costs, and can provide a route to faster implementation. However, very localised reuse systems can result in multiple compartmentalised systems in the absence of national standards. **National standardisation of packaging, tagging, software and labelling is essential to prevent siloed approaches from developing, which are likely to have limited expansion prospects and high loss rates outside the localised reuse system boundary.**

**The e-commerce sector is well suited for the early implementation of reusable delivery packaging into the system.** E-commerce occurs within a relatively closed system, with delivery packaging remaining at the delivery location. Some e-commerce companies already provide a similar service for recyclable packaging, which could be adapted to include reusable packaging. E-commerce could also provide a means to supply takeaway by ordering and return through





app-based software and subscription based reuse systems for the home and personal care sector. **A complete change to reuse systems would be ideal for food on-the-go and e-commerce delivery packaging as both sectors have a high turnover rate of single-use packaging and clear opportunities for the introduction of reuse systems.**

## Policy

**A ban on single-use packaging, for example in the food on-the-go and e-commerce delivery packaging sectors, would enable consumers to engage more easily with these reuse systems.** This approach also forces businesses to end their reliance on single-use packaging. The introduction of rules, ideally through legislation, specifying packaging ownership, washing and hygiene standards, and worker health and safety will establish a sound legal framework of ownership and safe operation. National government grants would be an enabler for smaller business start-ups in reuse systems and for a new type of business model providing third-party rental of reusable packaging and washing systems. Third-party reusable packaging and system rental could ease the transition to reuse systems for small and medium-sized businesses by providing access to reuse systems without capital outlay.

## Standardisation

**Reusable packaging standards should include the shapes and sizes of packaging, software, tagging systems, labelling and end-of-use collection arrangements.** For reuse systems such as food and drink on-the-go, the bottled beverage industry and e-commerce delivery packaging, national standardisation may be appropriate, but global standardisation would enhance international supply chain compatibility and is significant for some sectors such as FMCG. **The Global Plastics Treaty is an opportunity to define international reuse system standards.**

## Collaboration

**Reuse systems require extensive, non-competitive collaboration** to enable consumers to return packaging to any reusable packaging collection location, creating the convenience, efficiency and cost savings of a scaled approach. Collaboration through community-based reuse system cooperatives would enable the early introduction of reusable packaging for the food-on-the-go sector, as well as supporting job creation and community ownership. Further development would lead to third-party providers that could offer rentable packaging, establish collection points and sorting and washing hubs, and establish logistics networks. Collaboration will benefit businesses of all sizes, reducing entry costs, operational costs and infrastructure requirements while enhancing system convenience. The informal waste sector has extensive knowledge of waste types and waste streams, which could be used to inform and enhance the development of the collection, washing and sorting cooperatives at a community level. Their engagement in the initial stages is critical to a context-appropriate approach.



## Finance

**Developing end-of-use collection points and reusable packaging processing hubs will require considerable investment.** Public/private investment can accelerate the pace of implementation and provide a framework for reuse systems, lowering the risk for investors. Government investment can also facilitate reuse hub development, setting the foundations for the expansion of reuse systems whilst generating lower waste management costs, increased local employment, and retaining money in the local economy.

## Return system development

The collection of reusable packaging from the food and drink on-the-go sector could develop through cooperatives providing return locations. Informal waste worker groups and local community initiatives could provide complimentary collection and hub services. A key benefit of community-based approaches includes establishing multiple convenient collection points, for example in local shops, community spaces, recycling or buy-back centres in residential areas. The replenishment of food and drink on-the-go can generally occur at the location where purchased, with no need for off-site factory-based replenishment which would require infrastructure changes. E-commerce delivery packaging can be returned to a distribution centre through backhauling.

## Implementation

Food and drink on-the-go reuse systems could be introduced early on, as replenishment uses the same methods as those used for single-use packaging. In the e-commerce sector, reusable packaging rotations can occur through existing delivery and backhauling systems. The implementation of reuse systems in the food and drink on-the-go sector will be supported through the development of community-based local hubs which can retain and increase local employment and benefit the local economy. The extension of reusable packaging into other sectors will eventually require a centralised hub (an operations centre for reusable packaging collection, washing, sorting, replenishment and redistribution) approach for the expansion of cost-effective reuse systems into other sectors. Pooling reusable items in central locations builds community resilience against market shifts and extreme events, thereby creating a stable local economy. Local reuse cooperatives may be suitable at this stage to support the introduction of collaborative reuse systems, although national or international standards will be needed to avoid system incompatibility.

## Consumer actions

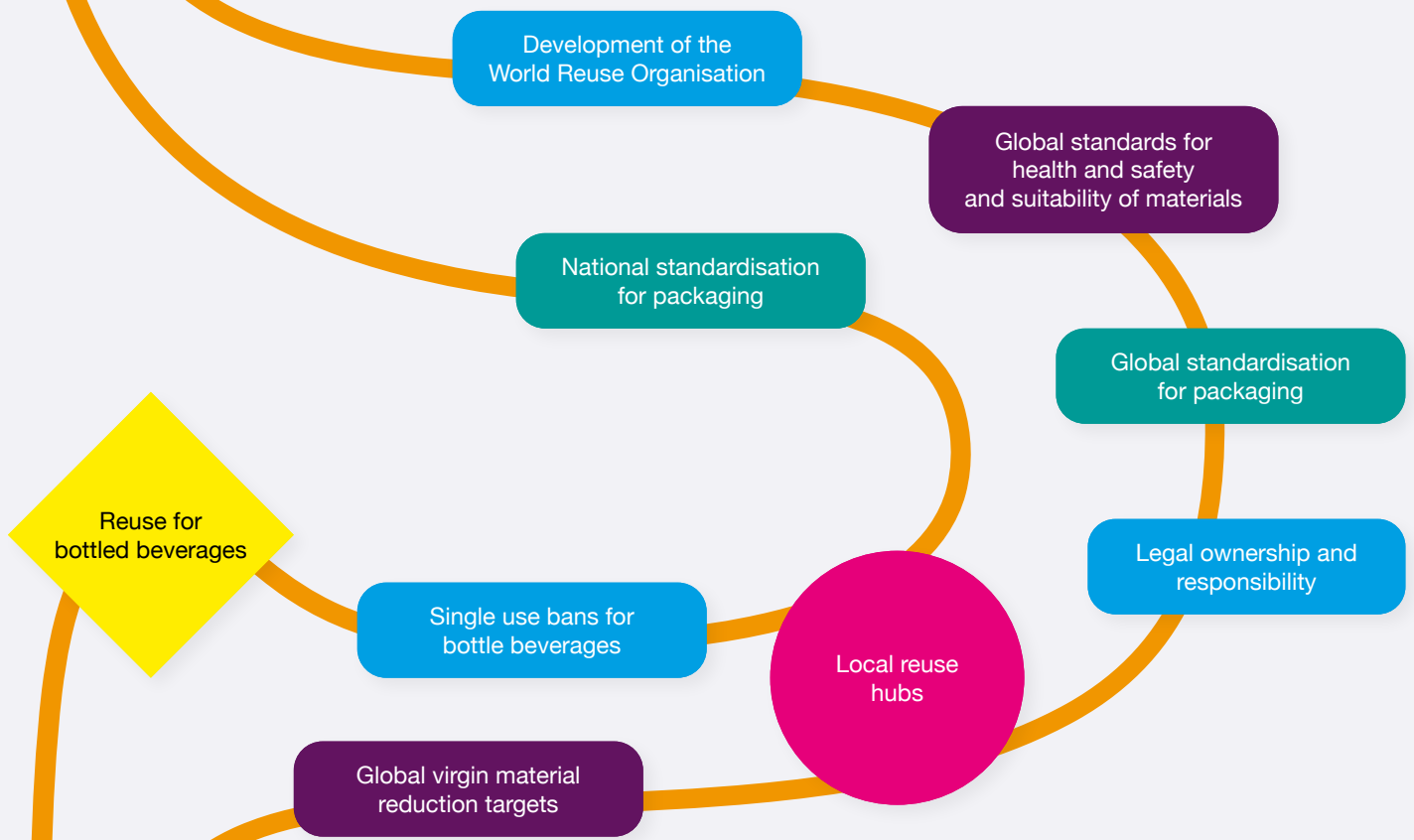
**Making the return of reusable packaging easy is critical to achieving high return rates** required to exceed the sustainability breakeven point of a reusable item. Consumers are highly influenced by convenience and value when making purchase choices. Therefore, multiple reusable packaging drop-off points are needed to provide convenience comparable to the disposal of single-use packaging. Replacing an entire sector's single-use packaging with reusable packaging removes the low-effort option of single-use packaging and requires consumers to engage with the reuse system. In addition, packaging prevention (refill) can be encouraged through economic incentives such as charges for single-use packaging or discounted refills of food and drink on-the-go when using BYO packaging such as lunch boxes and mugs.

## Stage 2

- E-commerce delivery packaging is a relatively closed system.
- The return pathway for e-commerce can be provided by backhauling.
- Takeaways and home and personal care subscription reuse models can be provided through similar online delivery and apps.
- The transition to reuse systems can be encouraged through percentage reusable packaging requirements or a complete sector shift to reusable packaging through a ban on single-use packaging for food and drink on-the-go and delivery packaging for e-commerce delivery.
- Establishing cooperatives that use standardised reusable packaging for the food and drink on-the-go sector could create a network of collection points.
- Retail staff are at the forefront of engaging and educating consumers about reuse systems.
- Population memory increases with each location introducing reusable packaging helping to embed the process of reuse as a norm.

Photo by James Wakibia

## Stage 3. Acceleration and scale up of reuse




Local hubs may now begin to develop both in rural and urban locations, in some urban locations larger reuse systems may evolve as automated facilities. Rural locations could rely more on the local population, community groups and job creation for operating the local hubs.

Business opportunities will be generated through the establishment and operation of local community and regional reuse hubs. Logistics companies will be well placed to establish, operate and service regional reuse hubs, as they have distribution networks already in place. Existing recycling facilities could provide reusable packaging sorting and washing services alongside recycling. Informal waste worker groups have extensive knowledge of waste streams within their local area and are well-placed to develop and lead the local provision of reuse systems. In many countries, waste reclaimers are the main or only providers of resource recovery. Establishing new reuse hubs provides opportunities for capacity building, secure employment, and safer working conditions. Integration and inclusion of waste reclaimers into new reuse systems will help to ensure a just transition and improved working conditions, social standing and status of these important players in global waste management.

The bottled beverage sector is similar to the FMCG sector, having extensive supply chains and multiple end-of-use points. Bottle reuse is still in the population memory in some countries, which increases consumer acceptance of new reuse systems. Reuse systems for the bottled beverage





sector can operate locally or regionally and can be replenished through bulk supply to the hub or through more local supply. For larger beverage suppliers, hubs may wash and sort before packaging is returned to the producer for replenishment. Standardisation of bottles is more straightforward than packaging for other sectors as there is a more limited range of formats.

**End-of-use is a critical moment to consider in the reusable packaging cycle.** The collection of reusable packaging can take place in multiple locations. In some contexts, local authorities are well placed to provide collection services, requiring only minor adaptations to current waste collection arrangements. For example, additional domestic bins could be provided for reusable items and collected during regular door-to-door waste collection services. Public smart bins for reusable packaging could be situated next to waste bins and recycling stations on the street. Third-party companies may also provide collection services for packaging returns. All returned reusable packaging should be scanned as part of the return mechanism, primarily to both monitor packaging rotation rates, but also to generate data to provide incentives for consumers, such as rewards through apps.

## Policy

Reuse of beverage bottles was once commonplace but has reduced significantly in recent decades due to the introduction of single-use plastic alternatives. Policies to reverse this decline and reinvigorate reuse systems in this sector could include a levy on single-use bottles or single-use bottle bans. Charges for single-use bottles could encourage both the development of reusable bottles and the expansion of refill through BYO containers. Government installation of water fountains and refill points has the potential to encourage consumers to refill, thereby avoiding single-use plastic water bottles. Compulsory refill of beverages and water by cafes, coffee shops and other providers in consumer-owned containers will increase the network of refill opportunities for consumers.

## Standardisation

Beverage bottles have many design similarities and could be standardised further with minor infrastructure changes. High levels of standardisation already exist for beer and water bottles in some countries and regions.

## Finance

Implementing reusable systems in the beverage industry would require some infrastructure modifications, although they would be less extensive than those required for the FMCG sector. Since many beverage suppliers operate at a national or multinational level, changes would primarily be required at national production sites. To facilitate the expansion of reuse systems in the beverage industry, establishing regional reuse hubs and the growth of local community hubs would be necessary. However, such expansion would demand substantial investments, green procurement practices from businesses, and support from national and subnational governments. Widespread collection services and regional hubs will not be feasible until large-scale reuse systems develop during the transition to reuse systems.



## Return system development

Bottled beverages can reach their end-of-use point in many different places, including at home, in the street, in cafes, coffee shops, events and venues. Some end-of-use collection points could operate similarly to bottle recycling banks, with consumers returning bottles to specific drop-off points. In addition, the formation of cooperative hubs could serve as centres for collecting, sorting and processing reusable packaging. To effectively manage the collection and return process, local waste management workers, including waste reclaimers, could play a vital role in collecting reusable packaging and returning it to the respective suppliers or producers. By involving waste management workers in establishing networks of cooperative hubs, the logistics of the return and sorting system can be streamlined, contributing to the successful implementation of reuse systems and minimising waste in the process.

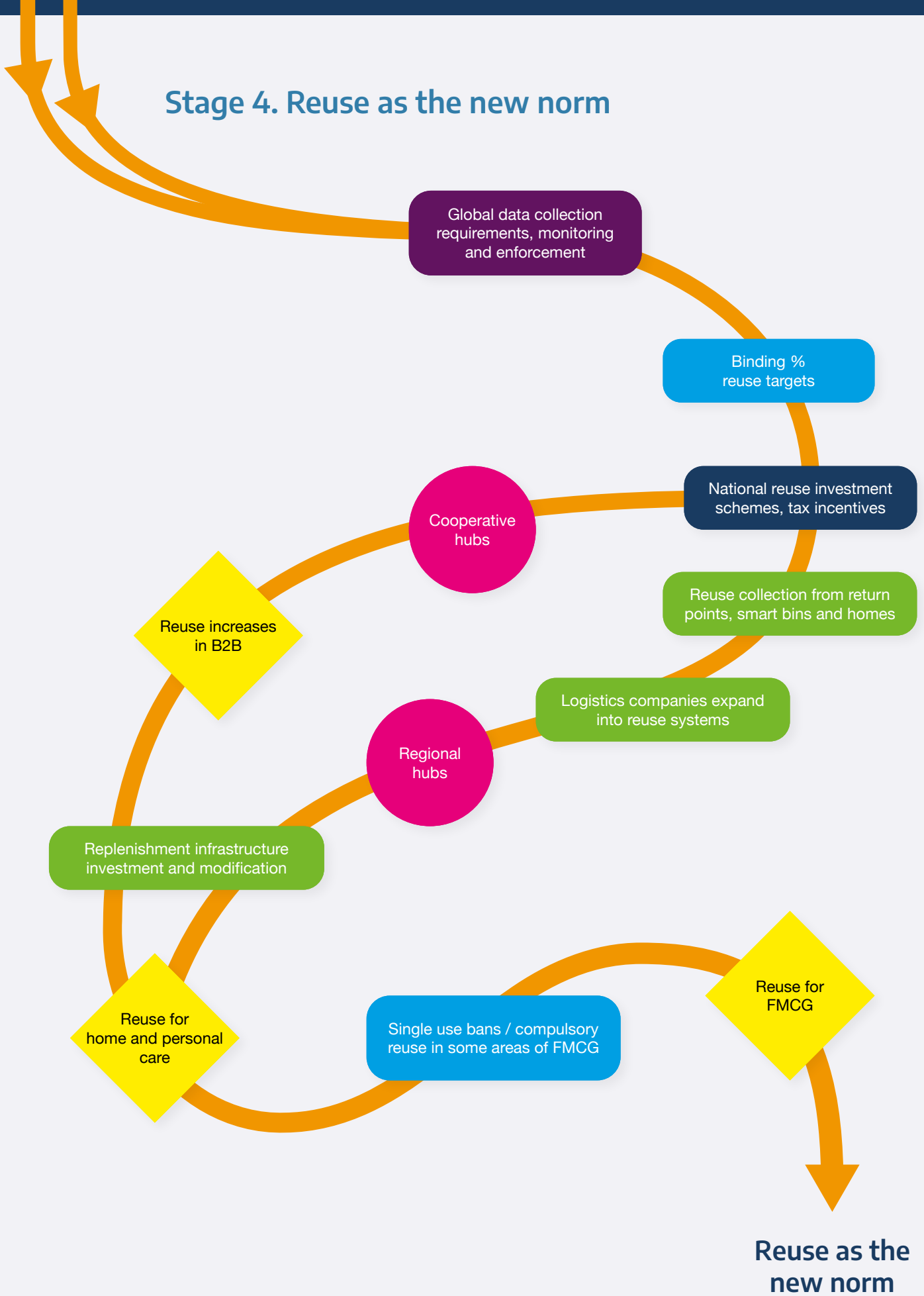
## Consumer actions

Some consumers are already familiar with bottle reuse systems or refilling bottles at drink stations. Bottle banks for recycling are common in some countries, and a change to include reusable bottle collection would require little consumer behaviour change. Consumers can be encouraged to use refill options by economic incentives, such as fees or discounts, although the impacts on vulnerable consumers will be important to mitigate.

## Stage 3

- Reuse hub development for sorting, washing, replenishment, and return to producers
- The reintroduction of reusable bottles for all beverages
- Collection points for reusable bottles introduced at recycling sites
- Deposit return schemes for bottles are already in place in some countries and could transition to reuse systems rather than recycling

## Stage 4. Reuse as the new norm



Some reuse systems, such as in the B2B and FMCG sectors, are likely to require international standardisation due to the global nature of supply chains. Collaboration between multinational companies and internationally consistent policy is therefore important for the adoption of reuse systems. While the FMCG sector is transitioning to reuse systems, packaging prevention strategies can be expanded in the short to medium term through refill at-home schemes using concentrates for some products, alongside refill in-stores using BYO packaging. Reusable packaging should align with the shapes and sizes used in the B2B sector to minimise changes to production lines and transportation. Some aspects of B2B delivery systems, such as crates for supermarkets, already exist and demonstrate how reusable systems can work in practice. Reuse systems can become the new norm for many products across all sectors and could grow to become part of everyday consumer actions.

## **Policy**

Over time, increasingly stringent legally binding reuse targets will promote the development of reuse systems in sectors where infrastructure changes are significant. Introducing reuse systems in the FMCG and B2B sectors requires significant infrastructure change, which may only be realised through legislation. However, voluntary collaboration can start to develop a vision for reuse systems in these more complicated sectors.

## **Standardisation**

International standardisation within the FMCG sector is critical to provide globally functional reuse systems. Collaboration across the B2B and FMCG supply chains is needed to establish the standardisation required across these sectors. This should include the packaging itself and the tagging and software system used to track and trace the packaging movements and return.

## **Finance**

The supply chain infrastructure is extensive in both the B2B and FMCG sectors. However, modifications would be necessary for these automated systems to accommodate standardised packaging. One potential obstacle to implementing a reuse system is the financing required for these changes. Consequently, legislation may be necessary to drive these changes, along with economic instruments and public/private investment. Green procurement and government investment can offer financial assistance for establishing reuse fulfilment hubs, while promoting innovation in this field. It may be advantageous to secure a cross-sector agreement to fully transition specific products to reusable packaging. Subsequent expansion would occur gradually, driven by the enforcement of binding reusable packaging percentage targets and public demand. Given their existing role in providing storage and distribution for producers and retailers, logistics companies are well-positioned to expand their operations into reuse hub operation.



## Return system development

Return systems for B2B packaging are integral to the existing supply chain and can leverage the backhauling logistics already in place. The introduction of pooling and international standardisation, as exists for shipping containers for example, may therefore only require small adjustments to accommodate reuse systems. Conversely, establishing a return system for FMCG packaging requires substantial infrastructure changes, which can be significantly facilitated through government support. Depending on the producers, the return process may involve local community hubs or regional hubs. It will be important to closely align the return system with the supply system to maximise the utilisation of backhauling and minimise disruptions.

## End-of-Use Return

The expansion of reusable packaging collection points will create a network of end-of-use points, increasing convenience for consumers. In some areas, collection from home could be introduced through governmental or community collection cooperatives. Reusable packaging should have an intrinsic value to incentivise its return to the system, along with tracking mechanisms provided through apps, in store, or through smart readers at return points.

## Replenishment by Producers

In a reuse system, the long-distance transportation of reusable packaging for replenishment is unlikely to be cost-effective or environmentally sound for some products, especially in the FMCG sector. Producers would potentially shift to local production or move products in bulk to reuse hubs for product replenishment. These changes will challenge current production and supply models, but over time the delivery method of the replenishment stage can be adjusted to align with specific reuse hub arrangements. Multinational companies may choose to operate within or outside local or regional hubs. Some may use washing and sorting facilities but not replenishment, and others may subcontract the entire system to a centralised hub. Some companies may adapt their current distribution networks to provide reuse systems or use logistics companies to provide this service. Collaboration between multinationals and the use of local hubs could provide shorter transportation distances reducing emissions and providing more cost-effective distribution, but multinationals may be reluctant to share sites due to competition and product control concerns.

## Consumer actions

The expansion of reuse systems in multiple sectors is likely to normalise the choice and use of reusable packaging. Consumers have embraced domestic recycling separation, which suggests that consumers want to make the right choices if given the opportunity and means. Retail staff have a key role, as they are at the forefront of building public awareness and understanding of reuse systems. Government campaigns can support public engagement and confidence in reuse systems.

## The expansion of refill

Targeted policies such as packaging reduction targets, GHG emission limits and virgin material production reductions could lead to the promotion and expansion of refill and zero waste stores. Localisation of supply can encourage a return to locally grown, seasonal shopping whereby local markets provide refillable packaging opportunities. Innovation in in-store refill dispensing could reduce product spills, abandonment and cross-contamination. In addition, legislation banning sachets could lead to their replacement with small-volume refillable packaging units, that allow consumers to purchase what they need and can afford.

### Stage 4

- B2B packaging is highly standardised in many sectors and a transition to reusable packaging has a clear pathway.
- Infrastructure changes for the transition to reuse systems in the B2B and FMCG sectors are likely to be extensive.
- Reuse system implementation will most likely be a step-by-step process for the FMCG sector and will require policy interventions to prioritise reusable packaging over single-use packaging.
- Binding reuse requirements, such as percentage reuse targets, can help catalyse a sector shift towards reuse systems.
- Consumer acceptance of reuse systems in FMCG is enhanced by reuse systems operating in other sectors.

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# Appendix 1: Definitions

**Reuse** — A system through which specifically designed packaging rotates multiple times for the same purpose and is not purchased or owned by the consumer, but is owned by the system.

**Roadmap** — A roadmap is a strategic plan that defines a goal or desired outcome and includes the steps needed to reach these targets. Roadmaps serve as a communication tool for the target audience of the involved stakeholders.

**Packaging prevention (Refill)** — Packaging which is owned by the consumer and is refilled. The areas this covers are refill in store and refill at home with concentrates.

**Sustainability break even point** — Number of cycles reusable packaging must complete to be equal to the environmental impacts of equivalent single-use packaging.

**End-of-use** — The point at which a reuse item ends the current function and is returned to the reuse system.

**Reverse logistics** — The process of moving items from their end-of-use destination back to the producer or retailers.

**Deposit return scheme (DRS)** — Refundable deposits paid by consumers and returned to the consumer on return of the packaging.

**Extended producer responsibility (EPR)** — An environmental strategy or policy to hold producer's responsible for a product at the post consumer stage of the product's lifecycle.

**Circular economy** — A system that aims to keep materials, products, packaging and their value contained within the economy for as long as possible, prolonging their life through effective durability design, reuse and recycling practices, reducing their rate of disposal, GHG emissions and pollution (EMAF).

**Back hauling** — The use of existing, empty returning transport systems.

**Closed system** — Where the packaging does not leave the site of sale.

**Open system** — Where the packaging leaves the initial purchase area.

**Life cycle assessment (LCA)** — Models used for the systematic analyses of the potential environmental impacts of systems, services or products throughout their life cycle flow, for example from their design and production (upstream), to their use/reuse (midstream) and their end-of-use/life management (downstream).

**Consequential LCAs** — Used to describe how the life cycle flows may change in response to decisions that are made, for example a type of packaging or material that is used in a system.

**Population memory** — Knowledge of an action occurring in the past, within a population

# Appendix 2: The barriers and enablers for refill

## Barriers for refill<sup>157,59,57,158,38</sup>

### System barriers

- BYO unsuitable or unclean containers
- Unintentional product mixing and cross contamination with allergens
- Cleanliness of refill station
- Lack of data of refill episodes
- Liability issues for suppliers and lack of traceability
- Refill at home often uses unrecyclable multilayer pouches

### Consumer barriers

- Remembering containers and carrying containers with limited transport
- Unclear pricing
- Fear of the new and understanding a reuse system
- Inconvenient and messy
- Access to clean water for washing containers

### Store barriers

- Storage and pest control for bulk
- Extra staffing for cleaning, refilling and instructing consumers
- Space for dispensers
- Policy banning refill of some products
- High levels of waste and abandoned product

## Enablers for refill<sup>159, 160</sup>

### System enablers

- Clearly defined refill zone
- Standardised containers which are retained as a reuse system
- Digital refill verification for data collection

### Business enablers

- Well trained staff
- Fuel pump or cost controlled delivery
- Traceability



## Consumer enablers

- Clear instructions and pricing
- Cost based dispensing
- Product information and expiry dates recorded to app

## Policy enablers

- Incentives and reduced taxation for refill
- Right to use own container for refill

Sometimes refill is included in definitions of reuse. For example, the Ellen MacArthur Foundation<sup>9</sup> has identified four models for reuse, two of which include refill:

- Refill at home in which users refill their reusable container at home
- Refill on the go in which users refill their reusable container away from home
- Return from home in which packaging is picked up from home by a collection service
- Return on the go in which users return the packaging at a store or drop-off point

## Applied examples of upscaling refill

The following list of examples presents the gradual development of the use of refill in companies from more informal system scenarios to upscaling and formalised refill systems examples.

1. **Purcell**<sup>69</sup> has developed a petrol pump style station which dispenses required volume or price linked to an App, providing automatic payment<sup>161</sup>.
2. **Algramo**<sup>123</sup> has developed a pouch based refill system that is easier for the consumer to carry<sup>162</sup>.
3. **Minimum Waste (MIWA)**<sup>159</sup> which has standardised tagged containers and an App enabling traceability, expiration date, product information, and automated delivery of product<sup>159</sup>. The system is operated by MIWA with sealed refillable containers.

QR coded pouches that only lock into specific product dispensers would prevent cross contamination or allergen transfer, for example household pouches would not be accepted by the machine for food refill and allergens could only be dispensed into specific pouches. Systems must be consumer based and engagement in these systems is motivated by lower prices, control over the amount purchased and staff engagement<sup>160</sup>. Lower pricing was a major driving force for consumers to choose a refill option. The environmental benefits of reuse were not the reason consumers chose to use refill<sup>92</sup>.

## Refill as a solution to sachet pollution

In some regions, up to 52% of plastic waste comes from sachets. In low and middle income countries, sachet purchase can provide an affordable option, but these same areas have poor or non-existent waste management infrastructure<sup>163</sup>. Sachets and other low-value plastics are not collected by waste reclaimers and instead accumulate in the environment, causing ecological damage and impact to local economies through harm to fishing and tourism industries amongst others. In the Philippines alone, approximately 164 million sachet packets are discarded daily<sup>163</sup>. Refill zero waste stores offer an alternative to sachet purchasing, allowing consumers to purchase small and affordable quantities of products without generating packaging waste. However, consumer behaviour is influenced by advertising and the desire for branded products. Multinational companies continue to promote the affordability and convenience of sachets despite their environmental impact. There is the potential to supply small quantities using volume or price based delivery systems and small refill containers.