ELLEN MACARTHUR FOUNDATION

Modelling and analysis by

SYSTEMIQ

eunomia

Unlocking a reuse revolution: **scaling returnable packaging**

Contents

In support of the study

At Amazon, we continuously work to lower the environmental impact of the packaging we use, including investing in new materials, packaging technologies, and fulfilment supply chains. We appreciate the collaboration with the Ellen McArthur Foundation in researching ways and developing frameworks to reuse packaging as a means to reduce waste across multiple packaging applications.

Zak Watts
European Director of Sustainability, Amazon

The reuse study has provided us with a comprehensive understanding of the opportunities and positive impacts on material consumption and emissions across different product categories and sectors. This is a great starting point to continue exploring solutions specific to personal care for us.

Eva Bredehorst
Manager Global Packaging Sustainability, Beiersdorf

Reuse is a complex topic with many different elements at play – and doing this across different global markets is even more complex, while aiming to reduce emissions and bring the consumer along. The modeling proposed in this report includes ambitious scenarios for returnable packaging that will require time, policy action ensuring the right enabling conditions and cross-sector collaboration to realize. Next to that, also refill models have an important role to play to increase reuse. We appreciate the Ellen MacArthur Foundation's ambition, and The Coca-Cola Company's global goal to increase reuse demonstrates our commitment to working with other companies and stakeholders to scale reuse.

Ben Jordan
Senior Director, Environmental Policy,
The Coca-Cola Company

Collaboration between retailers and manufacturers can bring the critical mass needed for systems change by offering solutions to consumers that are convenient, enable choice, and integrate well into their daily lives and shopping routines. The CGF is working to understand what we can do collectively to overcome the key challenges and support the scaling of reuse/refill models.

Cédric Dever
Director, Plastic Waste Coalition of Action,
The Consumer Goods Forum

Danone is committed to accelerating returnable models and reuse is one of the key levers to achieve our renewed sustainability ambition - Danone Impact Journey. Today, more than 50% of our global water volumes are sold in reusable format and we have more than 15 pilot projects on reuse/refill models in our portfolio. This study by the Ellen MacArthur Foundation paves the way for profitable scale-up, stressing the need for an industry-wide approach to address the challenge. We are happy to participate and share our learnings across categories and geographies.

Nicolas Gregoire
VP, Packaging Cycle, Danone

It is widely accepted that we need to reduce our consumption of natural resources to stay within planetary boundaries, but how do we do that in practice? Reuse has a key role to play, especially for short-lived products like single-use packaging. This breakthrough report shows that unlocking reuse will rely on deep collaboration, including between competitors, but that the environmental and economic benefits of getting it right are huge and attainable.

Joe Papineschi
Chairperson, Eunomia Research and Consulting

This valuable study issues a blueprint for achieving the crucial step-change from recycling to reuse, in a global economy which is now only 7% circular. Shifting towards reuse systems can increase circularity at scale, whilst at the same time creating new business options and social benefits. The financial sector has an important role to play in this transition, and the measures which are proposed herein for financial institutions are helpful in informing the way forward. We in the EIB, through our finance and advisory services, are well-placed to help realise the potential of the reuse revolution.

Ambroise Fayolle
Vice President, European Investment Bank

PepsiCo is working to increase reuse by 2030 through offerings that are easy and convenient for our consumers to enjoy. Making that happen requires a whole-system effort, including collaboration with peer companies, governments, and other stakeholders. This latest analysis from EMF shows that benefits can be realized through reuse but requires action across the full value chain. We are looking forward to working with partners to overcome current barriers to scale reuse including both refill and return models.

Anke Boykin
Senior Director, Global Environmental Policy, PepsiCo

The findings of this report address the critical obstacles for reuse which brands and retailers face, head-on. It's a real breakthrough to have proven such a compelling business case for industry collaboration and reusable packaging standardisation, and to understand exactly the conditions and applications for which the business case makes sense.

Yoni Shiran
Partner and Plastics Lead, Systemiq

Additional expert perspectives can be found quoted throughout the study

We're pleased with this publication and encouraged by the findings, along with the numerous stakeholders in the value chain who recognize the importance of scaling reuse models. We urge all business stakeholders to convert these findings into tangible actions that will bolster prefill reuse systems with urgency. As a system operator, we pledge to do whatever it takes for reuse adoption to be convenient as well as fiscally and environmentally attractive for the three most important stakeholders: consumers, manufacturers, and retailers.

Tom Szaky
Founder and CEO, TerraCycle and Loop

Turning the 'reuse revolution' ambition into a reality requires cross-industry collaboration. We're pleased to be working with the Ellen MacArthur Foundation and other industry partners to explore the economic, environmental, and experiential impacts of reuse models versus single-use. Only by better understanding these important variables can we make the case for scaling these systems all the more compelling.

Jolanda de Rooij
Senior Sustainability Manager Circular Economy, Unilever

Reuse and refill of packaging are two of the levers we need to activate if we want to reduce our CO_2 emissions by at least 80% by 2050 in order to meet the target set by the Paris Agreement in 2015. The development of reuse and refill requires major shifts in the way we produce, we consume, and we deal with packaging once the products they contain have been consumed. This study shows that we need all relevant players to collaborate in order to build, deploy, and finance the reuse and refill systems of the future. CITEO is fully committed to this objective, notably through its collaborative project: ReUse.

Valentin Fournel
Head of Eco-Design and Reuse, CITEO

Additional expert perspectives can be found quoted throughout the study

Recycling alone is not enough to combat plastic pollution and plastic soup. Worldwide, we need to focus more strongly on reusing plastic products and packaging, to reduce demand for virgin plastics and prevent environmental pollution. Let's make reuse the norm and prevent plastic pollution.

Jennefer Baarn
Netherlands, Head of Delegation to the UN treaty negotiations on plastic pollution

In a resource constrained and increasingly polluted world, reuse is the logical next step for packaging our goods. Modelling packaging systems is however notoriously complex. In this context, this new robust analysis from EMF provides yet further evidence on the environmental and economic opportunity that well designed reuse systems can deliver at scale. Now the pressure is on policymakers to create the necessary legislative conditions for reuse to thrive, and on business leaders in the fast-moving consumer goods sectors to change their practices, adopting truly circular solutions to end our addiction to single-use packaging.

Jean-Pierre Schwetizer
Circular Economy Manager,
European Environmental Bureau (EEB)

The study comes at an important time when the introduction of reuse systems is considered worldwide. It is extremely relevant as it contributes to shift the focus from the 'why' to the 'how' of effective and efficient reuse systems, particularly the application of shared infrastructure and standardization.

Tobias Bielenstein
Director Public Affairs & Sustainability, GDB

PR3 welcomes the focus on standards which are essential to ensure both environmental and economic performance. Our partners across the value chain who are currently advancing the PR3 Standards for use around the world will surely gain insights from this report.

Amy Larkin
Director, PR3

The insight and evidence presented by this new report reflects the evolving experience of Plastics Pact members around the world who have tested reusable packaging – collaboration, standardisation, and customer-centred design to maximise participation, are key to unlocking reuse at scale. WRAP welcomes the important contribution of this report to support the long-term business case for reusable packaging as we work with our UK Plastics Pact members to make the transition to delivering a full 'system change' to reusable packaging systems.

Lowelle Bryan
Sector Specialist, WRAP

'Unlocking the Reuse Revolution' is a critical body of work that provides governments and businesses with the evidence and steps needed for a ground shift from single-use to reusable packaging. Reuse lies at the heart of a circular economy and will be fundamental to solving plastic pollution while also delivering reductions in greenhouse gas emissions and water use. Now is the time for businesses and policymakers to seize the opportunity to transform our way of delivering products and unlock a future free from plastic pollution.

Sarah Baulch
Principal Associate, The Pew Charitable Trusts

Reuse has the incredible potential to transform our material systems if implemented at scale. The scenario-based modelling showcased in this report is exactly what we need to drive the uptake of this high-impact solution – highlighting the huge opportunity reuse can deliver for both business and the planet. EMF's analysis emphasises the need for industry-wide collaboration and collective action from all stakeholders in order to change the trajectory of the plastic pollution crisis. WWF is excited to build on these findings as we continue to work toward a more circular future.

Erin Simon
Vice President and Head of Plastic Waste & Business, WWF

Insights summary

A reuse revolution is critical to tackling the plastic waste and pollution crisis: this study offers insights and recommendations to design and scale returnable packaging and make that revolution a reality

Moving from single-use to reuse models presents one of the biggest opportunities to reduce plastic pollution.[1] Indeed, it is estimated that moving to reuse models can provide an over 20% reduction in total annual plastic leakage to the ocean by 2040.[2] Moreover, adopting reuse models at scale can play a critical role in not only tackling plastic pollution, but also in significantly reducing virgin material use, greenhouse gas (GHG) emissions, and water consumption. Despite concerted and ambitious industry initiatives, such as the Global Commitment,[3] the world is off track to eliminate plastic waste and pollution — with scaling reuse being identified as one of the key pivotal hurdles to overcome.[4]

Elimination of packaging is essential, where possible, and recycling efforts will still be needed, but to achieve a future where plastic never becomes waste, reuse systems need to be scaled. Over the past five years, there has been some momentum across the industry and existing pilots are a step in the right direction, but action must go further, faster in order to meet the scale of the challenge and realise the benefits of a reuse revolution.

This study focuses on business-to-customer returnable packaging, where customers purchase products — just as they normally would, but in reusable packaging, which is then returned to be professionally cleaned and refilled, before being placed back on the shelf. This differs from refill models, where customers own and refill their own packaging. Both approaches are an essential part of the solution, but this study focuses on **return** for two reasons:

1. **Returnable packaging filling, sales, and shopping experience closely map to current packaging systems** — from the filling of packaging to the retail supply chains, and through to the customer shopping experience. This means that return models can address a variety of reuse challenges, such as concerns about hygiene, retail space disruption, and customer convenience. In turn, this also means that returnable models can be applied across a broad range of applications, offering a clear route to scaling reuse in the long term.

2. **Scaling return models will need new infrastructure to collect and re-process packaging, and, therefore, unlocking the opportunity reuse-return systems present requires a focused approach as outlined here.** Designing, establishing, and operating return models needs stakeholders from across the value chain to collaborate, as virtually no organisation can do this on its own. This study aims to inform business, policymakers, and financial institutions on the key design choices to facilitate this collaboration and make reuse-return systems work effectively at scale.

Our analysis provides a vision as well as vital new data and insights, supported by 60 organisations, on how to design return systems to harness the full range of economic and environmental benefits they offer. These insights can also inform the ongoing negotiations for an international legally binding instrument on plastic pollution.[5]

This study focuses on the system design choices and quantifies the role of collaboration (see Context and key concept definitions). We recognise there are other important considerations and challenges that need to be further understood which are not part of the scope of this study, for example safety of reusing materials,[6] effective levers for customer behavioural change to return packaging, and governance models to ensure effective and equitable systems.

To reach the scale necessary to tackle plastic pollution, reuse urgently needs to be scaled; to make the economics work, collaboration is essential. While effective, scaled return systems do exist around the world, our findings, alongside an abundance of learnings from pilots, demonstrate that a concerted effort will be required for these to be replicated. Since businesses maintain ownership and responsibility for packaging throughout the reuse-return model, they have a pivotal role in designing these shared systems in an optimal way and incentivising customer adoption, while policymakers have a crucial role in creating the enabling conditions, and financial institutions in supporting and investing in the infrastructure. **As the need for action becomes evermore urgent, and in anticipation of increased regulation, now is the time to come together to make this reuse revolution a reality.**

About the study

This study aims to contribute to the debate on reuse through (i) analytically modelling the environmental and economic performance of return systems; (ii) better understanding and quantifying the key drivers that affect their environmental and economic performance.

Scenarios at varying levels of ambition have been modelled. The most ambitious scenario modelled — the System Change scenario — depicts a bold scenario for optimised return models at high scale. Achieving this will require a major transition from today's systems and supply chains, and will not happen overnight — but we should start working towards it today. For some applications for which return packaging is a proven solution (e.g. certain types of beverages), this bold scenario is roughly aligned with the most advanced existing systems (e.g. systems in Germany). For less mature applications, such as personal care or food products, there is a higher need for further research and development before this long-term vision will be within reach. As our model is based on existing technologies, it does not take into account potential innovation that might accelerate the transition to returnable packaging and further enhance its performance.

The modelling is sector-specific, to reflect sectoral differences. The focus sectors are: beverages, personal care, fresh food, and food cupboard items. Assumptions vary across these sectors. Within each scenario, system variables (see next page) are kept constant across sectors to aid comparison. In reality, the system can be a blend of different scenarios and vary by sector, for example, it's likely that any system would have a blend of bespoke and pooled packaging. For additional results, outside of the three scenarios, see page 38.

This study is based on advanced modelling with data and assumptions tested with 30+ experts, especially those operating the few reuse systems that exist at scale today. It is underpinned by advanced, scenario-based, analytical modelling, including GIS-based (Geographical Information System) logistical modelling, that quantifies the performance of return models under certain scenarios.

This study is intended as a starting point, not to provide all the answers. While many of the insights on the key drivers that impact the environmental and economic performance are applicable across multiple geographies, the specific outcomes presented in this report are based on French data and geography — having chosen one geography to enable as realistic modelling as possible. We encourage further detailed research for other geographies. We also recognise there are other important considerations and challenges that need to be further understood which are not part of the scope of this study, including hygiene and safety standards, and effective governance of shared reuse systems. For these we encourage further research and on-the-ground testing. For further details on the modelling design, assumptions, limitations, and underlying data, please see the section 'Model overview, key assumptions, and limitations' (pages 16-18) and the Technical appendix.

Model overview

We have modelled 4 different returnable packaging applications and their single-use equivalents...

Application	Single-use	Returnable
Beverages e.g. soda, juice	Single-use PET bottle	Returnable PET / Glass*
Personal care e.g. shampoo, shower gel	Single-use PE bottle	Returnable PE bottle
Fresh food e.g. yogurt, cream	Single-use PP container	Returnable PP container
Food cupboard e.g. rice, pasta, cereals	Single-use PP flexible	Returnable PP container

... Across three theoretical scenarios (using France as a representative geography)

System variables	Fragmented Effort A low scaled and fragmented return system	Collaborative Approach An established reuse system with potential to scale beyond	System Change A visionary scaled, shared, and standardised return system
Scale and shared infrastructure The volume of packaging switching to reuse, within a common system	Market share: **~2%** Due to low volumes and **fragmented infrastructure**	Market share: **~10%** Possible through big volume shifts to reuse and **some sharing of infrastructure**	Market share: **~40%** Large shift to reuse within a **highly shared infrastructure**
Packaging system Bespoke packaging vs. shared structural design that can return to any filler	Bespoke packaging	Pooled packaging	Pooled packaging
Return rate and average no. of loops How much packaging gets returned, determining how many times it can be reused	**80% return rate** enabling packaging to be reused **~5 times.**	**90% return rate** enabling packaging to be reused **~10 times.**	**95% return rate** enabling packaging to be reused **~15 times.**

To provide insights on:

Environmental performance: GHG emissions, water use, material use, and waste generation
Economic performance: total costs, including OPEX (operational expenditure), and CAPEX (capital expenditure).

* The analysis presented in this report focuses on the insights of a single-use plastic to returnable plastic packaging comparison (i.e a single-use 1L PET bottle with a 1L returnable PET bottle), and the insights of the single-use plastic to returnable glass packaging comparison are presented separately from the main analysis on page 45-46.

Returnable plastic packaging has the potential to achieve meaningful environmental benefits compared to single use, in the System Change scenario reducing GHG emissions and water use by 35 to 70%, and material use by 45 to 75% for selected applications

Our modelling shows that returnable plastic packaging has better environmental outcomes than single-use plastic packaging across almost all scenarios, applications, and performance indicators that were studied. At high scale, with highly collaborative systems and standardised packaging, the GHG emissions savings achieved range from 35% to 69%; water and material use are reduced by 45% to 70% and 45% to 76% respectively (Figure 1). These benefits are achieved in a plastic, single-use packaging to plastic returnable packaging comparison, but are dependent upon application and scale, for example the top range would be achieved in large-scale reuse systems (~40% of the market for that application), with high return rates (95%, ~15 loops*) and highly optimised transport.

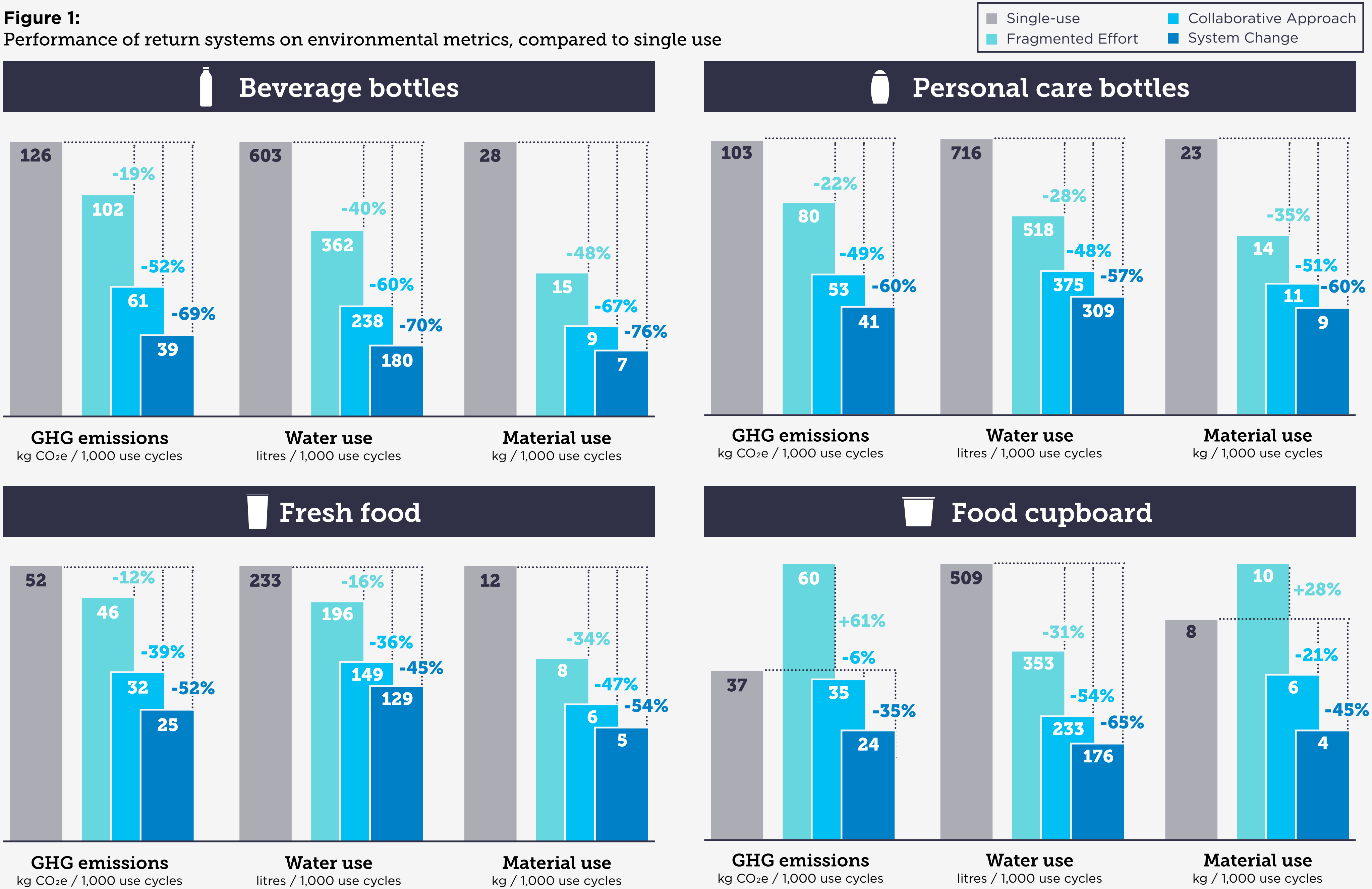
Even at lower scale and without standardised packaging or industry-wide collaboration, most applications achieve positive environmental outcomes. In a scenario with medium return rates (80%, ~5 loops), for all rigid-to-rigid packaging comparisons,** returnable packaging exhibits GHG emissions savings (12–22%) and material use reductions (34–48%) compared to single use. Water use is reduced across the board by 16% to 40%.

However, in some applications, a certain level of scale and system efficiency is necessary to compete environmentally with single use. When comparing single-use flexible packaging to rigid, returnable packaging, returnable packaging only outperforms single use on GHG emissions and material use when a Collaborative Approach scenario is achieved.

* Return rate is the percentage of packaging that is returned by customers. The amount of packaging returned, along with the quality loss rate, determines how many times the average piece of packaging can therefore be reused (or 'looped').

** This includes beverage bottles, personal care bottles, and fresh food packaging, where the single-use alternative is rigid packaging. For food cupboard products we compare to flexible, single-use packaging.

Figure 1:
Performance of return systems on environmental metrics, compared to single use



To compare single-use to returnable packaging, we look at the cost of providing a 'unit of product', for example 1 litre of soda or 250ml of shampoo, to a customer. For single-use packaging, '1,000 use cycles' will be all the costs associated with 1,000 single-use packages. For returnable packaging, this will be the cost associated with providing 1,000 units of the same product, but reusing packaging to supply it to customers. Often, depending on the variables (for example, the return rate), this will require substantially less packaging.

The economics can work: when designed collaboratively and operated at high scale, the economics of return systems can compete with single use for some applications

Our modelling shows that a collaboratively designed return system with standardised packaging and shared infrastructure can provide, at high scale, cost parity for beverage and personal care applications. In the System Change scenario, the total costs per unit of utility* of returnable plastic beverage bottles and personal care bottles are, respectively, 6% and 10% lower than single use (Figure 2). Whereas, fragmented, or low-scale systems are unlikely to reach cost parity with today's highly optimised, large volume single-use systems.

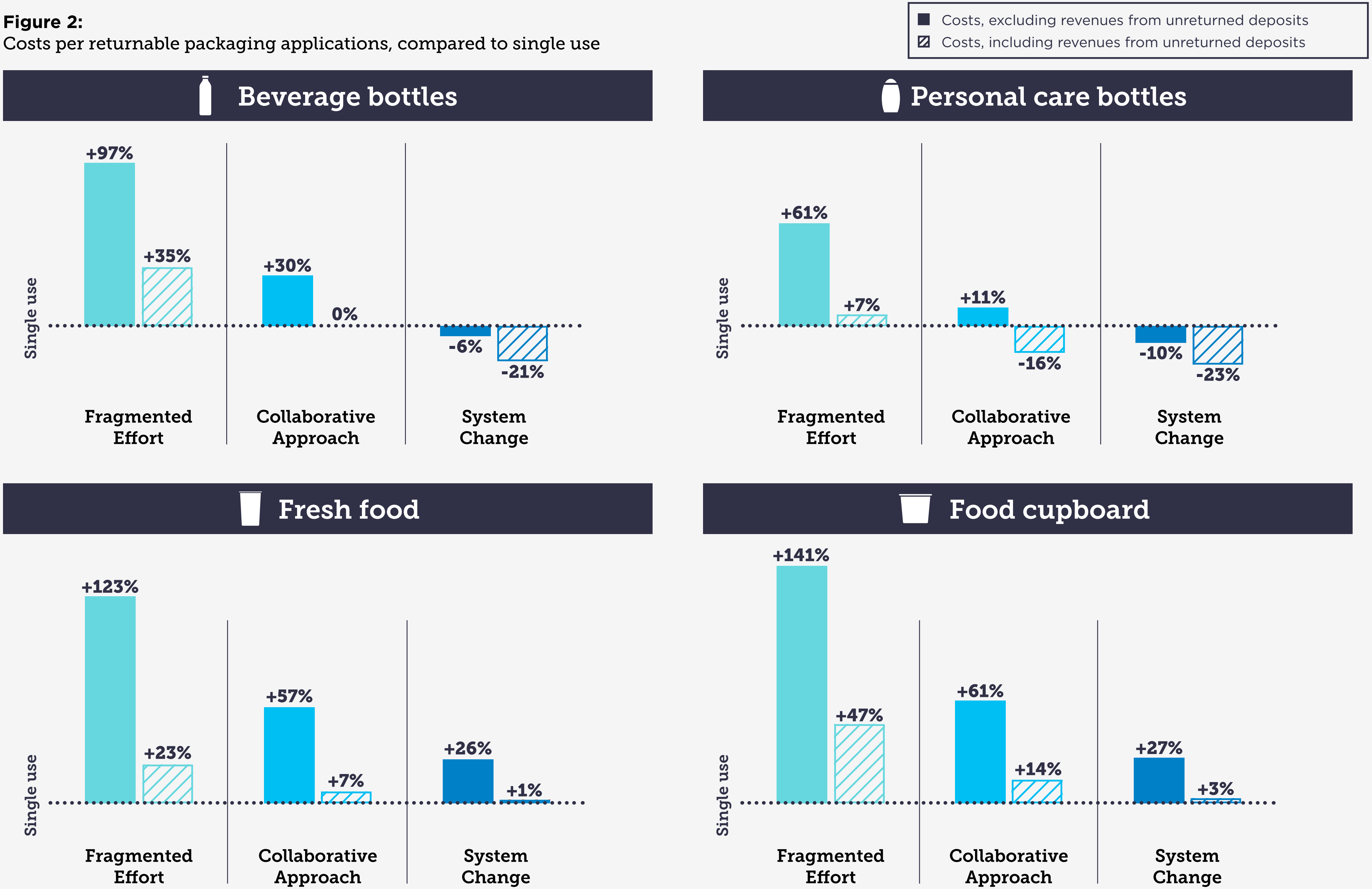
If 'revenues' from unreturned deposits are factored in, other applications also become economically competitive with single use. For returnable fresh food (e.g. yoghurt) and food cupboard (e.g. rice, pasta) packaging, the total costs per unit of utility are ~25% (~EUR 0.011) higher compared to their single-use counterparts. While reaching high return rates must be the absolute priority to achieve economic savings and maximise the environmental opportunity, unreturned deposits can have a significant impact on the economic viability of return systems. They can help de-risk or finance the transition phase, covering the lost value of unreturned packaging when return rates are low, before higher return rates come to fruition. The system setup and the wider governance is crucial to ensure that revenues are channelled correctly to support the economic viability of return systems.

It is widely expected that the full life-cycle cost of single-use packaging will increase, strengthening the business case for returnable packaging. With expected changes in regulation to fully account for packaging's end-of-life cost, externalities such as pollution and GHG emissions, and investor priorities,[7] the cost of single-use packaging looks set to rise. While this analysis is based on today's prices, this study projected potential increases in Extended Producer Responsibility (EPR) fees for flexible packaging, carbon taxes, and plastic taxes and their impact on the economics of reuse-return.** This resulted in returnable beverage bottle costs being 28% lower per unit than single-use bottles in the System Change scenario, and food cupboard costs only 3% higher than a single-use equivalent — even without taking into account revenues from unreturned deposits.

* A unit of utility is a unit of 'service' provided to a customer, e.g. 1 litre of beverage, or 250g of yoghurt. Serving one unit of utility in single use means producing one unit of packaging. For returnable, it means producing packaging for the first loop and reusing this same packaging for the subsequent loops.

** See 'Assumed price increases' (p35) for more details on this analysis

Figure 2:
Costs per returnable packaging applications, compared to single use



Realising the full potential of return systems relies on three key performance drivers

Our modelling shows that continuing and scaling fragmented efforts could bring some environmental benefits. But to make the economics work for returnable packaging and maximise the environmental opportunity, collective action is vital. This study has identified three key performance drivers:

Scale and shared infrastructure

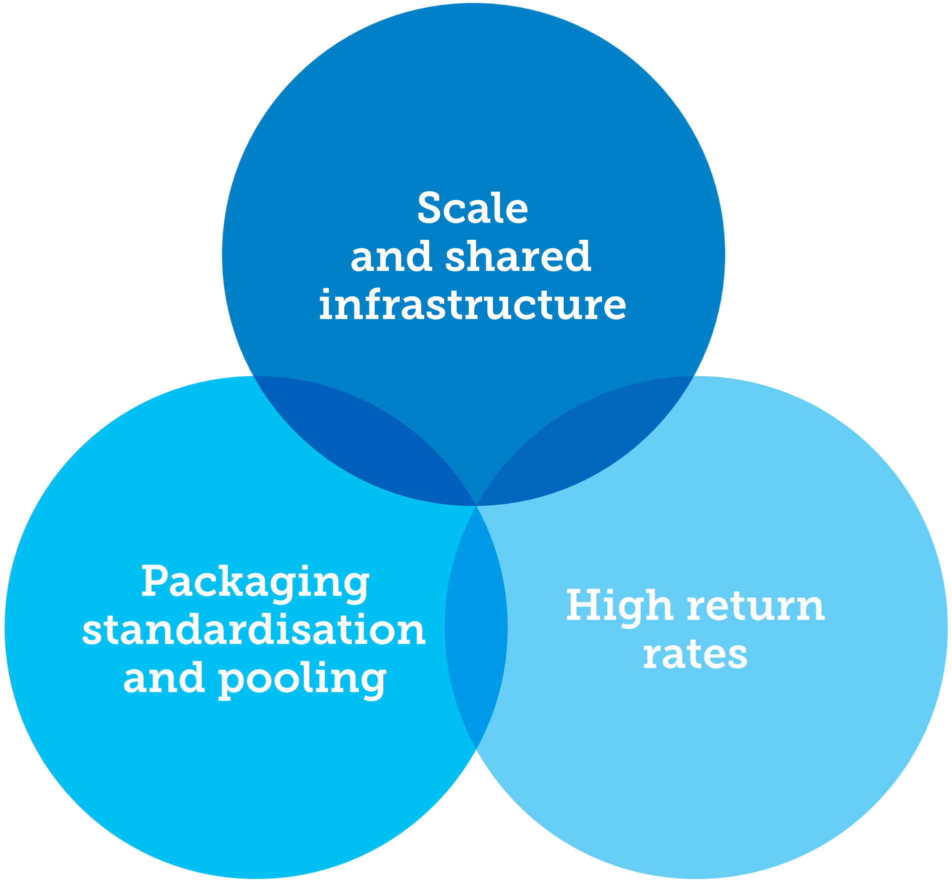
Sharing infrastructure provides economies of scale for all steps of the value chain (collection, sorting, cleaning, and transportation). It is particularly crucial to collaborate on collection infrastructure, not only to share costs, but also to offer customers a consistent and smooth experience. Customers are much more likely to adopt new models when they do not have to segregate packaging for, and interact with, different systems.

Packaging standardisation and pooling

Harmonising the structural design of packaging within a product category while using labels and closures to differentiate brand and product lines can significantly increase the efficiency of the system. Standardisation can drive down sorting, cleaning, and storage costs, and pooling* of packaging can dramatically decrease transport distances and associated emissions and costs.

High return rates

Reached through incentivising return and a frictionless return experience — are a key performance driver for all reuse systems. When transitioning, it is paramount to progress through the early stage, when return rates are likely very low, as quickly as possible. Among other factors, shared collection, a wide range of products, and customer convenience can help achieve high return rates by driving behaviour change. All actors must work together to learn how to reach the high return rates which this study shows are needed, the inspiration for which can be found in established systems.



* Pooled packaging refers to a set of packaging that is shared by several actors. See Part 3 for more details.

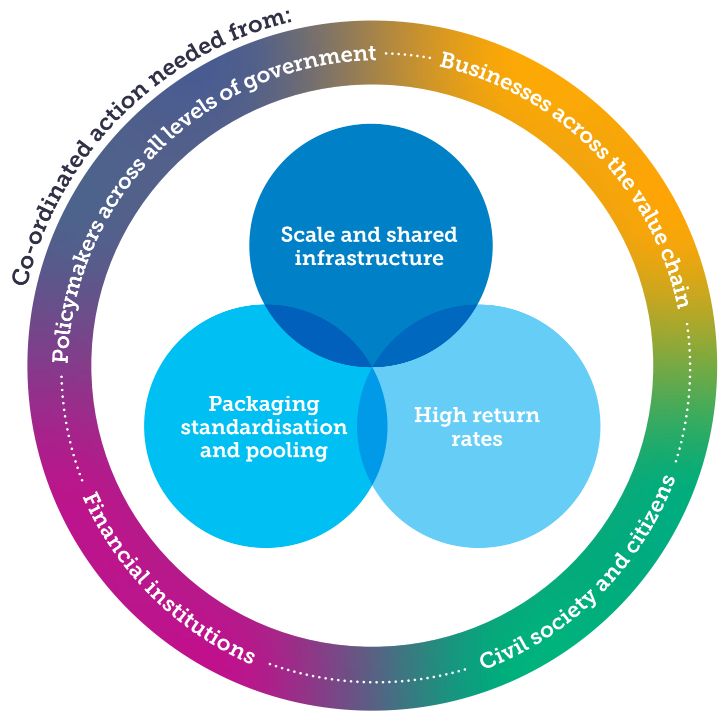
To realise the full benefits of return systems, a fundamentally new approach is required where industry peers, policymakers, and financial institutions work together to build shared systems. A major transition that won't happen overnight.

National and international policy will need to play a role to create the enabling conditions and mobilise an industry-wide transition. Given the need for a collaborative industry-wide approach and significant transformations of supply chains, it is clear that businesses cannot do this alone. Efforts such as the international legally binding instrument on plastic pollution and the EU Packaging and Packaging Waste Regulation (PPWR) have the opportunity to play a crucial role in bringing reuse to scale, building on existing global momentum.

Realising the potential of reuse-return will require a major transformation and a big shift from today's single-use model, but the foundations for this already exist. Infrastructure (e.g. collection, sorting, and cleaning), mindsets (e.g. packaging standardisation), and customer and business behaviour will all need to change. While the majority of collection, sorting, and cleaning infrastructure will need to be created (and can as such be optimised by design), other parts of the value chain, such as product manufacturing and filling facilities, already exist. Reaching the outcomes of our most ambitious scenario will be a massive transformation, requiring investment to evolve and retrofit equipment and adapt supply chains to suit a reuse system, but if the same expertise and drive to build hyper efficient single-use systems can be re-utilised to build reuse systems, these outcomes are achievable.

Scale is critical, so it will be crucial to strategically mobilise, and de-risk this transition period. Although environmental benefits can be achieved with relatively low-scale operations, the economic benefits are often only realised with a certain scale. Therefore, to reach the scale required as fast as possible and unlock the significant benefits that such a system offers, collaboration will be key.

There are clear indications of where to start and which existing efforts to build on. There are applications — such as plastic beverage bottles — where achieving economic parity with single use is easier, and can already happen at lower levels of scale. Additionally, there are some geographies — such as Latin America — with well-established systems for reuse that provide insights for how to scale. Lastly, there is deposit return infrastructure currently designed for recycling, that could be leveraged for reuse to reduce the investment needed to set up collection systems for returnable packaging.



To realise this vision, we urge all stakeholders to come together to take three concrete actions:

- **Adopt a fundamentally new approach**
- **Kickstart the transition by deploying collaborative multi-brand and multi-retailer systems**
- **Follow through by enlarging these systems across a greater range of products, sectors, and geographies.**

Calls to action

Adopt

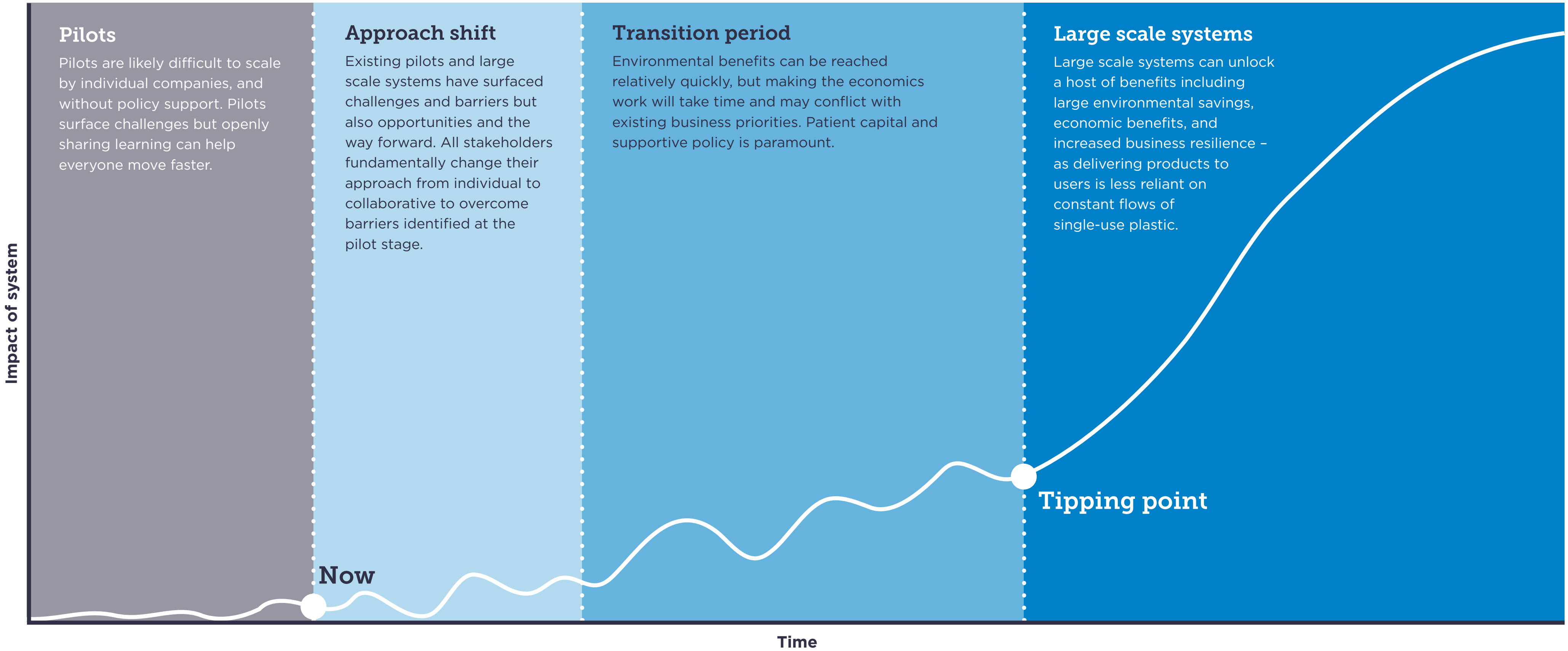
Rapidly adopt a fundamentally new approach to developing return systems – one that is collaborative and involves a larger number of stakeholders across the value chain.

Kickstart

With this new approach, urgently kickstart the transition by deploying collaborative multi-brand and multi-retailer systems – focusing in the short term on categories that most easily lead to economic parity, with the objective to reach the tipping point as soon as possible and start reaping benefits.

Follow through

Enlarge these systems across a greater range of products, sectors, and geographies – continue to expand existing return systems to fully realise their potential for a greater range of applications, and make the economics work for an increasing number of applications.



Calls to action for each stakeholder

	Businesses across the value chain (brands, retailers, service providers, startups)	Policymakers across all levels of government (municipalities, national governments, UN treaty negotiators)	Financial institutions	Civil society and citizens
Role	**Cultivating industry-wide collaboration and establishing scaling return systems as a key priority in packaging strategy, with dedicated resources, investments, and action plans, supported by targets and advocacy efforts.**	**Creating the enabling conditions by ensuring a level playing field, fostering industry-wide collaboration, de-risking the initial investments, and creating the right incentives for return systems (e.g. by leveraging the international legally binding instrument and EU PPWR).**	**Supporting the shift in business approach to scaling reuse, financing infrastructure investment and research projects through innovation funds with room to fail and long returns on investment, and redirecting long-term investment flows from single use to reuse systems.**	**Participating in new systems, and shifting demand from single use to reuse.**
Actions	Leverage combined technical expertise to plan and develop the establishment of shared logistics infrastructure for packaging collection, cleaning, and transport. *Scale with shared infrastructure* Bring packaging designers and marketers together to innovate towards standardised and pooled packaging for high priority products across a range of packaging materials and categories. *Standardised and pooled packaging* Retailers: scale up collection efforts. All actors: harmonise the customer experience and communication of how return systems operate to reduce friction to participate. *High return rates*	Set up and expand the adoption of Extended Producer Responsibility (EPR) systems — developed in collaboration with brands, retailers, and other industry stakeholders — with mechanisms (e.g. eco-modulation) to incentivise reuse. *Scale with shared infrastructure* Foster the uptake of reuse, for example by setting ambitious, evidence-based reuse targets. *Scale with shared infrastructure* Create and implement health, hygiene safety, and quality standards to ensure safe return systems. *Standardised and pooled packaging* Establish effective take-back systems such as deposit-return schemes (DRS) and develop guidelines for wider financial measures (e.g. EPR, taxes, subsidies) to ensure financial viability and incentivise widespread adoption and investment in shared return infrastructure. *High return rates*	Scale financial products and services that support the development of shared return infrastructure. Collaborate between public and private institutions on mechanisms such as blended finance, to offer guarantees, or de-risking, to crowd in sufficient capital. *Scale with shared infrastructure* Make capital available to businesses at favourable rates to support their transition to standardised and pooled packaging. *Standardised and pooled packaging* Support increasing return rates by linking financing to ambitious packaging return rate targets using mechanisms such sustainability-linked bonds and loans, where the cost of debt steps down if companies meet their targets. *High return rates*	Citizens: Return packaging to help achieve high return rates. Act as a watchdog to hold governments, businesses, and institutions to account. Raise awareness and call for strong regulation where it is required. Conduct advocacy and coordinate research to build evidence for how return systems can be designed effectively.

More detailed calls to action and calls for further research can be found in Part 4

Context and key concepts definitions

This study is the first ever to envision future return systems, bringing to life the role of shared infrastructure and standards in packaging design to model their economic and environmental impacts compared to single use. It seeks to catalyse action towards building these systems of the future by creating a shared understanding of the key considerations. It is underpinned by analytical modelling based on a comprehensive and granular packaging flow model elaborated by Systemiq and Eunomia. Conducted in collaboration with the Ellen MacArthur Foundation's network, this analysis builds on expertise and data from nearly 20 global brands and retailers, and 40+ reuse service providers, NGOs, and policy and finance institutions. Through our findings, we aim to support businesses, policymakers, and financial institutions in collaborating and taking concrete actions to unlock a reuse revolution.

> Plastic pollution caused by single-use packaging is harming our environment and our health. We simply have to move away from single use and develop safe and sustainable reusable packaging systems that work at scale. Recycling will not be enough.
>
> **Marcus Gover**
> Director, Minderoo

To help unleash the next wave of reuse action, our analysis uncovers:

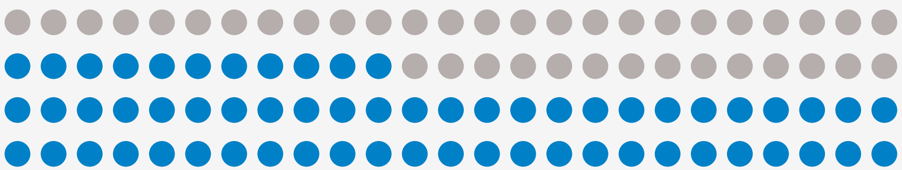
- The environmental benefits of scaling returnable packaging
- How to make the economics of returnable packaging compete with single use
- The key actions for businesses, policy makers, and financial institutions to enable returnable packaging to scale.

We need many different types of upstream innovation to tackle plastic waste and pollution at its source. Our *Upstream Innovation Guide* (2020) explored the opportunity to eliminate plastic packaging, followed by the role of reusable packaging, and latterly the role of redesign to enable high-quality recycling or composting — and current progress should be accelerated across all these efforts.

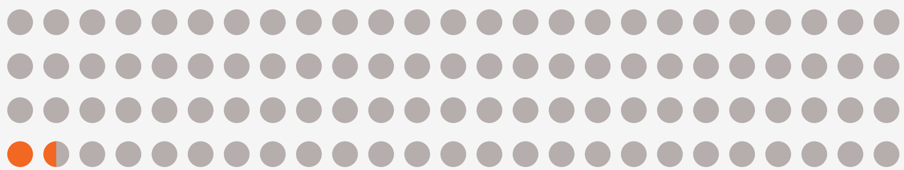
In the long term, scaling reuse is the biggest opportunity to reduce virgin material use in packaging. Without reuse, global virgin plastic use in packaging is unlikely to decrease below today's levels until at least 2050.[8] Reuse is vital to tackle plastic waste and pollution, and presents an opportunity to make progress towards net-zero while reducing dependency on finite resources. Looking back at five years of Global Commitment action and learnings, it is clear that we cannot only recycle our way out of the plastic waste and pollution crisis; given this, reuse has been identified as one of the three pivotal hurdles[9] to be overcome to unlock change at scale. By 2040, moving from single use to reuse models could reduce the total annual amount of plastic leaking into the ocean by over 20%.[10]

Existing reuse pilots and momentum are a first step in the right direction, but actions must move beyond pilots to achieve large-scale impact. Despite many businesses now having reuse pilots in place, hundreds of new reuse startups, and some initial national reuse policies in South America, Europe, and Australia, reuse has not scaled yet, as illustrated by the percentage of reusable plastic packaging among Global Commitment signatories remaining constant and below 2%. With an abundance of learning from these pilots, startups eager to scale, more reuse policy emerging, and an international legally binding instrument on plastic pollution being negotiated, the enabling conditions for reuse to scale are emerging.

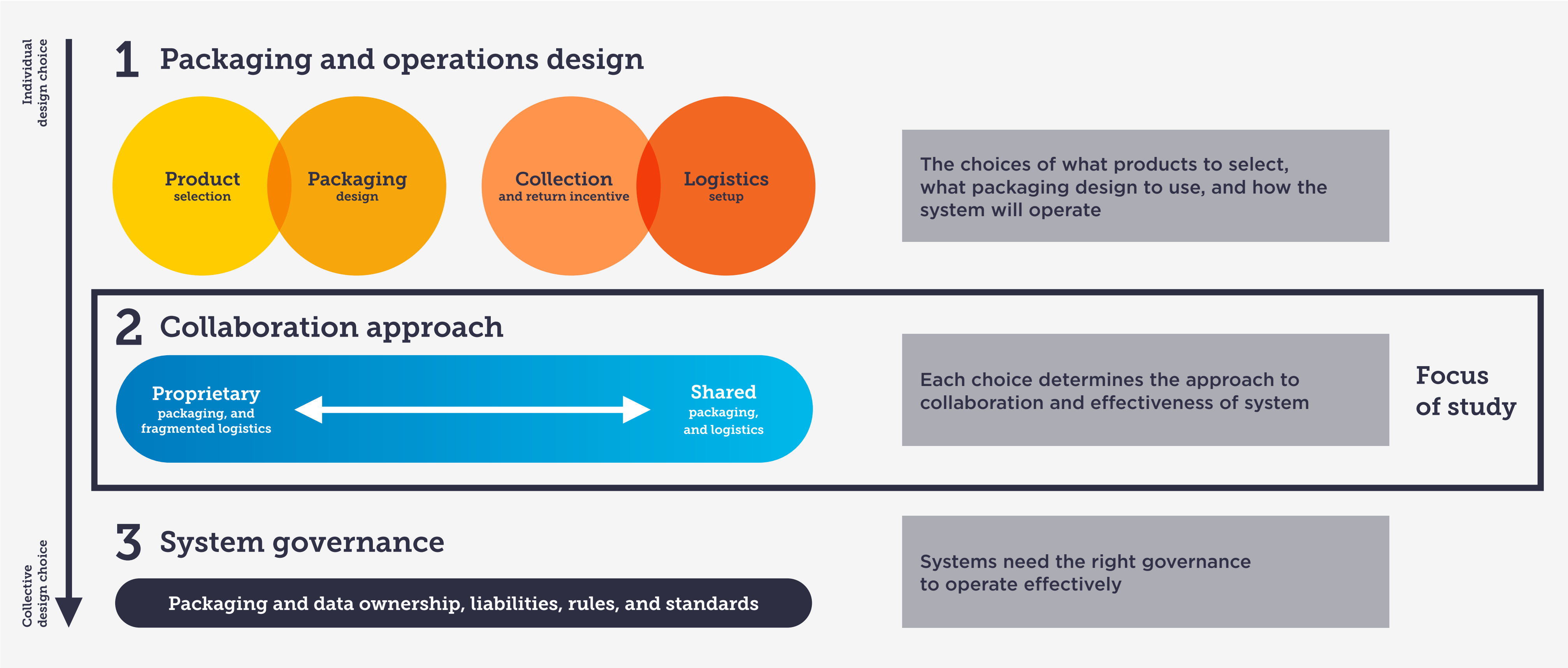
To tackle plastic pollution, it is crucial to scale all types of reuse models (see page 19 – What is reuse?). The focus of this report is on the role of scaling returnable packaging, where customers return empty packaging for it to be cleaned professionally and refilled. Such return models not only present complementary opportunities to refill models, but they are also likely to offer the biggest opportunity for scaling the breadth and volume of product sales in reuse. Once pre-filled, returnable packaging operations are very similar to single use (for example, similar logistics to distribute to retail stores, similar in-store display) and result in less disruption to current supply chains. For customers, the shopping experience with returnable packaging is very similar to the single-use experience, with the addition of having to return empty packaging. Also, as businesses maintain ownership and responsibility for returnable packaging during its whole lifetime, they have broader control over the return supply chain compared to refill, and consequently a pivotal role in overcoming return implementation barriers.



61% of Global Commitment signatories have reuse pilots in place



<2% of their plastic packaging is reusable



We have identified three levels of critical decision-making for return systems: packaging and operations design, approach to collaboration, and system governance. The choices made by individual actors (level 1), for example about what packaging design to use or what collection method, all determine how proprietary or how shared the system will be (level 2). Effective governance (level 3) must also underpin any effective system — and future systems may be enabled with new approaches such as a 'packaging as a service', where brands partner with others to deliver their reuse solution. While decisions on this first layer of choices and the governance structure are crucial to make the return system work, and require further exploration, our initial research identified a lack of common understanding of the critical impact collaboration has on the performance of a return system, and therefore it is this lever that we have concentrated on here.

This study aims to fill this gap and focuses on the role of collaboration to scale impactful return systems.

In addition to this report, animations presenting the modelled scenarios and outcomes are available on the Ellen MacArthur Foundation's website. Detailed information regarding the modelling methodology, assumptions, and data are presented in the Technical appendix. For further analysis and research on return systems, especially for insights going beyond the scope of this report, we recommend exploring:

- CITEO's consultation on packaging standards, which sets the basis for standardised glass packaging in France
- PR3's reuse standards, which outlines core requirements for aligning reuse systems between companies and brands
- WEF Consumers Beyond Waste's design and safety guidelines, which provides specific recommendations for implementing reuse models
- Upstream's reuse policy playbook, which offers policy models and strategies to scale reuse systems.

What is reuse?[11,12]

Reuse schemes, or 'packaging reuse', refers broadly to delivery models in which a single package achieves multiple 'rotations', 'cycles', 'loops', or 'uses' for the same purpose for which it was originally used.

This is distinct from, and complementary to, recycling. Reuse models circulate a product or packaging as a whole, whereas recycling reprocesses the constituent materials into a new product or package.

Reuse can be applied both in a business-to-business (B2B) and business-to-customer (B2C) context. In B2B, reusable packaging can, for example, take the form of reusable pallets. In B2C, reuse and refill models are wide-ranging. They include:

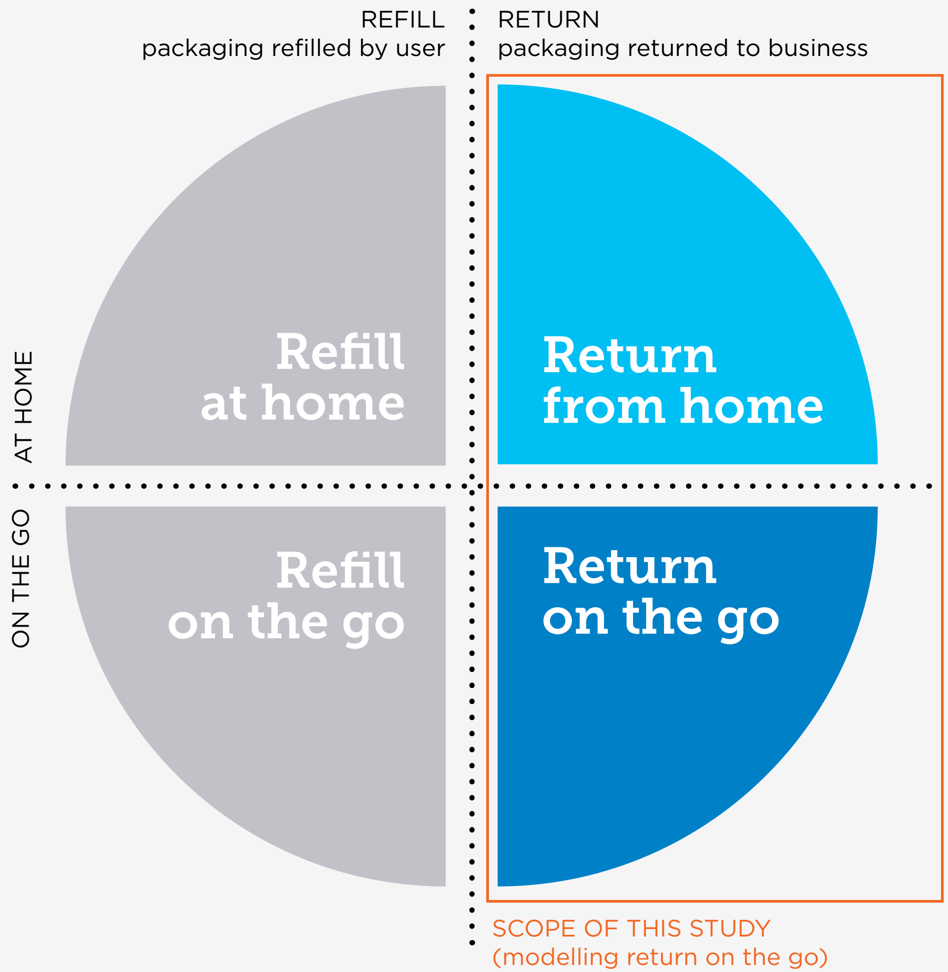
Refill at home:
Users refill a reusable container at home with refills either delivered to the door (for example, through a subscription service) or bought in a shop. Users retain ownership of the main packaging and are responsible for cleaning.

Refill on the go:
Users refill the reusable packaging at a dispensing point away from home, such as in a store. Users retain ownership of the reusable packaging and are responsible for cleaning.

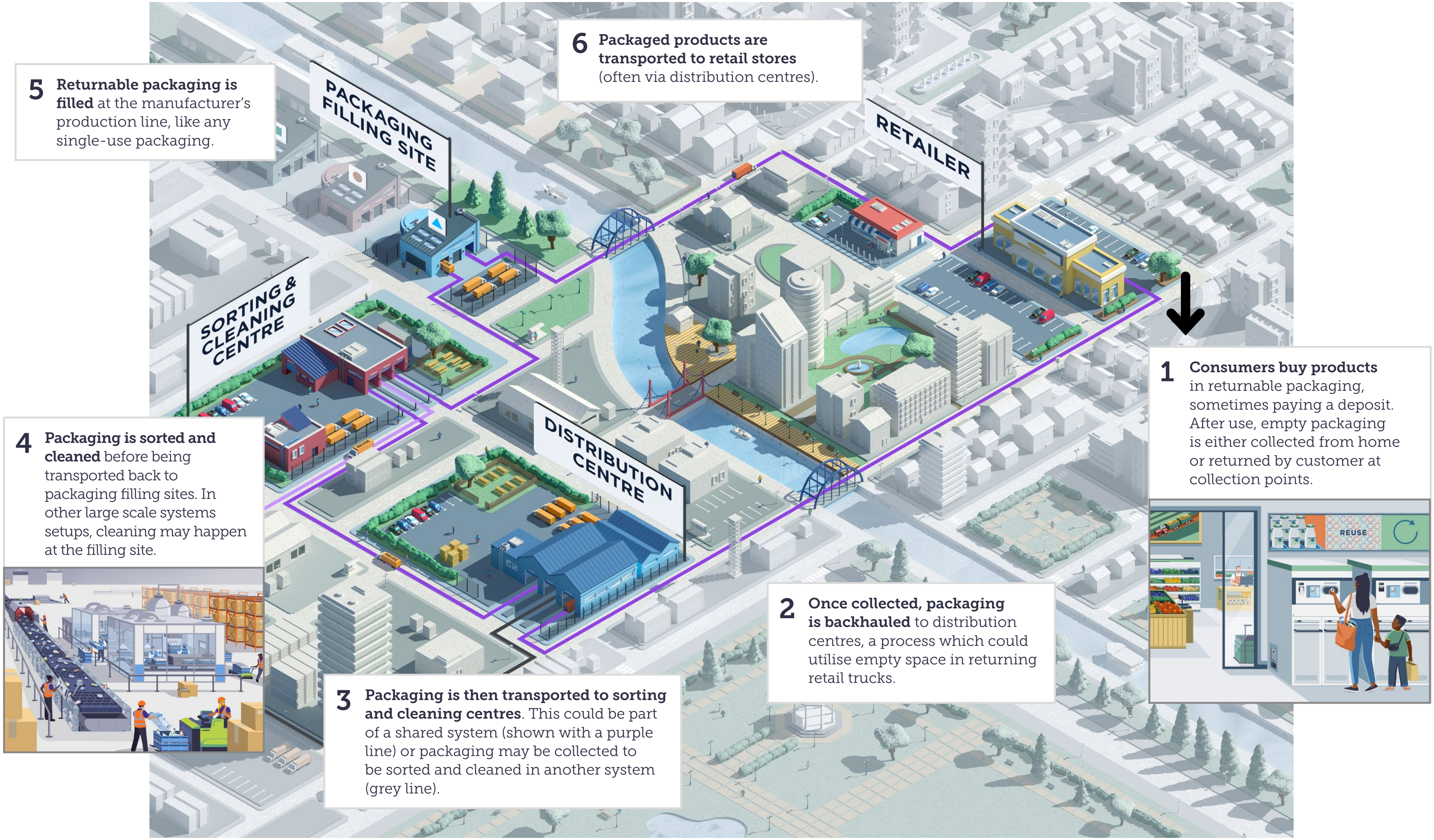
Return from home:
Users subscribe to a delivery and collection service that allows them to return empty packaging from home. A business or service-provider then takes care of cleaning and redistribution of the packaging.

Return on the go:
Users purchase a product in a reusable container and return the packaging at a store or drop-off point after use. The packaging is either cleaned where it is returned, or a business or service-provider takes care of the cleaning and redistribution.

For more information on reuse models, see Ellen MacArthur Foundation, *Reuse – Rethinking packaging*[13]



What is a returnable packaging system?



1 **Consumers buy products** in returnable packaging, sometimes paying a deposit. After use, empty packaging is either collected from home or returned by customer at collection points.

2 **Once collected, packaging is backhauled** to distribution centres, a process which could utilise empty space in returning retail trucks.

3 **Packaging is then transported to sorting and cleaning centres**. This could be part of a shared system (shown with a purple line) or packaging may be collected to be sorted and cleaned in another system (grey line).

4 **Packaging is sorted and cleaned** before being transported back to packaging filling sites. In other large scale systems setups, cleaning may happen at the filling site.

5 **Returnable packaging is filled** at the manufacturer's production line, like any single-use packaging.

6 **Packaged products are transported to retail stores** (often via distribution centres).

Model overview, key assumptions, and limitations

> In a resource constrained and increasingly polluted world, reuse is the logical next step for packaging our goods. Modelling packaging systems is however notoriously complex. In this context, this new robust analysis from EMF provides yet further evidence on the environmental and economic opportunity that well designed reuse systems can deliver at scale.

Jean-Pierre Schwetizer
Circular Economy Manager, European Environmental Bureau (EEB)

> The current worldview that single use is easier [than reuse] is derived from a world designed for single use waste streams.

Dr. Dagny Tucker
Co-founder, Perpetual

We have modelled 4 different returnable packaging applications and their single-use equivalents...

Application	Single-use	Returnable
Beverages e.g. soda, juice	Single-use PET bottle	Returnable PET / Glass*
Personal care e.g. shampoo, shower gel	Single-use PE bottle	Returnable PE bottle
Fresh food e.g. yogurt, cream	Single-use PP container	Returnable PP container
Food cupboard e.g. rice, pasta, cereals	Single-use PP flexible	Returnable PP container

... Across three theoretical scenarios (using France as a representative geography)

System variables	**Fragmented Effort** A low scaled and fragmented return system	**Collaborative Approach** An established reuse system with potential to scale beyond	**System Change** A visionary scaled, shared, and standardised return system
Scale and shared infrastructure The volume of packaging switching to reuse, within a common system	Market share: **~2%** Due to low volumes and **fragmented infrastructure**	Market share: **~10%** Possible through big volume shifts to reuse and **some sharing of infrastructure**	Market share: **~40%** Large shift to reuse within a **highly shared infrastructure**
Packaging system Bespoke packaging vs. shared structural design that can return to any filler	Bespoke packaging	Pooled packaging	Pooled packaging
Return rate and average no. of loops How much packaging gets returned, determining how many times it can be reused	**80% return rate** enabling packaging to be reused **~5 times.**	**90% return rate** enabling packaging to be reused **~10 times.**	**95% return rate** enabling packaging to be reused **~15 times.**

To provide insights on:

Environmental performance: GHG emissions, water use, material use, and waste generation
Economic performance: total costs, including OPEX (operational expenditure), and CAPEX (capital expenditure).

* The analysis presented in this report focuses on the insights of a single-use plastic to returnable plastic packaging comparison (i.e a single-use 1L PET bottle with a 1L returnable PET bottle), and the insights of the single-use plastic to returnable glass packaging comparison are presented separately from the main analysis on page 45-46.

Note: The scenarios keep all variables constant to aid comparison, but it is likely that any system would have a blend of bespoke and pooled packaging and high return rates may be easier or harder to reach depending on the application. For additional results, outside of the three scenarios, see page 38)

Model outcome interpretation

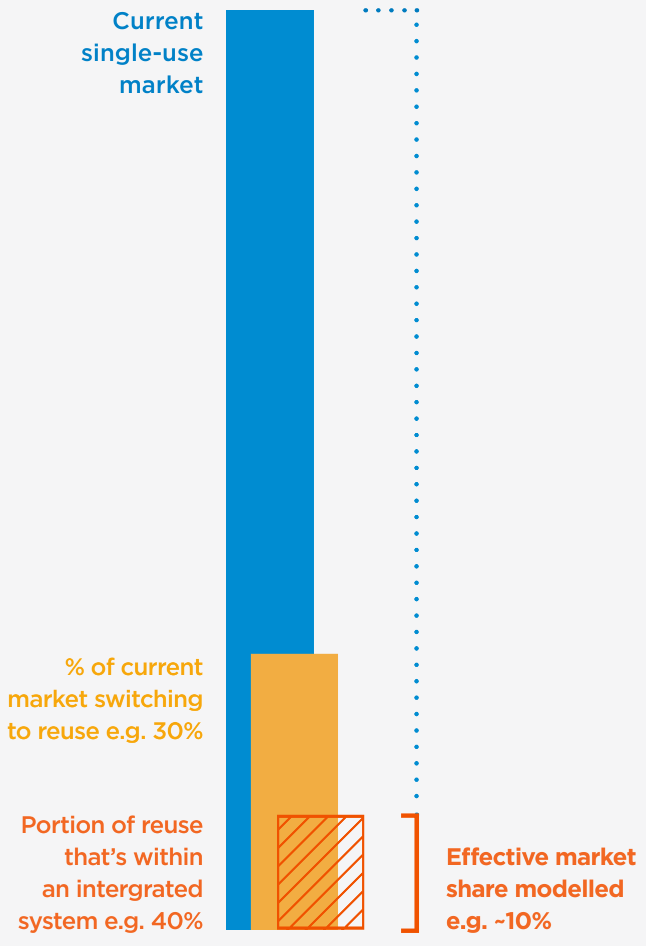
How do we account for shared infrastructure in the model and what is an 'integrated return system'?

In an integrated return system, we assume that within a packaging application, for example beverages, the sorting and cleaning centres, and transport to and from them, are shared. Filling remains at existing brand facilities.

Across the modelled scenarios, we assume that a portion of all the returnable packaging in the market, ranging from 20% (Fragmented Effort scenario), to 40% (Collaborative Approach scenario), and 60% (System Change scenario) is managed with an integrated system. This would assume the remaining returnable packaging in the market is managed by potentially many other fragmented reuse networks. We did not model a higher market share, as it is possible that even within categories, there will be multiple systems effectively operating in parallel. The effective market share we have modelled is the amount of returnable packaging in an integrated return system, compared to today's single-use market (Figure 3).

An integrated system does not mean a monopoly — the operation of transport legs, infrastructure, or regions, could be managed and operated by many actors — but rather that all actors operate under the same rules and standards. Other sectors, such as telecommunications operate under this model, sharing infrastructure to enhance coverage and reduce impact.

Figure 3:
How we account for shared infrastructure and calculate the market share modelled



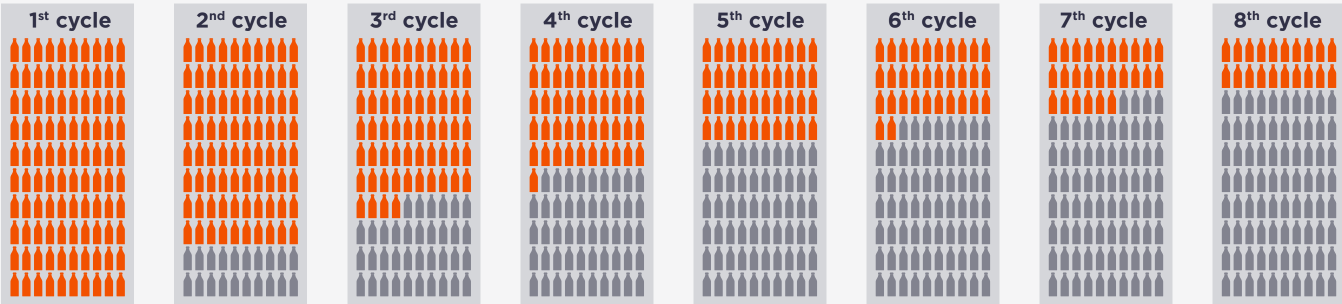
What are return rates and average number of loops, and how are they connected?

Return rate is the percentage of packaging that is returned by customers. The amount of packaging returned, along with the quality loss rate, determines how many times the average piece of packaging can therefore be reused (Figure 4). While return rates are likely to be low as new systems and behaviours are established, by working together to continuously improve the experience of returning packaging, all actors can help to reach high return rates.

What are 'units of utility' and '1,000 use cycles'?

To compare single use to returnable packaging, we look at the cost of providing a 'unit of product', for example 1 litre of soda or 250ml of shampoo, to a customer. For single-use packaging, '1,000 use cycles' will be all the costs associated with 1,000 single-use packages. For returnable packaging, this will be the cost associated with providing 1,000 units of the same product, but reusing packaging to supply it to customers. Often, depending on the variables (for example, the return rate), this will require substantially less packaging.

Figure 4:
At an 80% return rate, 20% of packaging is not returned after each cycle. This limits the number of times an average piece of packaging can be reused before it is 'lost from the system' and requires new packaging to be added.



In addition to the effect of the return rate, some packaging will also be removed from circulation if it is too damaged, or if it has reached its maximum number of safe uses. This is the '**quality loss rate**'.

For example, 80% return rate + 2% quality loss rate = average piece of packaging can be used 4-5 times.

Model scope

Packaging applications

The scope of this publication is pre-packaged, fast-moving consumer goods, and does not look at takeaway or customer refilled packaging.

Geographical scope

The focus of this study is to understand the impact of collaborative design choices on the effectiveness of return systems. These learnings are globally relevant. However, to yield more specific insights and ground the model in a specific context, we have used mainland France as a representative of European countries. This study uses French-specific data (e.g. population density, labour costs, energy mix) and our logistical modelling is performed on the French road network to offer representative analysis for similar European countries. France's population density (118 p/km^2)[14] and urbanisation rate (83.9%)[15] is close to the European Union average (112 p/km^2;[16] 75%).[17] We encourage further detailed research for other geographies, especially where there are less developed waste management systems.

Return model scope

Return from retailers, assuming at least one Reverse Vending Machine (RVM) per supermarket and hypermarket in France (i.e retail stores with over 200 sq m^2), increasing to up to 4 for larger stores at higher scale. We encourage further research to understand if and how other return method (e.g. neighbourhood collection points, kerbside collection, etc.) impact systems' performance and consumer experience.

Model key assumptions

Transport and logistical modelling

Filling, distribution, and sorting and cleaning centres were approximated based on French population distribution data. The number of these centres depends on the scale of the system modelled. The actual location of filling and distribution sites may vary.

Transport from product manufacturers' filling sites to retailer stores is not modelled, as assumed to be similar for single use. The transport leg from retailers' stores to retailers' distribution centres assume empty trucks leaving retailers stores are used to backhaul packaging — as such this transport leg is not modelled. Distances travelled from retailers' distribution centres to sorting and cleaning centres, and from sorting and cleaning centres to filling, has been calculated using actual by-road drive times.

Collection

Empty packaging is returned at retail stores via RVMs, where it is pre-sorted by application type and reuse network. The infrastructure for collection points is shared between applications and reuse networks — i.e. all reusable packaging can go to all collection points. In smaller format retailers or other geographies, packaging may be returned over the counter without the large cost of RVMs, though we have not modelled this.

Sorting & Cleaning

Sorting and cleaning facilities are assumed to be co-located, meaning they share a building. While it is common practice in some sectors (e.g. beverage) to have cleaning co-located with filling, we have assumed co-location of sorting and cleaning lines to be able to compare applications and scenarios. Transport distances would be not impacted if cleaning moved to brands' filling sites, but the impact on cleaning efficiency would vary on a case-by-case basis, mainly depending on size of filling sites and cleaning needs. Our analysis may be conservative, as in some cases, brands may find further efficiencies in cleaning just before filling.

Different applications and different reuse networks are assumed to have separate sorting facilities (or at least separate lines in the same facility). Returnable packaging is sorted, cleaned, quality checked, and repalletised before going back to filling. Different applications are assumed to have different cleaning requirements, and so different water/energy intensity and costs (e.g. personal care products are assumed to be harder to clean than food cupboard and beverage packaging).

Model limitations

Data availability and return systems maturity

The availability of data, both in terms of return systems' costs and environmental impacts on filling facilities, collection, and sorting and cleaning facilities is limited as at-scale reuse systems are rare. This limitation may introduce uncertainties in the analysis, and it is important to acknowledge the data gaps when interpreting results. To reduce these uncertainties and ensure a robust assessment, we have tested assumptions and results in interviews conducted with 30+ experts, especially those operating systems at scale today.

It is important to acknowledge that whereas return systems are proven solutions in sectors such as beverages, there is little knowledge to date on how these systems could operate for other products, such as personal care, which will require further investigation.

Trade

Our analysis does not account for cross-border transport of the packaging, packaged goods, or plastic packaging waste. Modelling an international reuse system would require additional assumptions and considerations. For example, transport distances could be higher where filling sites are more regional (e.g. personal care and food cupboard or where packaging is not pooled), however transport represents a small proportion of overall costs and impact and alternative solutions exist for regionally produced products (e.g. reusable, bulk, B2B packaging with local filling).

Transport logistics modelling

Our transport modelling does not represent any specific, existing supply chain, nor the exact locations of existing facilities; instead, the locations of existing distribution centres and filling sites needed to be estimated using population density hotspots. This means that the estimated locations of sites are likely optimised. Given existing infrastructure and location constraints for certain facilities or certain products (e.g. mineral water filling next to source), real-world systems may not fully achieve the optimisation of transport distances as modelled. We encourage product manufacturers and industry groups to build on this work to model their own supply chain and understand the potential of return systems for their setup.

Part 1
Environmental analysis

Returnable plastic packaging has the potential to achieve meaningful environmental benefits compared to single use

Our modelling demonstrates that returnable plastic packaging outperforms single-use plastic packaging on the three environmental metrics we studied: material use (and related waste generation), greenhouse gas (GHG) emissions, and water use. This is not only true in our most ambitious scenario, but also for most applications in the least ambitious one. Even in a modest reuse system, returnable packaging can bring important environmental benefits. When scale, collaboration, and return rates increase, the related environmental benefits grow — reaching up to 75% reduction in material use, GHG emissions, and water use.

> This study really builds the case for pooling our resources to make reusable packaging the primary mode of product delivery in the future. No matter how renewable your material is, no matter how recyclable, this study shows that nothing beats reuse when it comes to reducing environmental impact. The question is not if we should increase reusable packaging - it's how fast can we get it done #ReuseAddsUp

Willemijn Peeters
CEO and Founder. Searious Business

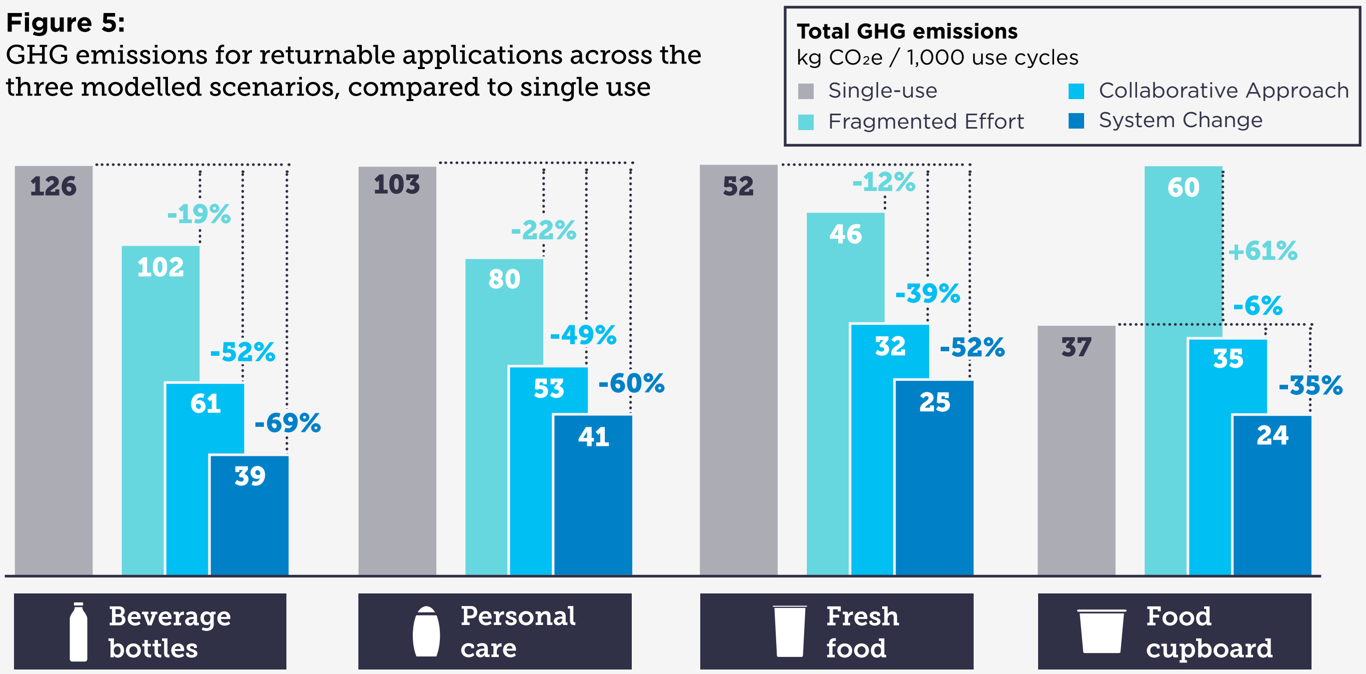
While this study focuses on the impact of collaboration in the design of return systems, and material selection is not part of the scope, one case study of reusable glass packaging for beverages was modelled to indicate the impact of material choice. These high-level results are presented on page 45.

1.1

Switching from single use to returnable plastic packaging provides significant GHG emission reductions across all scenarios, with up to 69% in rigid-to-rigid* packaging switches. Also, when replacing flexible packaging with returnable rigid packaging, GHG emission savings can be achieved in the two most ambitious scenarios.

Under the System Change scenario, all returnable plastic packaging applications exhibit GHG emission reductions, ranging from 35% to 69%,** compared to equivalent single-use plastic packaging (Figure 5). In the Collaborative Approach scenario*** — where the amount of reusable packaging is lower, the level of collaboration within a shared return network is lower, and return rates are slightly decreased — all reusable applications still demonstrate significant GHG emission reductions, ranging from 39% to 52%, with the exception of food cupboard which is slightly above single use (Figure 5). In the Fragmented Effort scenario**** — where the scale of the return network and return rates are lower again, and packaging is not standardised and pooled — return can still yield GHG savings of up to 22% for applications with a rigid-to-rigid packaging comparison (Figure 5). This indicates that while large-scale and collaborative systems bring the highest GHG emission savings, lower scale and individual systems can still reduce GHG emissions compared to single use.

Figure 5:
GHG emissions for returnable applications across the three modelled scenarios, compared to single use



* Rigid plastic packaging to rigid plastic packaging applications include beverage, fresh food, and personal care.

** High-scale and highly shared infrastructure (~40% effective market share), highly standardised pooled packaging), and very high return rates (95% return rate, ~15 loops)

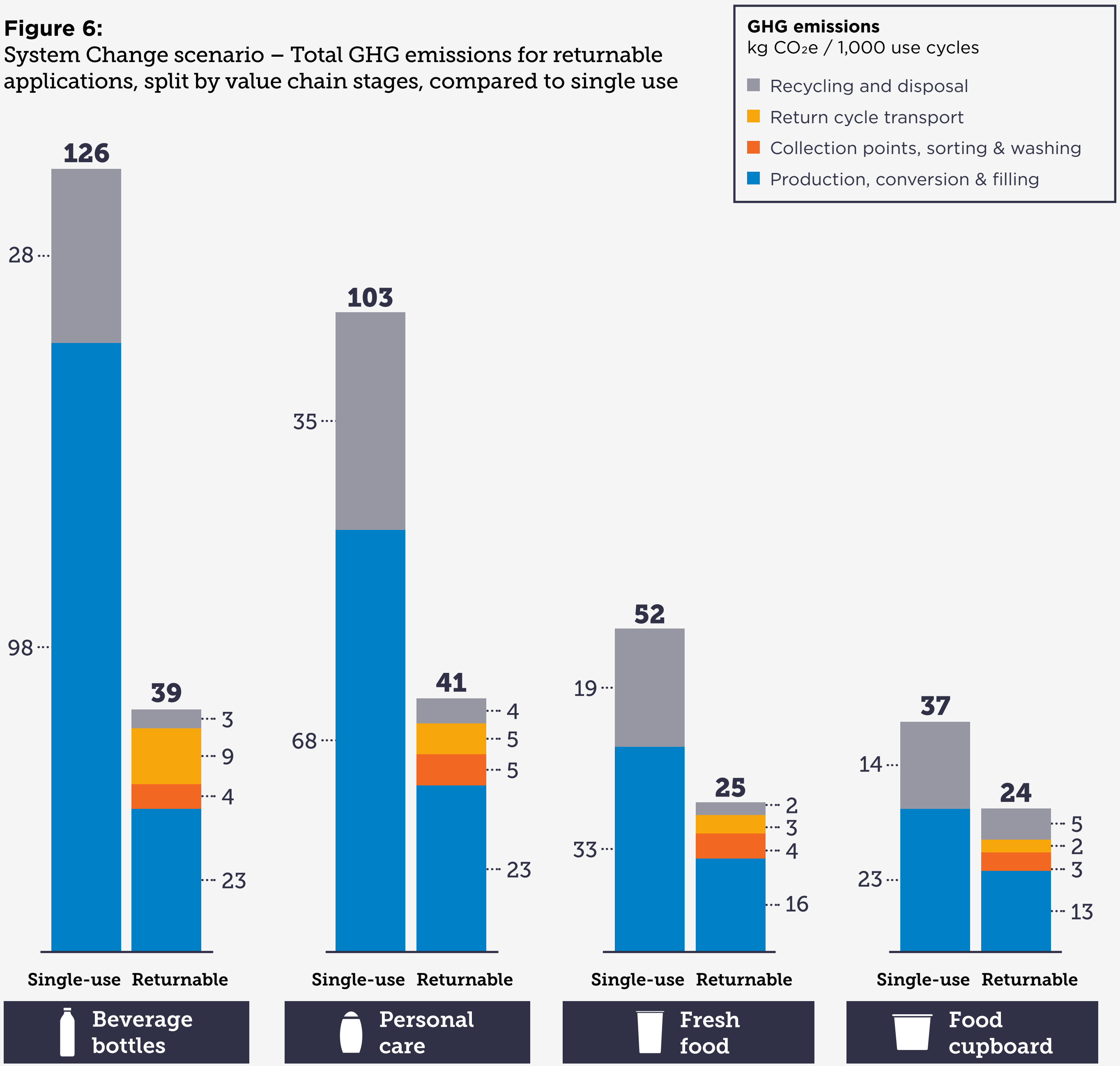
*** Medium scale and some shared infrastructure (~10% effective market share), highly standardised pooled packaging, and high return rates (90% return rate, ~10 loops)

**** Low scale and little shared infrastructure (~2% effective market share), non-standardised individual packaging, and medium return rates (80% return rate, ~5 loops)

The main driver (Figure 6) of GHG emissions is the production of packaging, whether single use or returnable. Returnable packaging performs better than single use because the emissions generated at the production stage are distributed over many use cycles. The difference is less pronounced for the food cupboard application, for which single-use, flexible packaging is replaced with returnable rigid packaging, as this leads to significant weight differences (returnable rigid PP pots are 5x the weight of single-use flexible PP alternatives). When comparing the modelled scenarios, increases in emissions are mainly noticeable in production and transport emissions, with return rates and scale being the primary drivers, as discussed later in this report (see Part 3).

Perhaps surprisingly, reverse logistics emissions have a relatively low impact on overall emissions in the System Change scenario (10% to 22% of total emissions, depending on application). In a high-scale and highly standardised system the return cycle infrastructure can be optimally distributed to minimise transport distances. This also means that decarbonising reverse logistics could further reduce emissions by around 10% to 20% for the System Change scenario, depending on application, and further improve the case for reuse.[18] Analysing the other scenarios shows that the share of emissions from reverse logistics increases when scale reduces and packaging is not standardised and pooled. This is illustrated by the Fragmented Effort scenario in which reverse logistics represents from 19% to 35% of the total emissions, depending on applications.

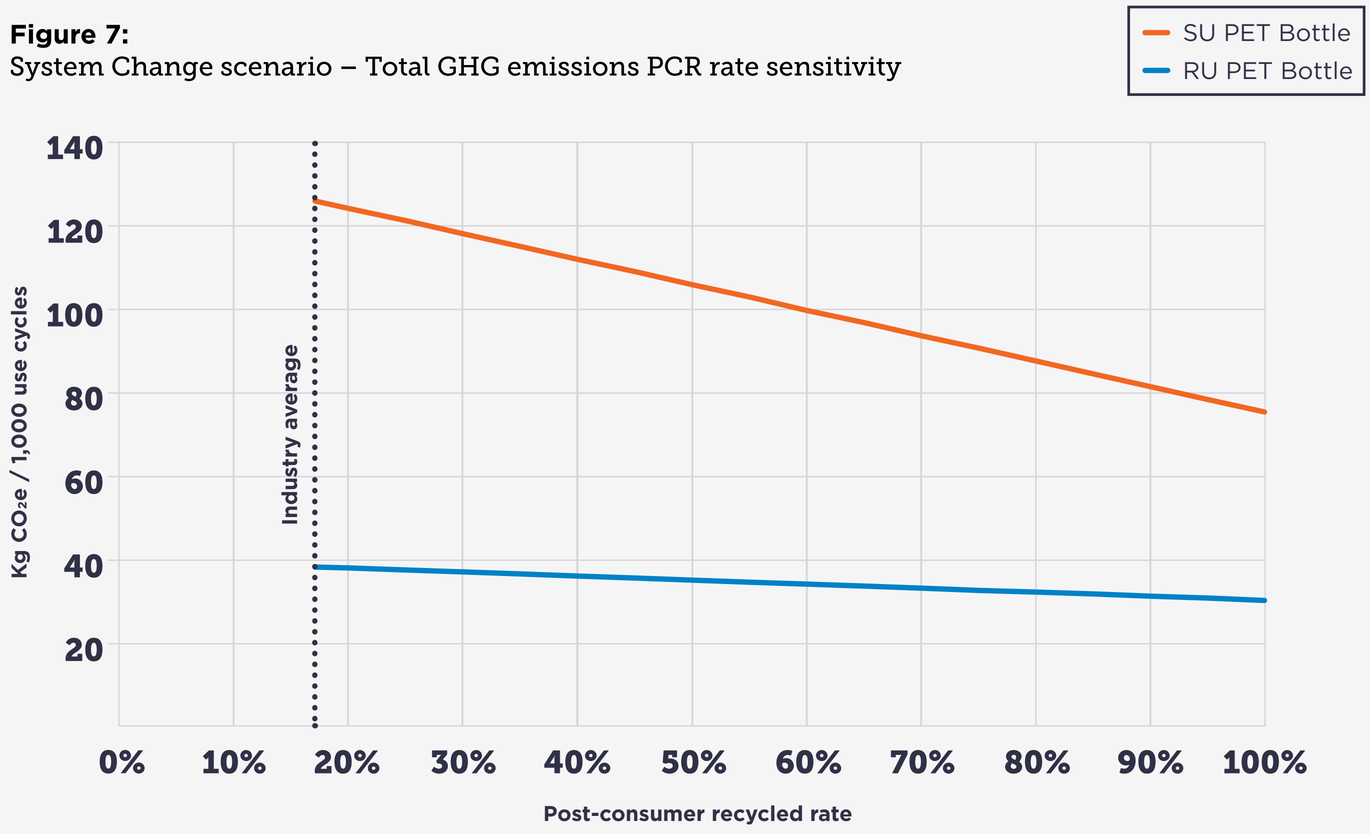
Figure 6:
System Change scenario – Total GHG emissions for returnable applications, split by value chain stages, compared to single use



May not sum to total due to rounding

Finally, our model shows that increasing recycled content[19] in both single-use and returnable packaging reduces emissions further, but return always offers the biggest GHG savings. Even with 100% recycled content, all returnable applications outperform their single-use equivalent in the System Change scenario. Figure 7 shows GHG emissions for a single-use and a returnable plastic bottle at different levels of post-consumer recycled content (PCR), and is representative of trends for all other applications. When analysing the Collaborative Approach scenario, increasing recycled content is never enough to make GHG lower for single-use to rigid-to-rigid packaging switches. When replacing single-use flexible packaging with returnable rigids, PCR content rates above 50% in the Collaborative Approach scenario would be enough for single use to generate fewer GHG emissions than returnable. However, such PCR content levels are unlikely to be achieved through mechanical recycling in the coming years for flexible food packaging and chemically recycled PCR would come with a higher GHG footprint as this technology is still in its infancy and is very energy intensive.

Figure 7:
System Change scenario – Total GHG emissions PCR rate sensitivity



1.2

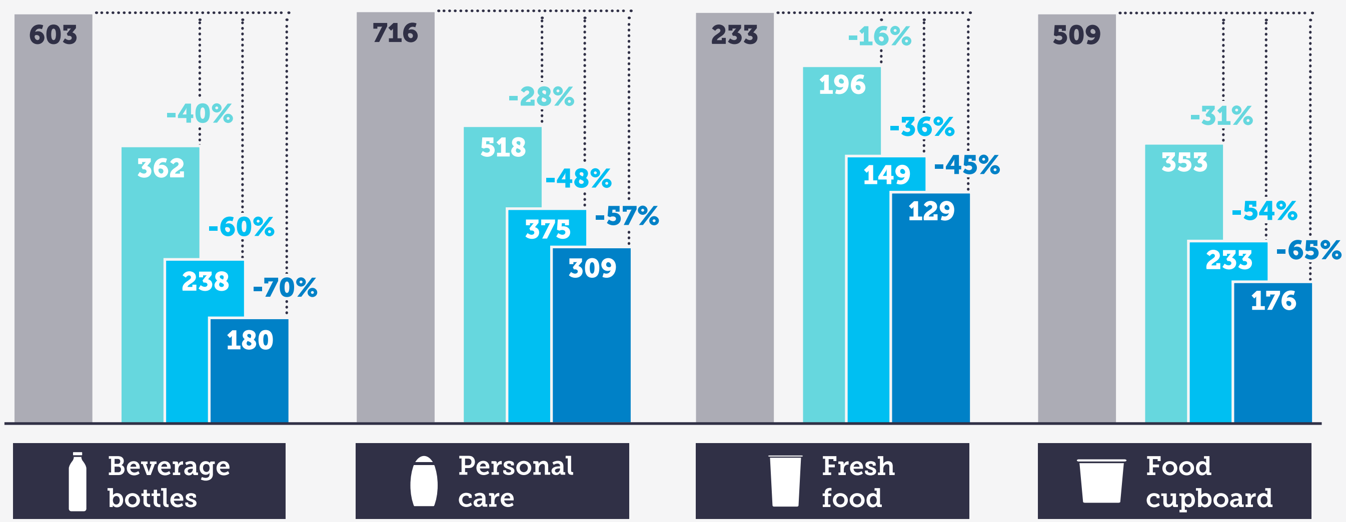
Returnable packaging is less water-intensive than single-use packaging in all scenarios modelled, using up to 70% less water

Despite returnable packaging requiring water in the washing stage of each loop, overall water use is reduced because the water used to produce one single-use packaging unit is 2 to 7 times higher[20] (depending on application) than the water used for cleaning the equivalent returnable packaging unit. As a consequence, each time a packaging item is cleaned and reused instead of being replaced by a new one, significant amounts of water are saved: the higher the return rates, the lower the water use. With return rates at 95% (~15 loops) such as in the System Change scenario, water use is reduced by 45% to 70%, depending on application. Even with lower return rates (80%, ~5 loops) such as in the Fragmented Effort scenario, water use is reduced by 16% to 40%. Our modelling is based on data and inputs from existing industrial cleaning facilities, where water is treated and reused several times.

Product application is a primary driver of water use. Our model has taken into consideration different water use requirements for cleaning different applications. For example, for fresh food and personal care applications there is little experience in cleaning packaging. Due to their setting and foaming properties, more intensive and thorough cleaning, with higher water and energy use, has been assumed for these applications compared to the well-known cleaning processes for beverage bottles. Given the relatively nascent industry of cleaning customer product packaging, there is significant scope for innovation in cleaning processes, particularly for packaging applications that are more difficult to clean, which may further improve reusable packaging's water footprint.

Figure 8:
Water use for returnable applications across the three modelled scenarios, compared to single use

Water use
litres / 1,000 use cycles
Single-use
Fragmented Effort
Collaborative Approach
System Change



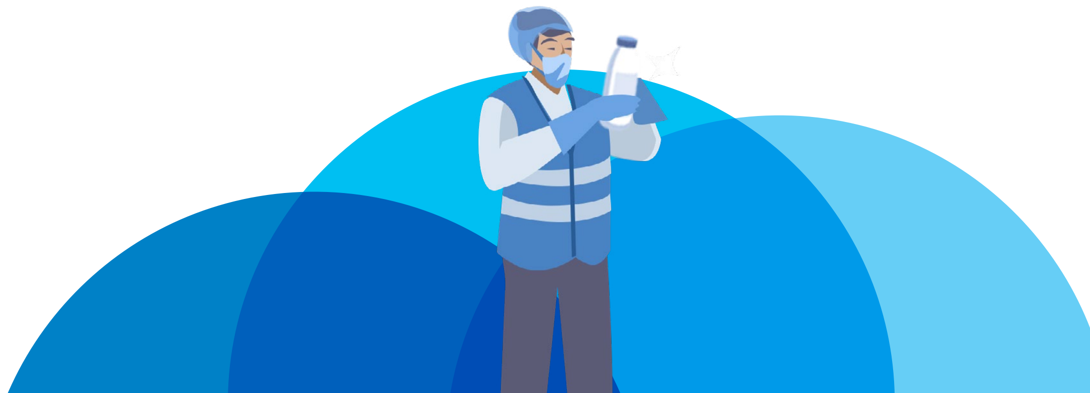
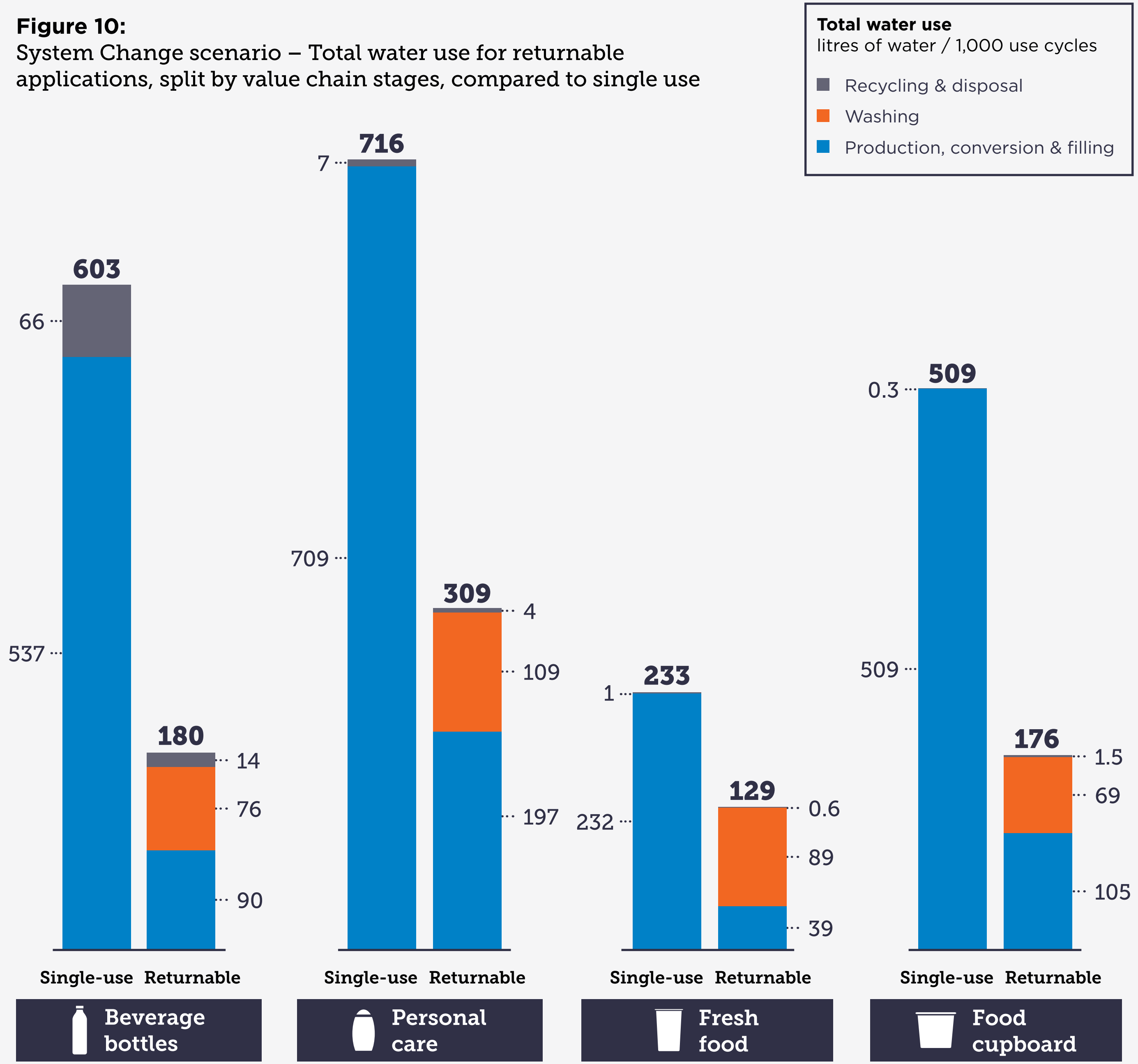


Figure 9:
System Change scenario — Water use to deliver five units of utility (for the beverage application)

Figure 10:
System Change scenario – Total water use for returnable applications, split by value chain stages, compared to single use



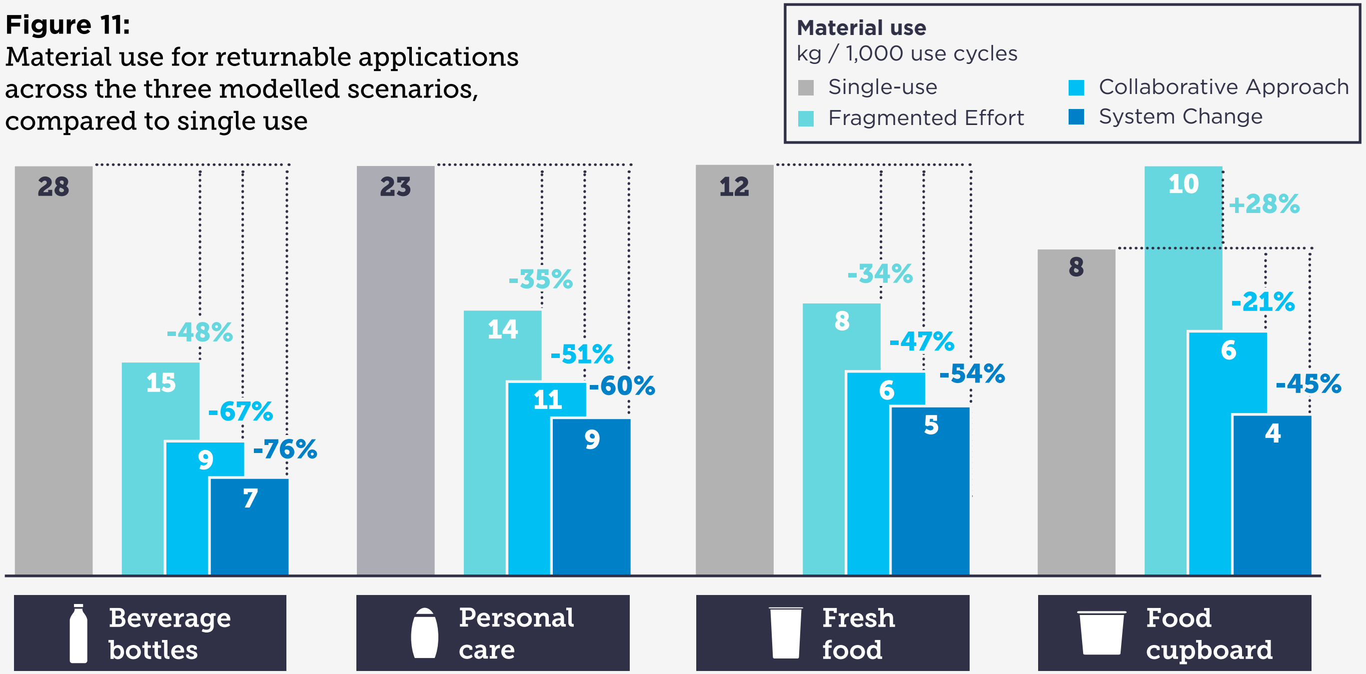
May not sum to total due to rounding

1.3

Switching from rigid single use to rigid returnable packaging provides a significant reduction in plastic volumes across scenarios — 54% to 76% — and a dramatic decrease in waste generation[21] — around 90%.

While each individual returnable pack requires more material than single use to ensure durability of the container over multiple use cycles, return systems can lead to significant material use reduction if packaging is reused enough times to offset the additional material used. The returnable packaging modelled is around twice as heavy as its single-use equivalent, with the exception of the returnable rigid food cupboard pot which is five times heavier than its single-use, flexible plastic equivalent. Yet, in the Collaborative Approach and System Change scenarios with high to very high return rates (90–95%), the ~10 to 15 loops per package result in significantly less material use across all applications, including food cupboard, where the single-use packaging is extremely light-weight flexible PP (Figure 11). Even with lower return rates (80%, ~5 loops), such as in the Fragmented Effort scenario, returnable packaging can achieve 34% to 48% material saving for rigid-to-rigid packaging comparison (Figure 11). The only case for which material use and waste generation could increase is when flexible packaging is replaced with rigid packaging and return rates are below 80%, as in the Fragmented Effort scenario (Figure 11).

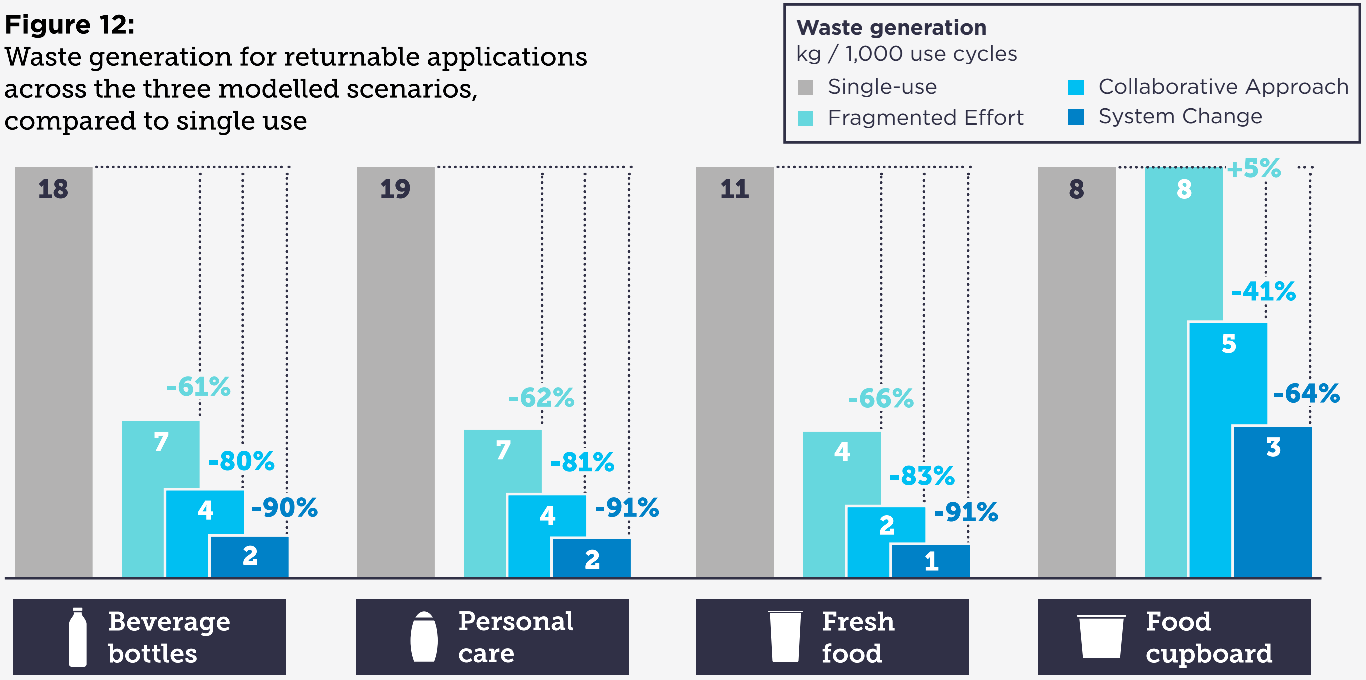
Figure 11:
Material use for returnable applications across the three modelled scenarios, compared to single use



Because material use is significantly reduced and because all returned packaging that cannot be reused anymore (due to structural damage or for aesthetic reasons) is sent directly to recycling, return systems also lead to a dramatic waste generation reduction: 64% to 91% for the System Change scenario. As returned packaging that is no longer suitable for use is centrally aggregated, it can be recycled in a high-quality, closed loop setup. Even at lower return rates (80%, ~5 loops), return can achieve substantial waste generation reduction for rigid-to-rigid packaging swaps.

Reusing closures in return systems could further reduce material use and waste generation. Our analysis has assumed single-use closures (caps and lids) for all reusable applications, given this is often the case in existing reusable packaging systems given the additional complications reusable closures pose to sorting and washing processes. As a result, in the System Change scenario — in which material use for the body of the packaging is greatly reduced compared to single use (see paragraphs above) — closures account for between 23% and 76% of the remaining material use per loop, depending on application, and the relative weight of returnable packaging body to closure. Therefore, significant further plastic savings could be achieved through either minimising the weight of single-use closures, while still ensuring their recyclability, or innovating to enable efficient sorting and cleaning of reusable closures. This additional material reduction would also have a positive benefit of potential GHG savings for reusable packaging over single use, where closures currently account for between 20% and 50% of all GHG emissions associated with returnable packaging.

Figure 12:
Waste generation for returnable applications across the three modelled scenarios, compared to single use



Part 2
Economic analysis

When designed collaboratively and operated at high scale, return systems can reach cost parity with single use for some applications

Our modelling has revealed that returnable packaging can compete economically with single use, if built with high levels of scale and collaboration. Shared return infrastructure and packaging designs play a crucial role in making the economics work. With today's prices, two out of the four modelled applications (beverage and personal care) reach cost parity with single use in our most ambitious scenario. With expected changes in regulation to fully account for the end-of-life cost and externalities of packaging, the business case for returnable packaging is set to become stronger for all applications studied. Finally, when deposit schemes are used, revenues from unreturned packaging can significantly support the economics of return models.

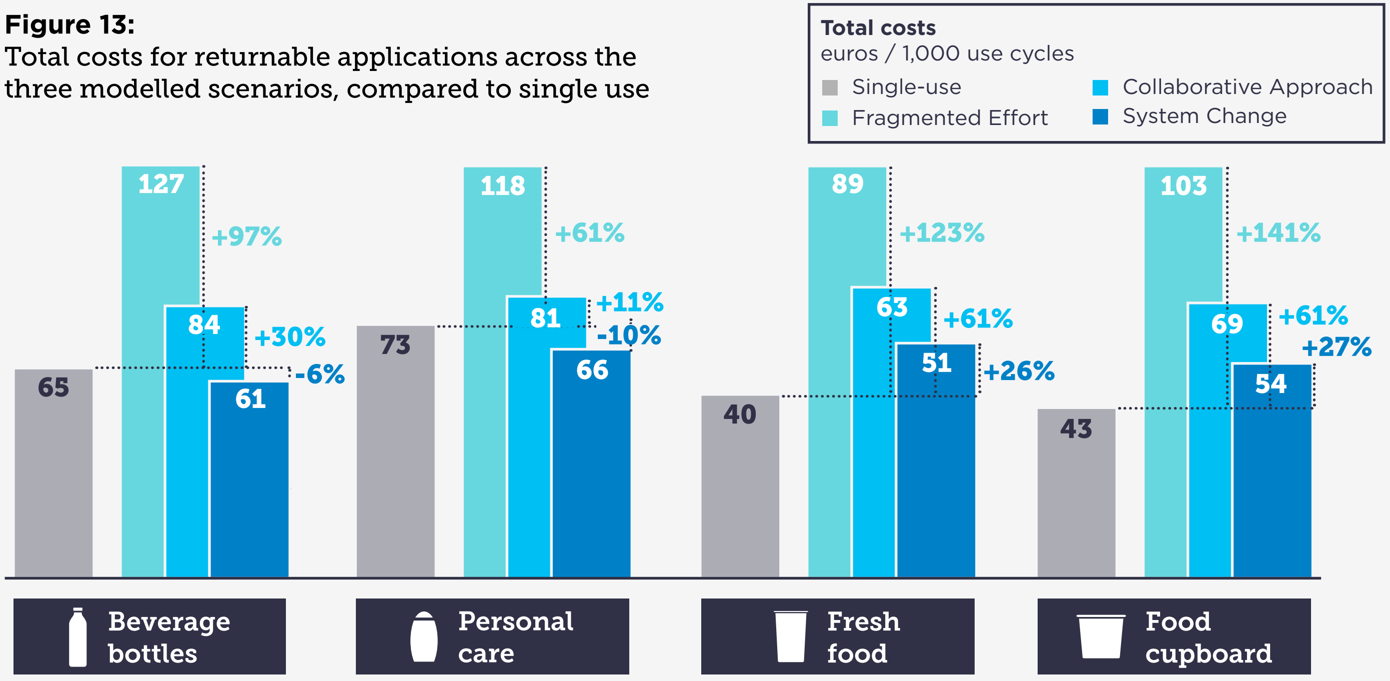
> It's a real breakthrough to have proven such a compelling business case for industry collaboration and reusable packaging standardisation, and to understand exactly the conditions and applications for which the business case makes sense.
>
> **Yoni Shiran**
> Partner and Plastics Lead, Systemiq

2.1

Modelling system costs at today's prices, highly scaled returnable packaging systems, built collaboratively from the outset, can reach cost parity for beverage and personal care sectors. The food applications modelled require additional enabling conditions to make the economics work.

In the System Change scenario, the total costs per unit of utility[22] for returnable plastic beverage bottles and personal care bottles are lower than single use (Figure 13). For reusable fresh food and food cupboard packaging, the total costs per unit of utility could be ~25% or ~EUR0.011 higher per use cycle compared to their single-use counterparts (Figure 13). Cost parity is dependent on the cost of production of the single-use packaging, which sets the baseline for reusable packaging to compete with. The differences between beverage and personal care applications and fresh food and food cupboard applications are not driven by significant increases in absolute sorting and cleaning costs for fresh food and food cupboard applications, but rather lower costs per unit for their single-use equivalent packaging.

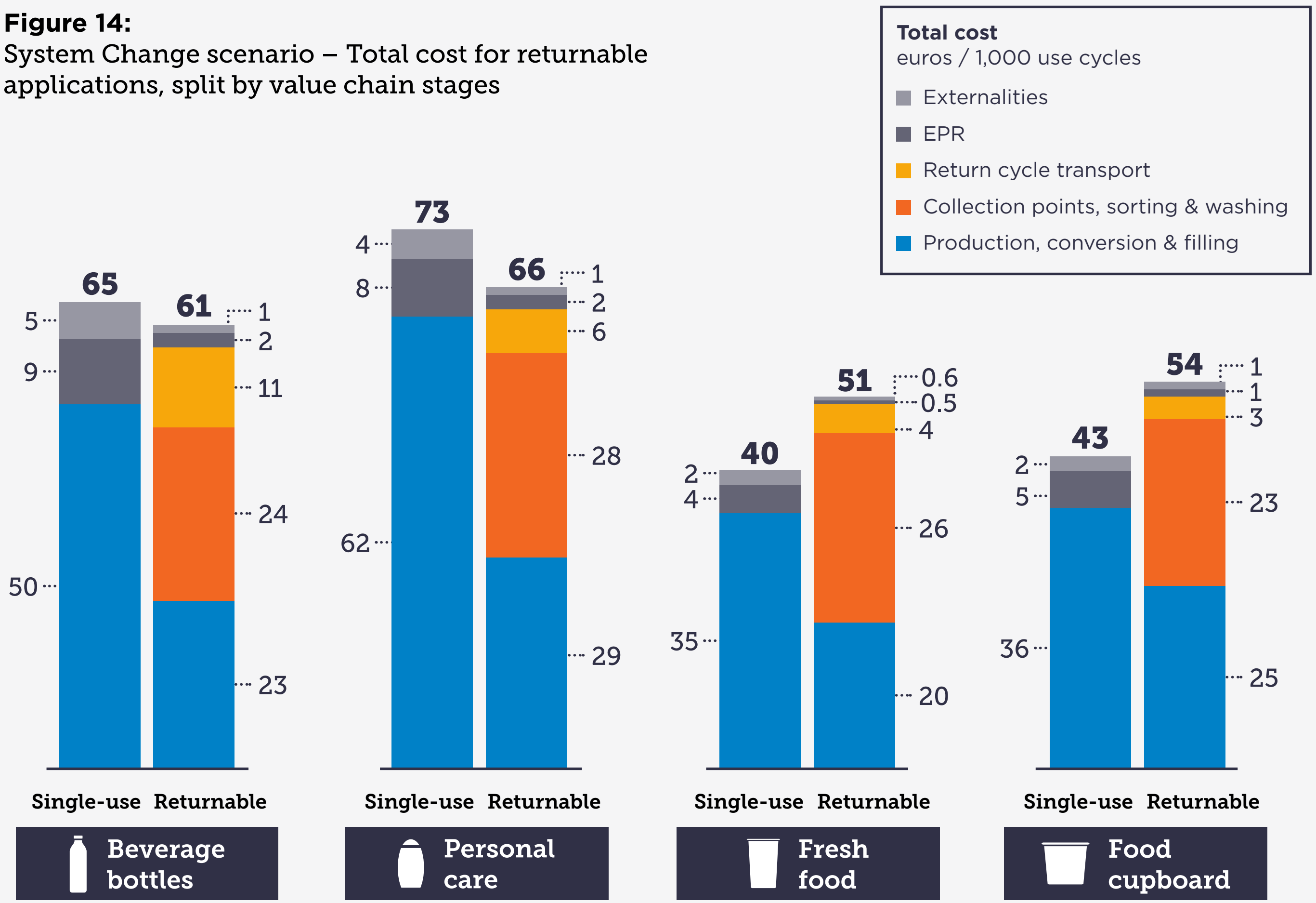
Figure 13:
Total costs for returnable applications across the three modelled scenarios, compared to single use



> Convenience and cost matter to consumers – so the idea that returnable packaging models could tick both these boxes in future is very promising. Getting these models working economically at scale, however, will take time and will require significant collaboration between retailers, manufacturers, policymakers, and civil society. Fragmented efforts will not be enough to drive the necessary systems change.

Jolanda de Rooij
Senior Sustainability Manager Circular Economy, Unilever

Figure 14:
System Change scenario – Total cost for returnable applications, split by value chain stages



May not sum to total due to rounding

A scenario-based approach has been used to communicate the modelling insights, in order to provide clarity across multiple variables. However, the analysis in this table provides other results for the best, and worst peforming categories: beverage and food cupboard.

This sensitivity analysis provides directional insights on the impact of reduced return rates, and the role of standardised or pooled packaging across two market shares: 10% and 40%. A system with a mix of bepoke and pooled packaging would likely fall between the two results for each return rate.

The results show the **% difference** of total costs of returnable applications, compared to single use, not including unreturned deposit revenues.

Scale and shared infrastructure

As used in the Collaborative Approach and System Change scenario

Packaging system and return rate

Results for both bepoke and pooled packaing.

Results for return rates between 50-95%.

Return rate	Packaging system	Market share: ~10% – Possible through big volume shifts to reuse and **some sharing of infrastructure**: Beverage bottles	Market share: ~10%: Food cupboard	Market share: ~40% – Large shift to reuse within a **highly shared infrastructure**: Beverage bottles	Market share: ~40%: Food cupboard
50%	Bespoke	+71%	+151%	+54%	+139%
	Pooled	+62%	+137%	+40%	+124%
70%	Bespoke	+63%	+119%	+40%	+102%
	Pooled	+48%	+99%	+21%	+81%
80%	Bespoke	+58%	+103%	+33%	+84%
	Pooled	+39%	+80%	+10%	+59%
90%	Bespoke	+53%	+87%	+25%	+65%
	Pooled	+30%	+61%	+0%	+37%
95%	Bespoke	+52%	+79%	+22%	+55%
	Pooled	+28%	+57%	-6%	+27%

2.2

Return incentives, such as deposits, can support the economic viability of return systems and de-risk the transition phase

Financial incentives (e.g. deposits or penalties) can play an important role in improving return system economics. Importantly, such financial measures can incentivise customers to return packaging.[23] This is important because high return rates mean packaging achieves a high number of loops, spreading the initial costs of production and conversion and reducing the cost per unit of utility.[24] Additionally, financial incentives de-risk the investment as retained deposits from unreturned packaging can cover, partly or fully, the cost of that packaging. This is particularly relevant as businesses transition, or in scenarios characterised by relatively low return rates.

In the System Change scenario with high return rates, if a EUR 0.20 financial incentive (as a example, and in line with deposit prices of the highest performing European DRS systems)[25] is retained when packaging is not returned, the net costs of returnable beverage and personal care bottles would become significantly lower than their single-use equivalent (-21% and -23%) and food applications would reach cost parity (Figure 15). At lower scale and with lower return rates, such as in the Collaborative Approach scenario, these mechanisms open up the opportunity for the net costs of beverage and personal care applications to respectively match and be lower than single use (Figure 15). The system setup and the wider governance of return systems will be required to determine and manage how these revenues are accounted for.

Figure 15:
Total costs of returnable packaging, compared to single use for the three modelled scenarios

2.3

The primary cost drivers of return systems are collection, sorting, and cleaning costs — largely influenced by labour costs — with transport costs being relatively low when logistics are optimised.

Costs for returnable packaging are roughly evenly split between two main cost centres: initial production of the packaging and return costs (i.e. transportation, collection, sorting, and cleaning). Over 80% of total costs are operational expenditures (OPEX). In the System Change scenario, production of returnable packaging represents from 37% to 47% of the total cost, depending on application, and return costs from 49% to 58%. For example, the analysis of beverage bottles in the System Change scenario shows that the total cost to deliver a unit of utility is EUR 0.061, of which 37% (EUR 0.023) is production costs and 58% (€0.036) return costs. Labour costs contribute over 60% to the operational costs of reusable packaging. Given this analysis is based on labour costs in France, in countries where the average labour costs are lower, reusable packaging could more easily compete with single use. However, reduced labour costs shouldn't be advocated for when they disadvantage workers, particularly relative to costs of living in their geography — it's vital that the type of jobs that are created in a circular economy are considered so the health, safety, and rights of all people involved are respected.

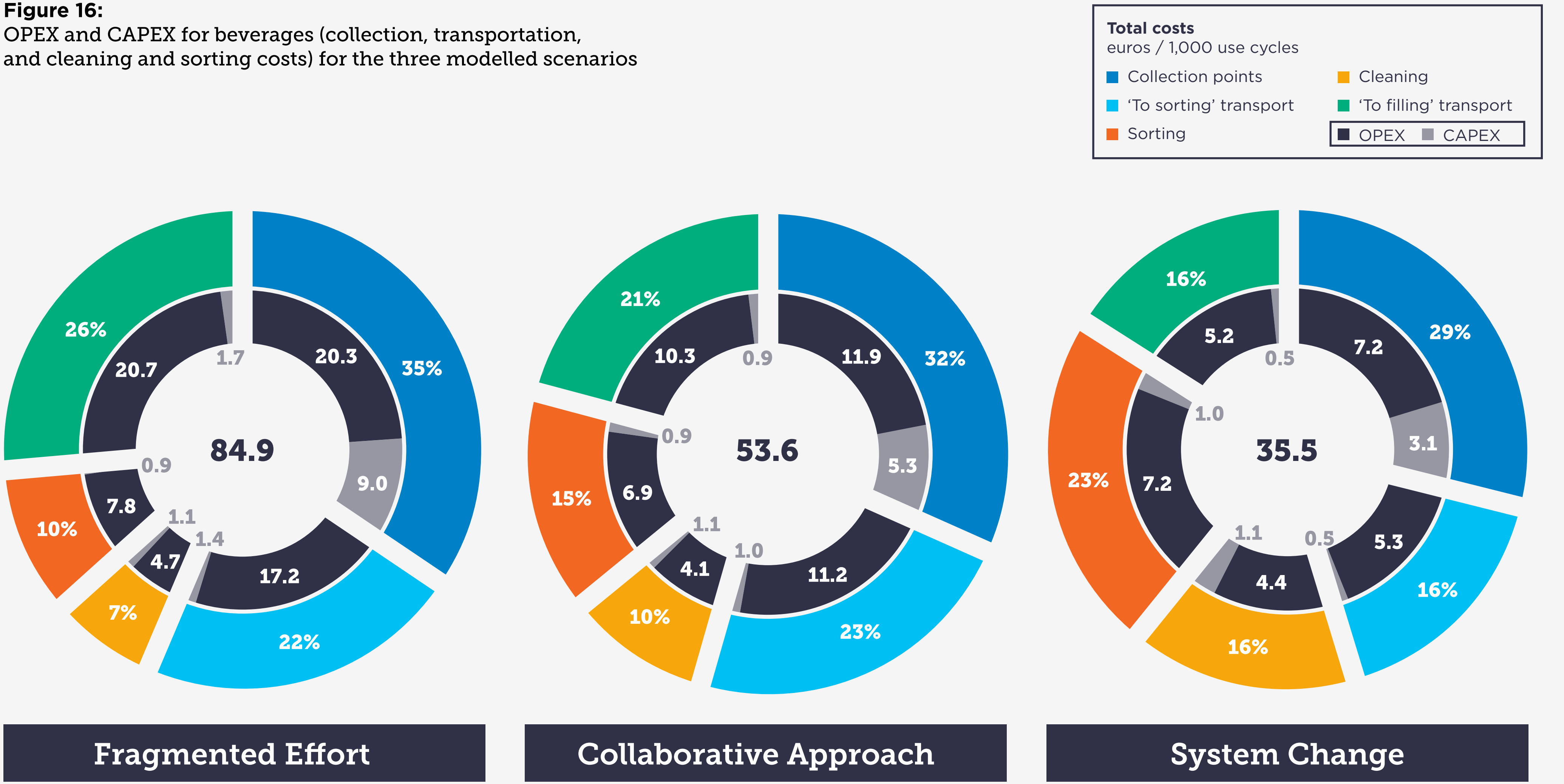
Collection costs represent a significant proportion of return costs and are highly sensitive to economies of scale. Further research on other collection methods is needed to understand their economic potential and experience for customers. Collection costs represent 29% to 39% (depending on application) of the total return costs (including collection, reverse transport logistics, and sorting and cleaning) in the System Change scenario, and 35% to 52% in the Fragmented Effort scenario. In our model, collection point infrastructure is relatively fixed: at low scale, every supermarket in France[26] must be equipped with at least one Reverse Vending Machine (RVM) (~15,000) and this number increases with scale, up to ~30,000. This means that at low scale, only a small number of packages are collected per RVM, resulting in a high investment cost per unit of utility. This significant bucket of fixed costs decreases rapidly when scale increases, as the number of units collected by collection point increases. As such, the collection CAPEX and OPEX per 1,000 units of utility for all applications reduces by 65% in the most ambitious scenario compared to the least ambitious (reflected in Figure 16 for beverages specifically) — *see section 3.1 for further analysis on the role of scale in reducing collection cost.*

Other collection methods exist, for example, return from neighbourhood collection points, return from home upon online grocery delivery, and return from home via kerbside collection — see Design pathways appendix for more details. As these systems require very different logistics than return to retailer, they were not included in the scope of this study, but we encourage further research to understand if and how different collection systems can reduce collection costs while increasing customer convenience, adoption, and return rates.

Finally, in the System Change scenario, the impact of transport on total cost is limited (6–19%) as at high scale and with standardised packaging, the distribution of sorting and cleaning facilities is dense, resulting in very low transport distances — averaging about 130km for reverse logistics for beverages and food applications, and 240km for personal care applications.* In comparison, in the Fragmented Effort scenario, transport costs represent 13% to 32% of total costs. For further analysis on the impact of scale and standardisation on transport costs and environmental impacts, see sections 3.1 and 3.2.

* The distance of each route varies significantly – the longest route for beverages and food is between 425km and 600km, and personal care is 680km.

Figure 16:
OPEX and CAPEX for beverages (collection, transportation, and cleaning and sorting costs) for the three modelled scenarios



May not sum to total due to rounding

2.4

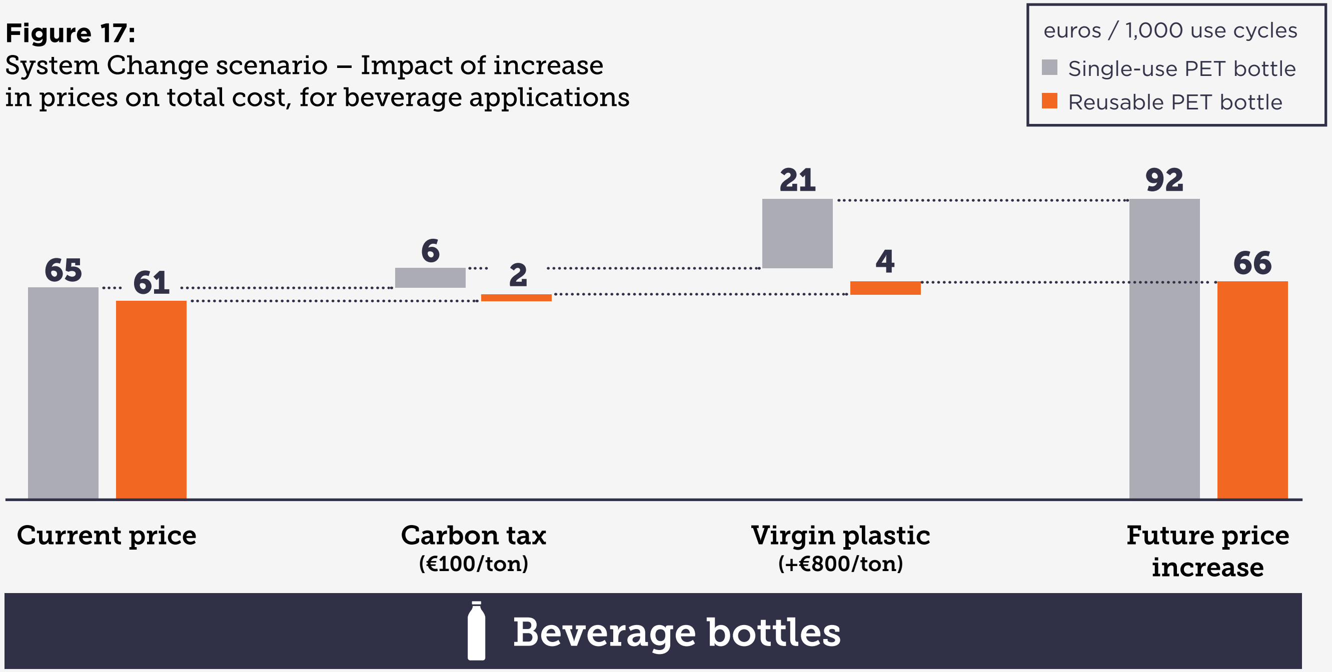
With expected changes in regulation, to fully account for packaging end-of-life cost and externalities, the business case for returnable packaging is set to become stronger

> Policies, technological innovations, and the public are fostering smarter and more circular use of materials. This is set to make single-use packaging more costly and to provide opportunities for market front-runners using returnable solutions. In the long-run, single-use products and packaging are simply not sustainable for the planet or as a business model. They need to be left in the past.
>
> **Tobias Nielsen**
> Circular economy expert, European Environment Agency

While our analysis has used today's prices, it is widely expected that the total life-cycle cost of single-use packaging will increase in the future as governments extend the responsibility of producers to pay for the externalities caused by their packaging use. EPR and carbon tax legislation is being introduced in a growing number of countries, and governments are increasingly looking at plastic taxes to restrain plastics production and demand. We conducted a high-level estimation of the impact of different price increases for beverage and food cupboard (see section below: Assumed price increases), as they are representative of an application that competes with single use at today's prices, and one that does not.

With these increased prices as a result of legislation, the case for return becomes stronger. Indeed, the total costs per unit of utility for returnable beverage bottles could be 28% lower than single use in the System Change scenario (Figure 17). Even for food cupboard packaging, where the economic difference between single use and return is largest, the impact of these increases results in return costs almost matching single use (+3%, Figure 18). This is without taking into account potential revenues from financial incentives (e.g. deposits) that could further support the economics of reuse.

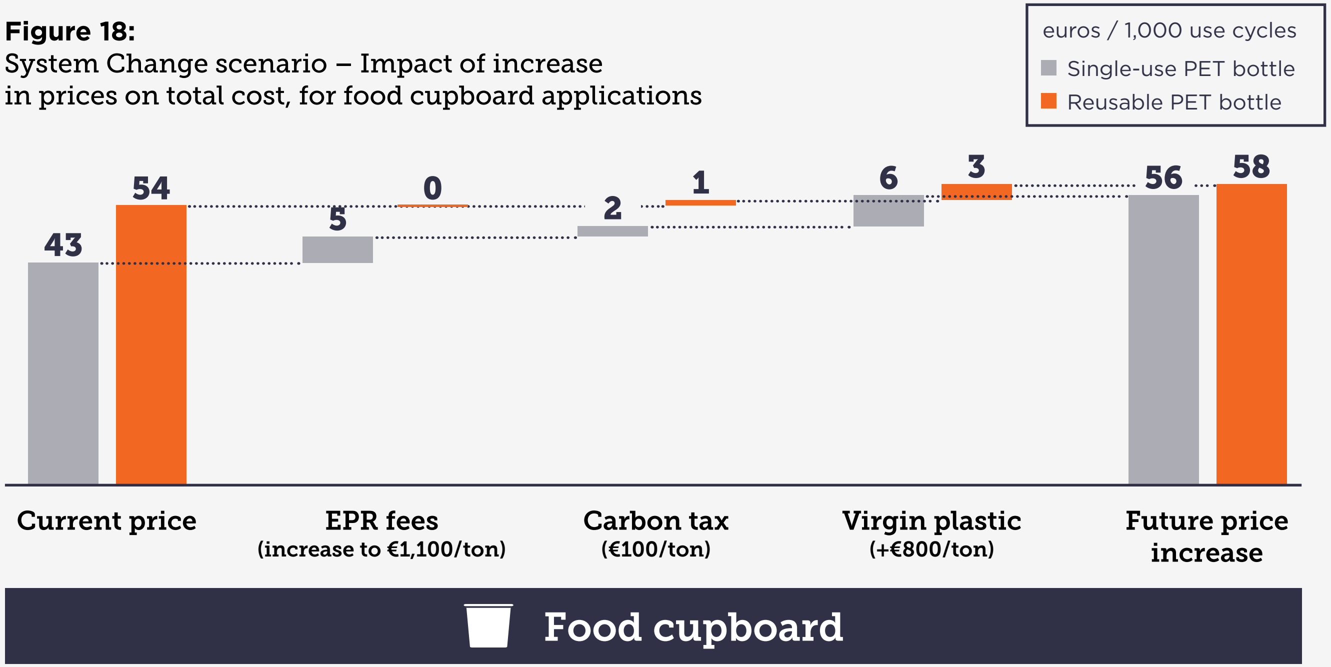
Figure 17:
System Change scenario – Impact of increase in prices on total cost, for beverage applications



May not sum to total due to rounding

As return models beyond beverages are still in relatively early stage development, we expect innovation and learnings gathered over time to drive efficiencies — especially in collection, and sorting and cleaning processes — and reduce the cost of returnable packaging, for example through customised return models building upon existing e-commerce infrastructure (e.g. return from home) or innovation in operational technology.

Figure 18:
System Change scenario – Impact of increase in prices on total cost, for food cupboard applications



May not sum to total due to rounding

Assumed price increases

While it is not possible to predict future regulations and related tax levels, this analysis aims to study the potential impact of such regulation on return economics and shows that regulatory trends shift the economics in favour of reuse.

We made the following assumptions:

- **Carbon prices increasing from EUR 45 to EUR 100 per tonne**, in line with the current price of the carbon tax in France[27] and the 2030 objective of French regulation.[28]
- **The cost of plastic increasing by EUR 800 per tonne via a plastic tax** – impacting the cost of both reusable and single-use packaging. This is in line with the European plastic contribution,[29] in place since 1 January 2021, which applies a rate of EUR 0.80 per kilogram to plastic packaging waste that is not recycled, and slightly under the tax on plastic packaging modelled by the OECD in its Plastic Global Outlook of USD 1,000/tonne by 2030.[30]

We then considered the impact of EPR in two different contexts:

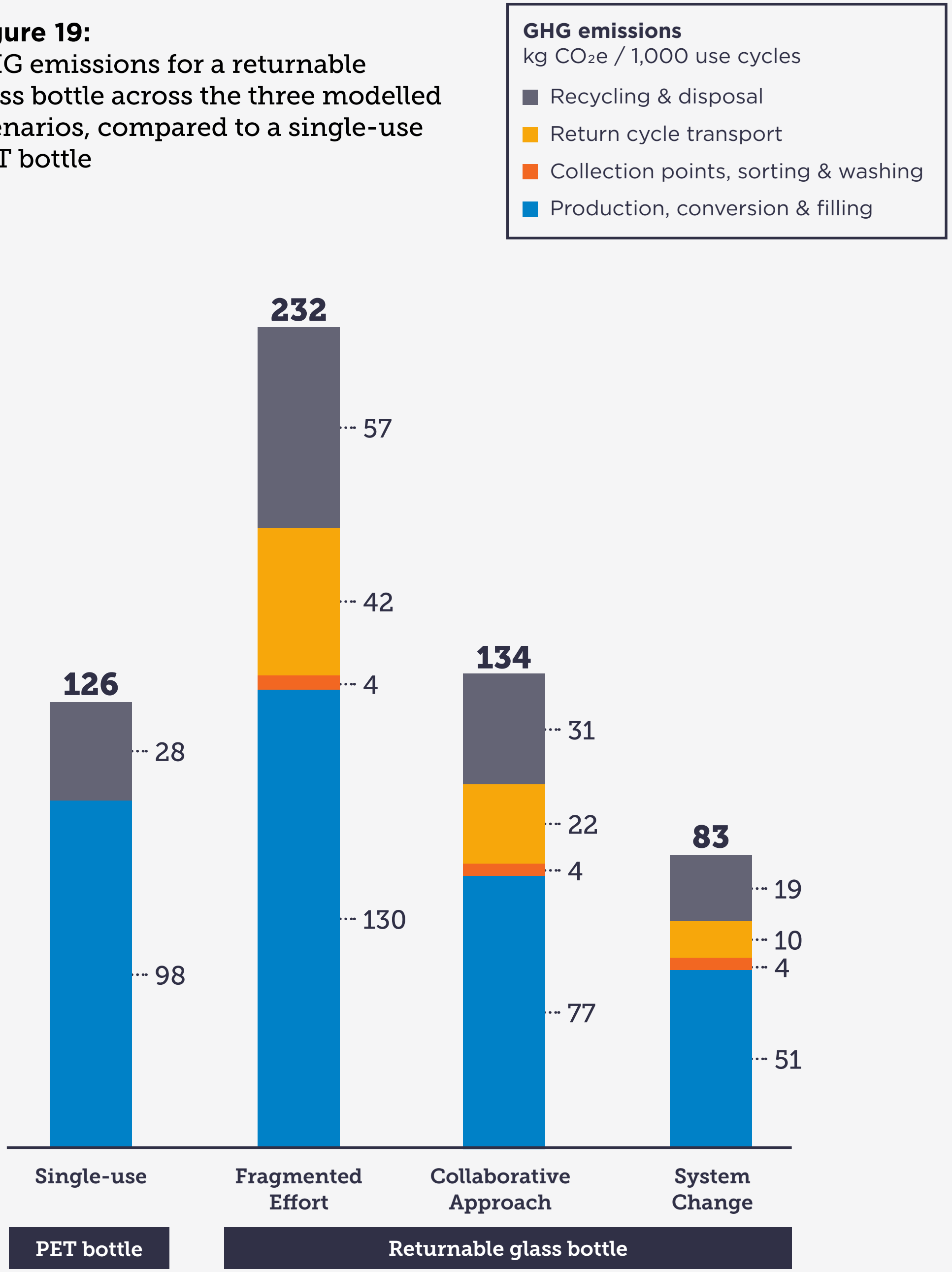
- For beverage bottles, we assumed EPR fees to stay constant (as current EPR systems and fees in France enable economically viable recycling for PET) and assessed the impact of two different levers.
- For food cupboard packaging, we conducted a high-level estimation of the impact of **EPR fees for flexible packaging increasing from EUR 487 to EUR 1,100 per tonne**, recognising the current fee is insufficient to make recycling work for flexible packaging, and using a similar, conservative fee to that charged in Belgium (EUR 1,383 for PE film; EUR 1,844 for PP or other plastic films; EUR 4,033 for films with aluminium laminates or other non-recyclable elements), where flexible packaging is now collected for sorting and recycling.[31]

Returnable glass: impact of material changes on returnable packaging performance

This study focuses on the impact of collaboration in the design of return systems to allow for comparison across our scenario builder variables: packaging design and material selection are not part of the scope. However, in order to lay the foundations for further discussion, we considered a substitution with glass to assess the impact of material change. We chose to study glass as well-proven beverage return systems have been operating with glass bottles for decades, offering valuable data and learnings. However, we acknowledge that other materials, such as metal, can also be utilised in reuse models.

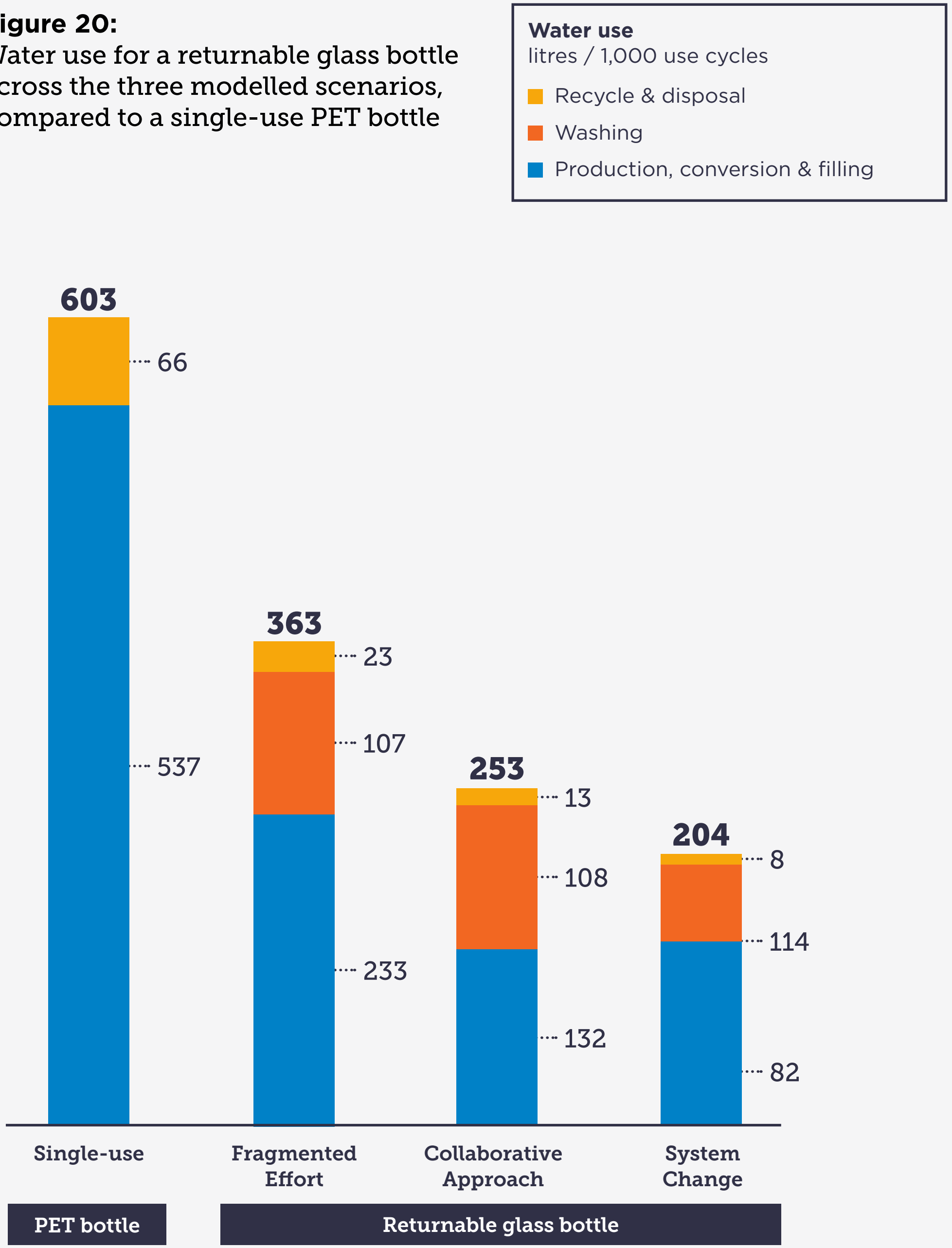
- In an ambitiously scaled, highly collaborative and standardised reusable packaging system (as described by the System Change scenario) switching from single-use PET beverage bottle to reusable glass, despite its higher weight, can reduce GHG emissions by 34% and water use by 66% — see Figures 19 and 20.
- Economically, in this scenario, glass bottles cost 42% more per use cycle than their single-use PET alternative — see Figure 21 below.
- The largest driver of both these environmental and economic impacts is production and conversion, because reusable glass bottles weigh 20x more than single-use PET bottles. Reducing the production-related emissions for glass by shifting to renewable energy sources would have a dramatic effect on the GHG comparison.
- In scenarios with lower scale collaboration, return rates, and standardisation, glass packaging performs significantly worse — primarily driven by lower return rates resulting in higher emissions, water use, and cost from production and conversion.
- Transport emissions from glass bottles in comparison to PET bottles is not notably very different, primarily because the majority of the weight in the logistics value chain is the truck itself, the transport packaging, and the liquids transported, not the bottles themselves.
- The comparison of single-use glass to returnable glass is likely to offer more positive outcomes, as demonstrated by a recent study conducted by l'ADEME[32] which found a relative advantage for reusable glass compared to single-use glass for a large majority of the scenarios studied, and for five of the seven environmental impact categories covered, including climate change.

Figure 19:
GHG emissions for a returnable glass bottle across the three modelled scenarios, compared to a single-use PET bottle



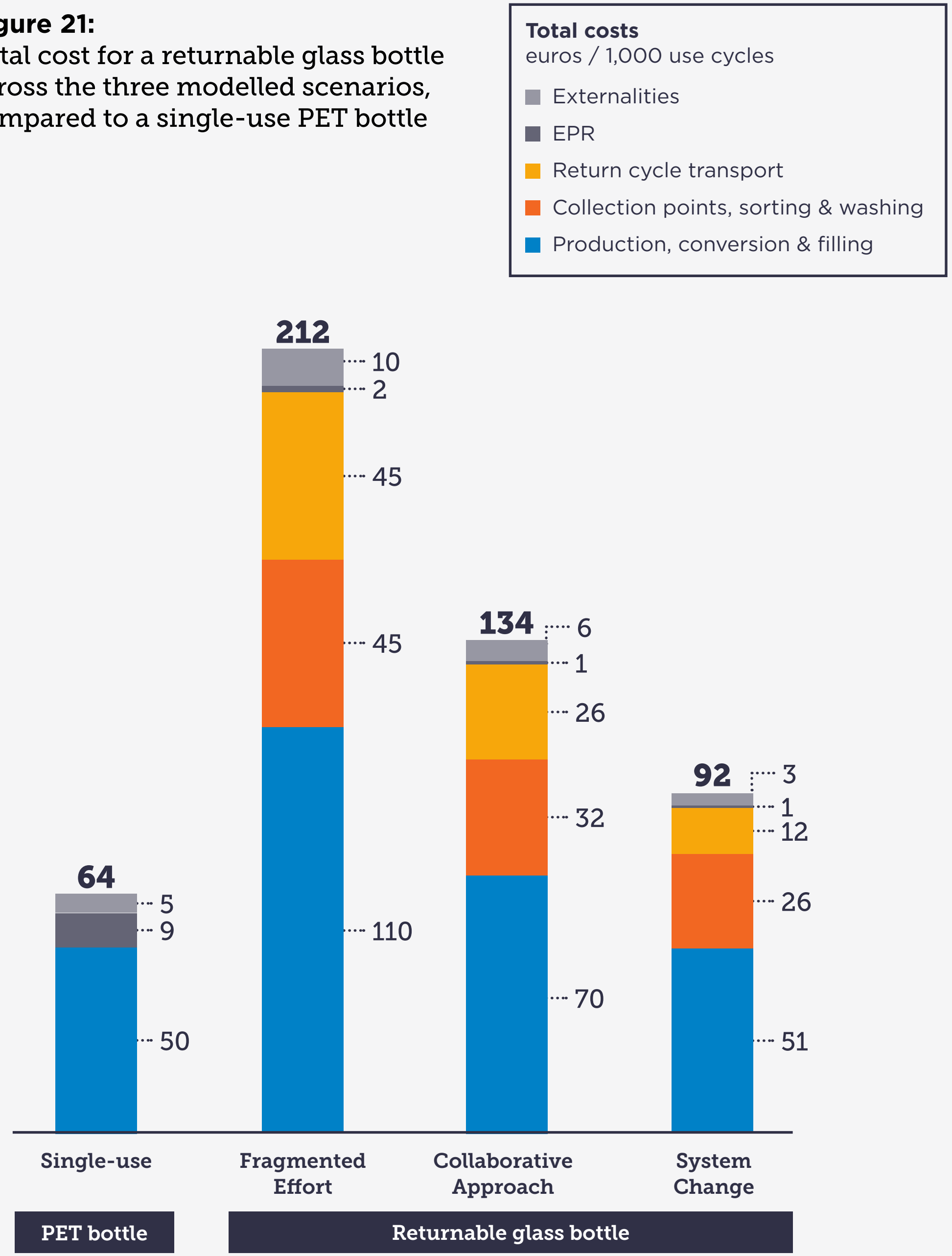
May not sum to total due to rounding

Figure 20:
Water use for a returnable glass bottle across the three modelled scenarios, compared to a single-use PET bottle



May not sum to total due to rounding

Figure 21:
Total cost for a returnable glass bottle across the three modelled scenarios, compared to a single-use PET bottle



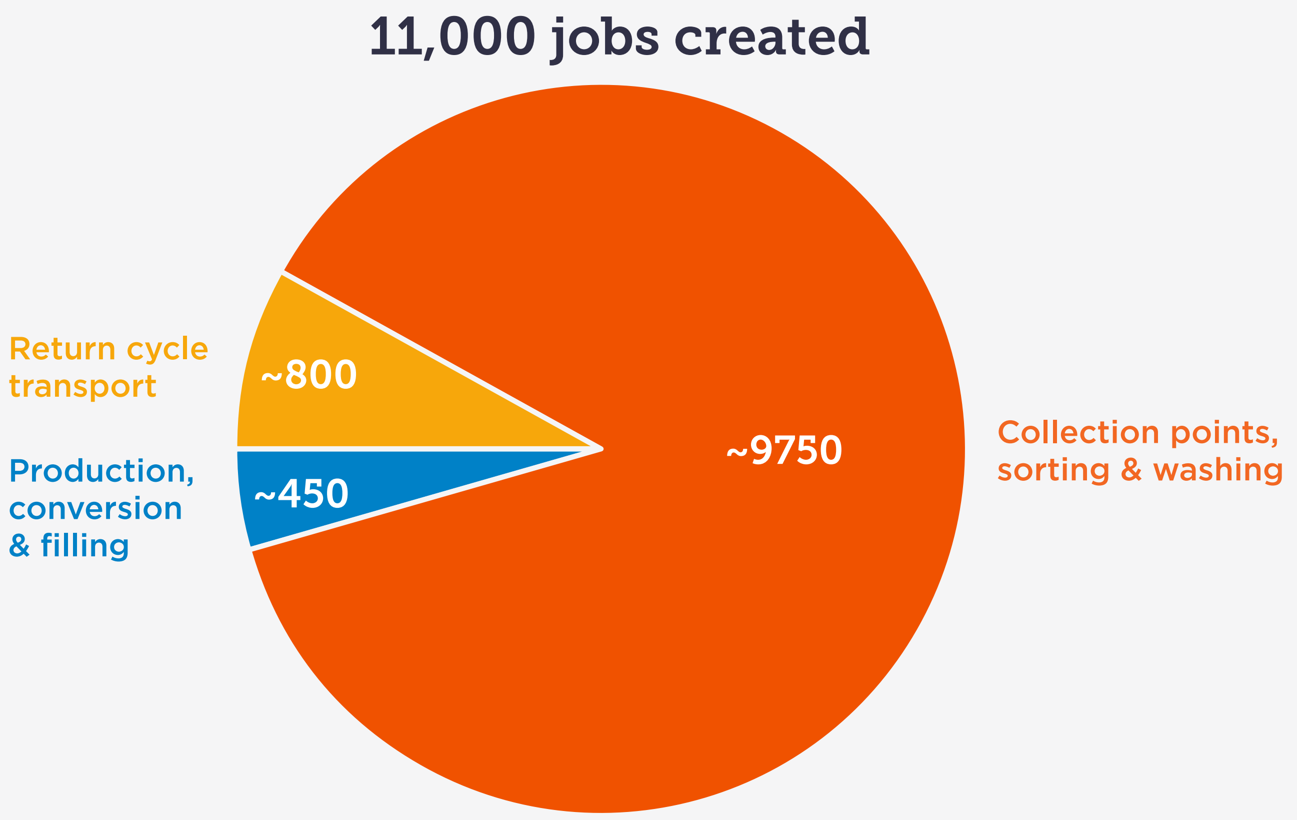
May not sum to total due to rounding

2.5
Scaling return systems is a unique opportunity to create local jobs across the return value chain

Building scaled return systems, could create at least 11,000 local jobs for return logistics activities in a market like France, based on the four modelled applications making a 70% switch to reuse. This represents an eighth of the total jobs in the French recycling industry today (across all materials).[33] The majority of these job opportunities would be semi-skilled or skilled jobs, primarily within the sorting and cleaning stages, requiring personnel to operate and oversee the sorting and cleaning lines, as well as to manage the operations of return centres.

This considers only the new jobs required to manage the operations of a returnable packaging system — in filling, collection, sorting, washing, and reverse logistics. A significant number of additional jobs would be required to enable a transition to returnable packaging, for example head-office staff at return service providers to develop and grow their offering. We have not modelled jobs that might be displaced in sectors such as fossil fuel extraction, plastic production and conversion, and waste management. However, the return industry is typically more labour intensive and localised than the extraction and production of single-use packaging (especially the sorting and cleaning process).[34] Ultimately, the number of jobs created by moving from single use to return will depend on multiple factors, including the willingness of public authorities to reorient the economy and their ability to offer skills training and retraining.

Figure 22:
'Return jobs' in France, considering 70% of four modelled applications' market switch from single use to return



May not sum to total due to rounding

2.6

Scaling up return systems incurs investment costs to adapt supply chains to new packaging and processes, and deploy the necessary infrastructure. Our study demonstrates these costs are considerable but manageable, even with the most transformational scenario.

Transitioning to return systems involves transition costs for:

1. The adaptation of filling lines and processes to accommodate new returnable packaging (or the building of new lines and processes when retrofitting is not possible).
2. The implementation of collection infrastructure, logistics network, and the creation of sorting and cleaning centres.

Additionally, scaling return systems will require sustained research and development investments, along with communication efforts to ensure customer adoption.

Adaptation of filling lines

The investment costs to shift production processes from single use to return depend on the type of current and proposed packaging, and significance of changes needed to the production line. The amount of disruption to existing production and filling processes can be thought of in two broad groups:

- **Single-use packaging that can be used in return systems as is or with a limited number of design adjustments** (e.g. bottles — if the body material is not changed and if fully formed single-use bottles are used, not 'preforms'). In this case, most of the existing infrastructure and production equipment (e.g. filling, capping, labelling machines) can be retrofitted to accommodate very similar, albeit more durable, returnable packaging. These 'quick win products', which have only a limited transition cost to shift to filling returnable packaging, can outperform single use relatively quickly.
- **Single-use packaging that requires significant design changes or complete redesign of the packaging or manufacturing process to be used in return systems** (e.g. moving from single-use flexible film to reusable rigid container). In this case, most of the existing infrastructure and production equipment must be changed, involving significant investment.

Moving to standardised packaging can further increase the transition cost in the short term. However, it has the potential to significantly reduce the operational cost, as discussed above.

When considering investments to transition filling lines, It is worth noting that — to some extent — brands are used to the process of redesigning packaging and adapting supply chains and production processes accordingly; it is common for brands to change their packaging design every two to 10 years to update the branding, or as material technology or legislation requires it. As such not all of these investments need to come 'on top' of routine investments.

Collection infrastructure, logistics, and sorting and cleaning centres

Transition costs related to collection, sorting and cleaning infrastructure is dependent on scale, collaboration, and the collection method implemented:

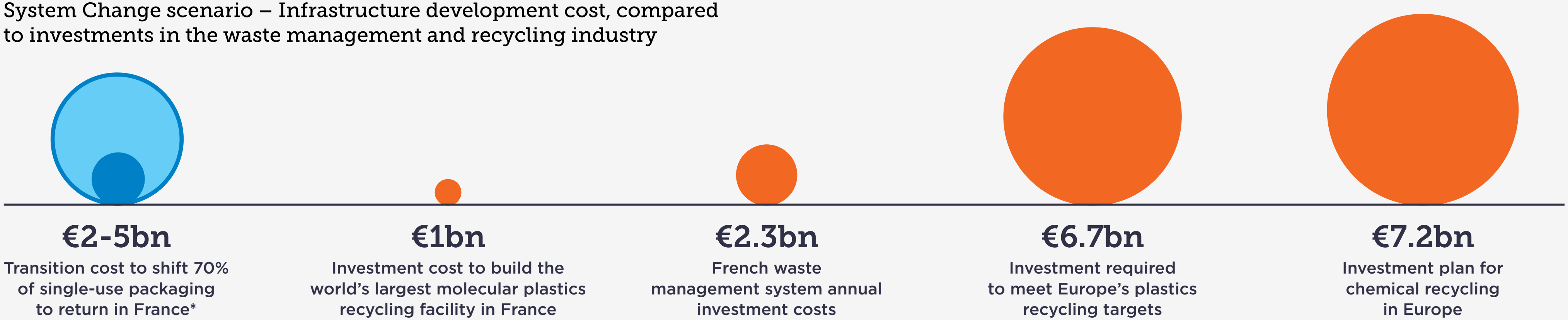
- High-scale systems processing large amounts of packaging will require more collection points and sorting and cleaning centres. This will have a high transition cost but also a potentially quick pay-back period as costs per unit are significantly lower than in smaller scale systems (see Part 2 for more details)
- Sharing the infrastructure can reduce investment costs and avoid duplication of return infrastructure
- Different collection methods, for example customers returning to retailers (requiring RVMs), collection from home via grocery delivery (increasing home delivery complexity), and kerbside collection will have significantly different investment costs.

Our analysis quantified transition costs needed to scale up return systems in France to make return the norm. Our findings indicate a shared transition cost of EUR 2bn to 5bn in CAPEX. Put in context, this is comparable to current annual investments dedicated to the recycling industry. This figure covers the investment required to shift 70% of packaging to return systems (return to retailers) for the four modelled applications in France. It accounts for costs to adapt or retrofit existing filling lines, install RVMs at retail collection points, build sorting and cleaning centres, and acquire vehicles to manage the logistics. It does not include other costs that might be required in the transition, for example customer education campaigns, establishing data systems, or conducting pilots. While these are considerable investments, they would be spread across multiple organisations throughout the entire sector and value chain.

Comparing this estimated cost of transition with other investments in the sector indicates that it is manageable and within industry norms. The French waste management system costs approximately EUR 20 billion per annum of which over EUR 2 billion is annual investment costs.[35] Eastman recently announced a EUR 1 billion investment to build the world's largest molecular plastics recycling facility in France.[36] In Europe, a study from the European Investment Bank shows that at least EUR 6.7 billion investment is required to meet Europe's plastics recycling targets[37] and European recyclers announced an investment plan for chemical recycling growing from EUR 2.5 billion in 2025 to EUR 7.2 billion in 2030.[38]

These investments would not necessarily be in addition to existing investments. Given significant reductions in material use and waste generation in return models, investments in return systems would replace other investments in sorting and recycling infrastructure that would otherwise be required to deal with the equivalent single-use packaging. Countries with existing DRS, even if for recycling and not reuse, may significantly benefit from a reduced cost of transition by repurposing this collection infrastructure.

Figure 23:
System Change scenario – Infrastructure development cost, compared to investments in the waste management and recycling industry



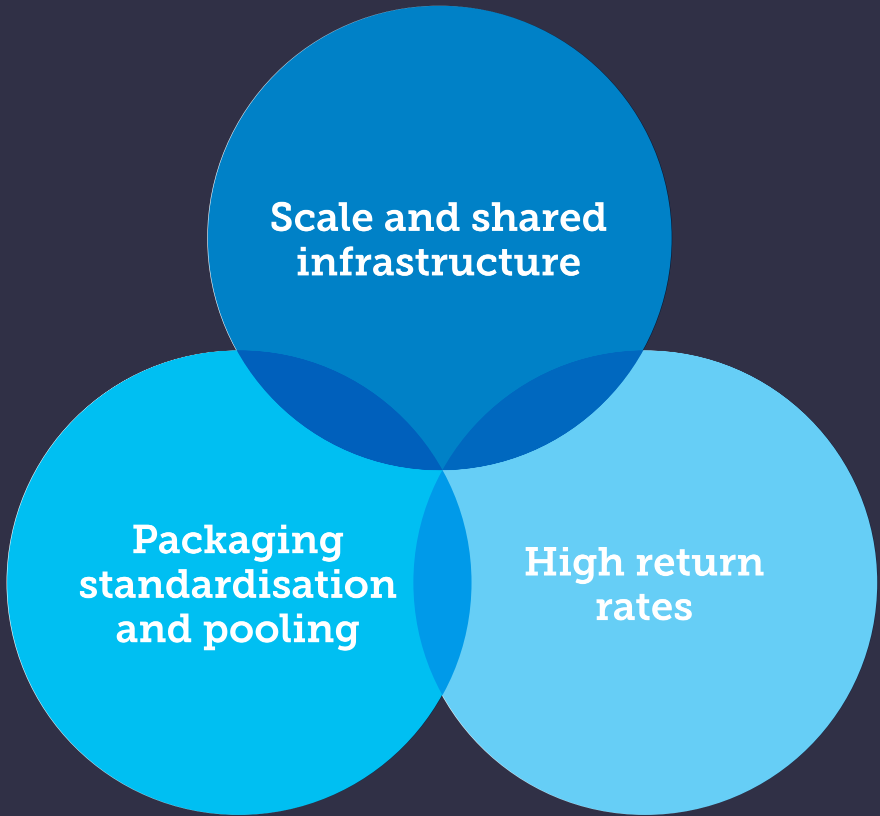
* for the four modelled applications (see section 'about this report'), calculations based on French data

Part 3
Key drivers of performance

Realising the full potential of return systems relies on three key performance drivers and overcoming implementation challenges

It is clear that to reap the full rewards of return systems, from an economic and environmental perspective, collaboration is key. Therefore a fundamentally different approach is required to build effective reuse-return systems, involving collective action on three key drivers of performance.

It is also important to note that while there are many design choices that can unlock efficiencies in return systems, three that have the potential to dramatically improve the economic and environmental outcomes are shared infrastructure, standardisation in packaging design, and achieving high return rates. See the Design pathways appendix for more analysis on other design choices such as product selection, material selection, packaging design, and other operational factors.



3.1

Sharing infrastructure unlocks major economies of scale, which are crucial to make return economics work.

The scale of return systems is a key factor of performance, as large-scale systems achieve economies of scale, significantly reducing costs, and environmental impacts. Aggregating larger volumes of packaging is particularly important for two stages of a return system:

- Collection drop-off points
- Reverse logistics and sorting and cleaning operations.

A shared infrastructure system does not mean that one single actor owns and operates the system. In a shared return network, operations happen under common rules, and could be operated by many organisations — for example different cleaning companies in different regions, and a range of logistics firms handling transportation.

As the cost of collection points is relatively fixed, sharing this infrastructure investment is vital. In our model, every supermarket[39] in France is equipped with at least one RVM (~15,000), even at low scale, to ensure customer convenience. However in this scenario, RVMs are running far below their capacity. While more machines need to be added in larger stores as the scale of the entire return model increases (up to ~30,000), increasing the amount of packaging flowing through these collection points unlocks economies of scale, which can lower the shared cost for the collection of each piece.

Concretely, costs associated with RVM installation and staff sorting are three times higher per unit in our lowest scale scenario compared to our highest scale (see section 2.3 for further analysis). This points to the importance of sharing the cost of establishing a single network of collection points and increasing the amount of packaging flowing through this common network.

It's also of paramount importance for the customer experience that collection points are shared. Requiring customers to segregate returnable packaging, or return it to different RVMs or even different locations, is likely to dramatically affect customer adoption and return rates.

For the logistics, and sorting and cleaning centre operations, unifying this network can avoid non-optimal systems operating in parallel and duplicating journeys. For example, rather than three independent sorting and cleaning centres in close proximity serving the same large region, a unified system could have those three facilities each serving a more localised region, reducing transport distances significantly. This clearly shows the need for industry to collaborate on one or a limited number of return networks to unlock sufficient scale, as is current practice in existing reusable B2B packaging (e.g. Swedish Return System)[40] and B2C packaging systems (e.g. returnable beer or GBD's mineral water system in Germany). See page 60-62: Case studies of standardised packaging and shared infrastructure.

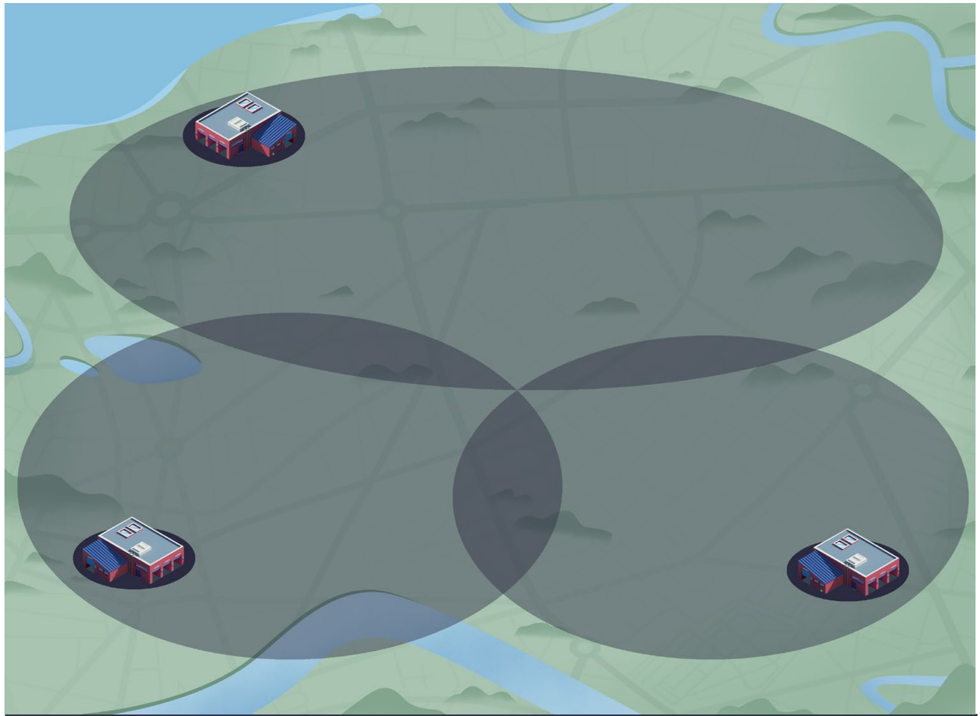
> Small pilots or implementation without sufficient scale and return infrastructure pits reuse against the ubiquitous infrastructure for single use; placing an unreasonable action burden on the customer (or end user) and an insurmountable gap in the economics for business. Shared return infrastructure is going to be absolutely critical for returnable packaging to scale.
>
> **Dr. Dagny Tucker**
> Co-founder, Perpetual

Aggregating packaging volumes in one common system can also allow for more localised sorting and cleaning infrastructure. With more volume in a single system, it is likely that sorting and cleaning centres would reach capacity faster, and new centres would be increasingly distributed, lowering transport distances and associated costs and emissions. Contrastingly, a lower scale, fragmented scenario would result in fewer sorting and cleaning centres, and longer transport distances and costs.

Creating equitable return systems that are accessible for all to use is paramount. Policy could play a crucial enabling role to foster collaboration through governance, standards, and incentives. Return systems must be accessible for all businesses to use — this is especially true for smaller players who may not be able to create efficient systems alone.

Impact of sharing infrastructure: sorting and cleaning centres

Fragmented systems operating in parallel with longer transport distances



Common system operating with sorting and cleaning centres serving more local areas, reducing transport distances

3.2

Packaging standardisation and pooling are key drivers of a return system's environmental and economic outcomes, unlocking economies of scale and greatly reducing transport distances and packaging cleaning and sorting complexity.

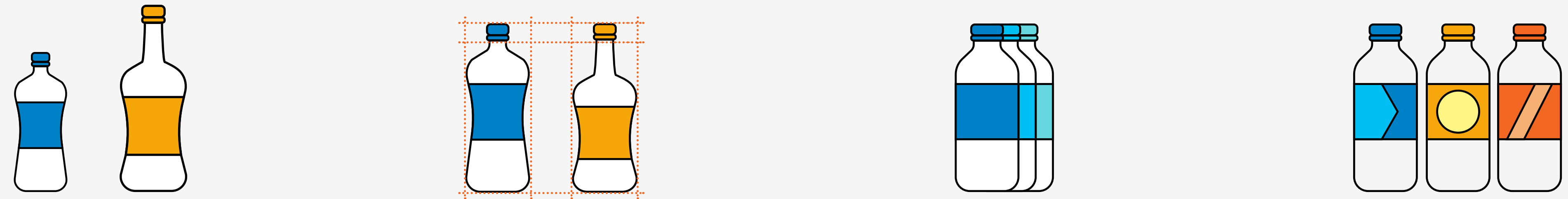
Although the focus of this report is not packaging design, this section explores at a high level the opportunities and challenges of packaging standardisation and the role of design specifically within that, including some speculative standardised packaging designs created in collaboration with JDO on page 63-66. Standards can also play a role in many other parts of a return system — such as data governance, cleaning protocols, reverse logistics process — but this section focuses on the standardisation of packaging design.

Packaging standardisation consists of harmonising packaging design among an organisation's portfolio, or cross-industry, to meet common requirements. Pooled packaging refers to a set of packaging that is shared by several actors. To some degree, standardisation is a prerequisite for pooled packaging. As illustrated below, packaging standardisation and pooling can be implemented at different levels.

While our modelling analysis shows the impact of either fully bespoke or fully pooled packaging to ease comparison, it's much more likely that brands will operate with a mix of packaging types taking into account the different branding, margins, and volumes of different product portfolios.

Packaging standardisation is not entirely new. In today's single-use system, many packaging standards already exist. Complete designs, such as drink cans or food tins, are already commonly standardised, as are packaging characteristics like the neck size of bottles, which comes in a few different variations and for which the supply chain (e.g. filling equipment and processes) is optimised.

Packaging standardisation and pooling are commonly recognised as the most important enablers of efficiencies within return systems.[41] They unlock economies of scale, logistics efficiencies, increase convenience for the system's users and improve business resilience — with pooled packaging offering more flexible operations. The table below details these opportunities and maps which benefits can be unlocked with standardisation alone, and which of them need packaging pooling to be unlocked. Some of these benefits are quantified and explored further in this section.



Bespoke packaging
(e.g. more durable material, changes to aid cleaning)

Bespoke with shared standards
(e.g. to fit in a crate, common identifier placement, neck size)

Standardised and 'pooled' within a company
(within a brand portfolio, a category, or across categories)

Standardised and pooled packaging within a market
(packaging could be filled by a different company each cycle)

Opportunities and benefits unlocked with standardised or pooled packaging

✓ (orange) Some benefits unlocked ✓ (blue) Full benefits unlocked

Opportunities		With standardised packaging ONLY	With standardised AND pooled packaging
Reaching high scale to unlock economies of scale	Lower procurements costs	✓ (orange)	✓ (blue)
	Lower sorting and cleaning costs	✓ (orange)	✓ (blue)
	Ability to co-pack (share filling lines)		✓ (blue)
Creating logistic efficiencies	Better transport utilisation (stackability, nestability, etc.)	✓ (orange)	✓ (blue)
	More efficient/easier filling	✓ (blue)	✓ (blue)
	More efficient/easier collection	✓ (orange)	✓ (blue)
	More efficient/easier cleaning	✓ (orange)	✓ (blue)
	More efficient/easier sorting		✓ (blue)
	Smaller pool of packaging needed in the system		✓ (blue)
	Consumption variation (seasonality) more efficiently managed		✓ (blue)
	Reduce storage space/time (at any step of the value chain)	✓ (orange)	✓ (blue)
	Shorter reverse logistics time		✓ (blue)
	Shorter transport distances		✓ (blue)
Offering compelling customer experience	Recognisability of reusable packaging	✓ (blue)	✓ (blue)
	Ability for customers to reuse dispensing mechanisms like triggers/pumps at home	✓ (blue)	✓ (blue)
	Ease of return (e.g nestability, use of crates)	✓ (blue)	✓ (blue)
Other	Shared R&D	✓ (orange)	✓ (blue)
	Value chain standardisation for equipment	✓ (orange)	✓ (blue)
	Recycling (better quality recycling at end of life)	✓ (orange)	✓ (blue)
	‘Off the shelf’ returnable packaging that can be utilised by smaller players, lowering R&D and procurement costs barriers.	✓ (orange)	✓ (blue)

Impact on storage and sorting: Packaging standardisation and pooling greatly reduce complexity, resulting in lower per unit processing costs. In a pooled packaging system with highly standardised designs, packaging only needs to be sorted by a few different types. This aggregates sufficient volumes quickly, ready for cleaning. In a system with differentiated designs, packaging has to be sorted by numerous different designs resulting in packaging having to be stored for longer before reaching sufficient volumes to start the cleaning process or transport to a filler. Thus, the most important factor for sorting is the number of unique designs and if they are pooled.

Impact on cleaning: Standardised packaging, if optimised for cleaning, can significantly reduce complexity, and associated environmental and economic impacts. For cleaning, unlike sorting, standardisation alone can unlock efficiencies as the same cleaning line can be used for a wider range of packaging. Additionally, standards ensure packaging is designed to be as easy and as fast as possible to clean, for example, avoiding angles where water might get trapped, and enable a batch of packaging to be cleaned and dried together with optimised water, chemicals, and energy for each piece of packaging.

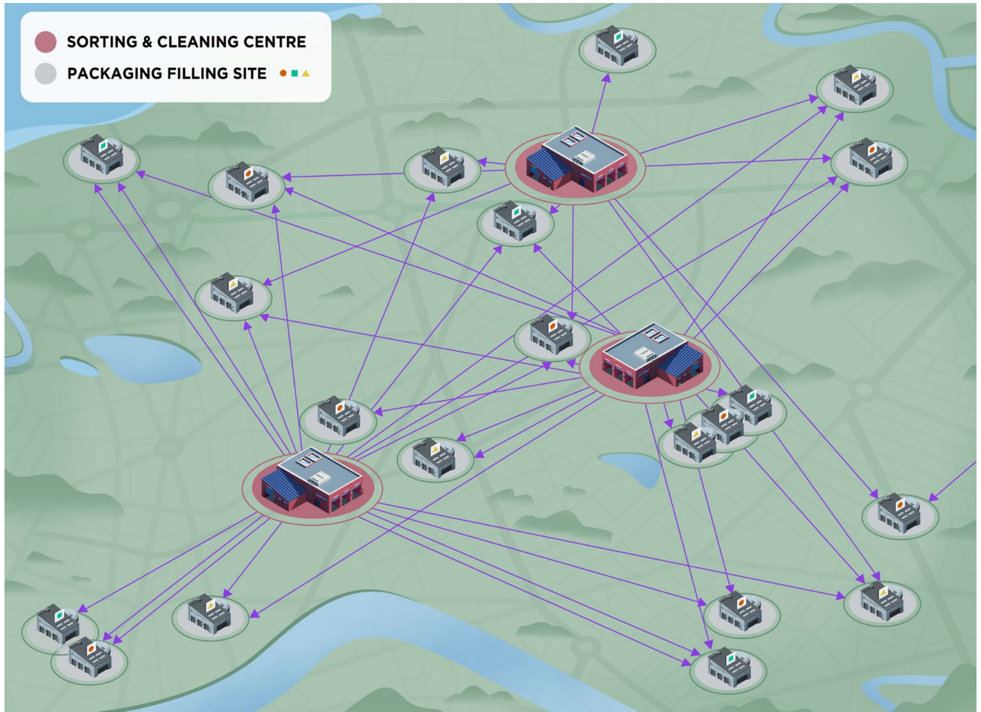
Inside a sorting and cleaning centre

Bespoke packaging

Pooled packaging

Impact on transport: Packaging pooling is crucial to reduce reverse logistics complexity and transport distance, and so reduce cost and environmental impacts. In a pooled packaging system, packaging is transported after cleaning to the closest filling location where it is needed, and to any manufacturer participating in the return network. In a system with non-pooled packaging (whether differentiated or standardised), packaging must be transported back to the respective manufacturers' filling site. As a result, in systems with non-pooled packaging, the total distance between sorting and cleaning centres and the filling sites is much higher. Our analysis included a geographical modelling (see more detail in the section 'Model overview') that quantified the average transport distances for the reverse logistics and enabled comparison between pooled packaging and non-pooled packaging. The results show a decrease of 67% in average transport distance between sorting/cleaning and filling for beverage bottles when packaging is standardised and pooled, and 83% for personal care bottles (Figure 24). These reduced transport distances, which are broadly representative of all applications modelled, translate into reduced cost and emissions.

Impact of standardised packaging: final transport leg



Bespoke packaging returning after sorting and cleaning to every filler

Pooled packaging returning after sorting and clearing to the closest fillers which need packaging

The extent of this impact depends significantly on the size of the region that a particular sorting and cleaning centre services and the specialised nature of the filling lines. For products manufactured regionally that have a relatively high number of filling sites per area, such as beverage, transport distances are highly optimised and short in a standardised and pooled packaging system, as packaging is delivered simply to the closest filling sites. Equally, beverage manufacturers' filling lines tend to be less specialised than filling lines for personal care products. This means beverage manufacturers have several filling sites producing the same product, which helps reduce transport distances.

In comparison, for products with a higher degree of specialisation, such as personal care, differentiated packaging must be transported back to specific filling sites to match the specialised nature of the product, rather than the closest filling location. In an System Change scenario, average transport distances vary between about 90km for high packaging standardisation and 520km for low packaging standardisation (Figure 24).

In addition to these application-specific impacts, the effectiveness of standardisation and pooling is related to scale and the number of sorting and cleaning centres across a geography (Figure 24).

With standardised pooled packaging, the greater the number of sorting and cleaning centres in a given geography, the shorter the return transport leg (from cleaning to filling) can be. The extent of the impact depends on the existing infrastructure, for example the density of filling and sorting and cleaning infrastructure, and the specialisation of filling lines. Under the System Change scenario, transport distances from sorting and cleaning back to filling can be reduced by 67% to 83% depending on application with a corresponding impact on GHGs.

Figure 24:
System Change scenario – Average transport distances from sorting and cleaning centres to filling

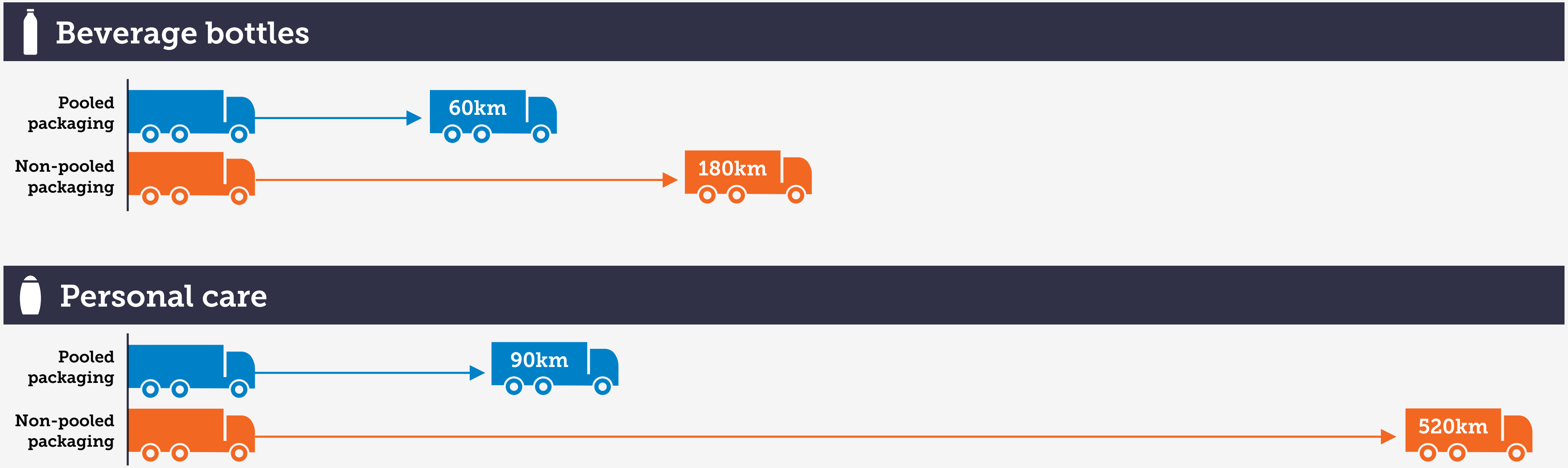
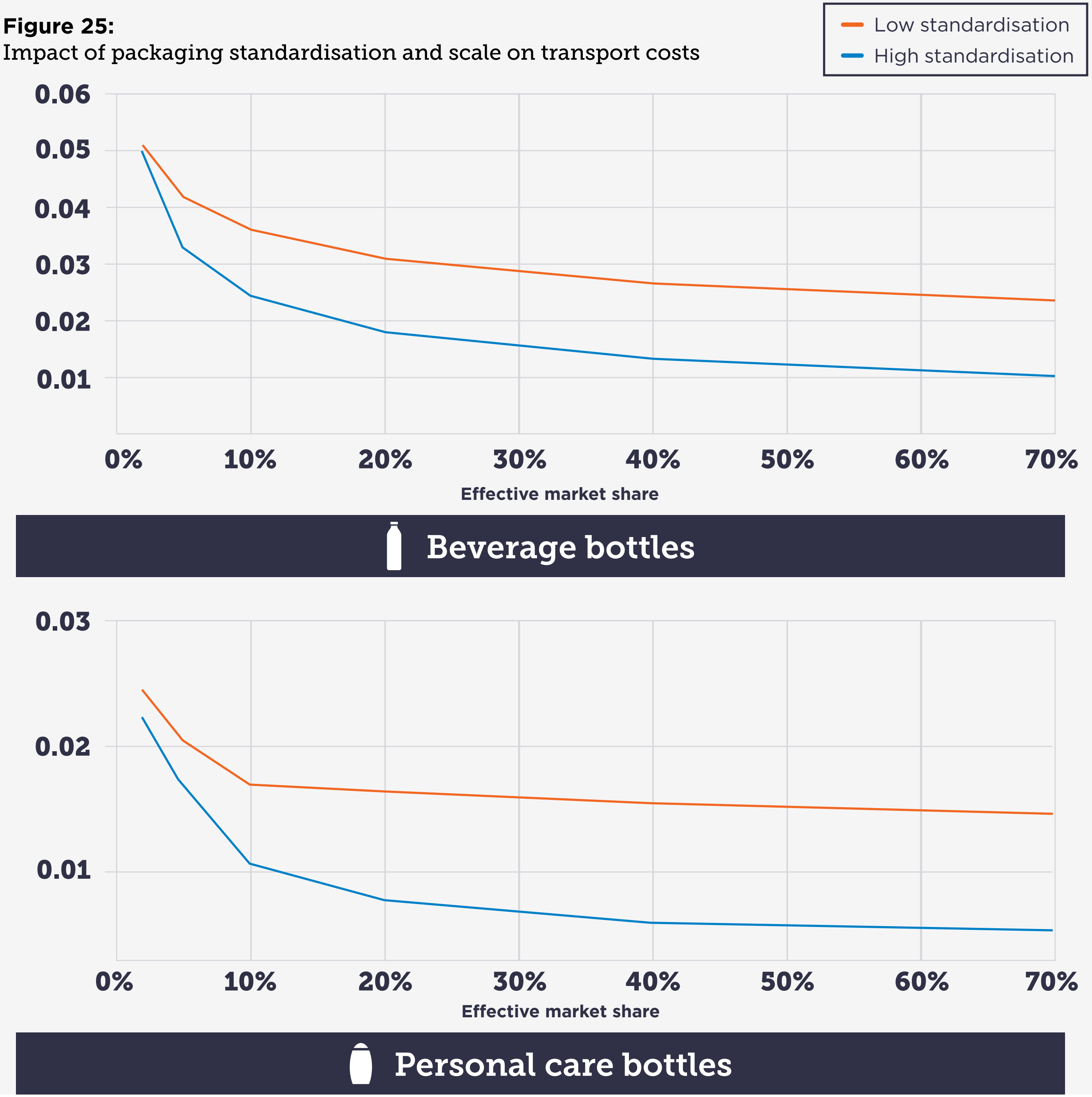


Figure 25:
Impact of packaging standardisation and scale on transport costs



While packaging standardisation and pooling offer a wide range of opportunities, they also pose challenges that will require collective problem-solving and innovation to be overcome.

Brand differentiation and equity

When exploring standardisation, maintaining brand differentiation and equity is a common concern, as packaging design is a key element of brand marketing. While standardisation challenges traditional ways of differentiating product categories where brand equity is achieved through the form and shape of the packaging design, there is a creative opportunity to maintain brand differentiation through the product, labels, artwork, closures, in-store experiences, and digital marketing, while defining a new way to deliver product to users (see pages 63-66). There is an opportunity for retailer-owned brands, which have a large volume of sales, to pioneer this approach. Finally, the increase of online shopping (with pick-up or at-home delivery) will challenge traditional shelf presence requirements of packaging.

Investment costs

The more distinct the returnable packaging design is from its single-use alternative, the higher the investment costs, not only to design this new packaging but also to re-fit the production processes and lines to accommodate this new design. While standardisation might reduce operational costs over the longer term, it might involve significantly higher upfront costs that could stifle early action. Therefore a pragmatic approach to standardisation in the early scale-up period will be required to balance operational efficiencies with early investment.

Product safety

In pooled systems, cleaning and hygiene risks are increased as the same packaging might contain different products throughout its life. For food products, for example, this poses significant challenges to ensure there is no cross-products and allergen contamination. For personal care products, managing scents and micro-biological sensitivity is crucial. To address these brands and legislators must develop and implement health and safety standards.[42]

Product and brand specific requirements

In some cases, components of the packaging can provide a brand or product specific need, e.g. accurately dispensing (e.g. pumps/triggers) pre-defined doses. As such, standardising these packaging elements is a challenge. This challenge could be addressed with innovations enabling consumers to keep the customised dispensing system at home and return the main standardised container.

Cross-industry collaboration

To make packaging standardisation and pooling happen at a large scale, high levels of collaboration across sectors and industries will be required to design packaging, elaborate standards, and establish relevant governance systems. It is paramount that the design of standards helps lower, not increase the barriers for small and medium enterprises to operate within a return system. Businesses will need to embrace mindset changes and legal reviews (e.g. antitrust and competition laws) for this collaboration to happen.[43]

Despite these challenges, many existing systems and initiatives have shown it is possible to run shared return systems with standardised packaging, even at large scale. The following box details some examples of existing solutions, at different levels of scale and maturity.

> There is an important opportunity for innovation for reusable packaging. Materials that are inert and do not transfer their chemical constituents into foodstuffs are the most suitable for reuse since they will not absorb contaminants.
>
> **Jane Muncke**
> PhD, Managing Director and Chief Scientific Officer, Food Packaging Forum Foundation

Case studies of standardised packaging and shared infrastructure

The German Wells Cooperative (GDB)

Standardised and pooled packaging | Shared logistics, sorting, and cleaning

The purchasing and service organisation for German mineral water springs with around 150 member companies.

All the German Wells Cooperative (GDB)'s bottles are refillable, either PET or glass, and are used by bottlers for carbonated beverages and mineral water products as part of a managed pool system. The iconic design of GDB's 'Pearl bottle' comes in 12 different formats (different sizes and colours) and is recognised by 97% of the German population. Once consumed, the bottles are returned via a deposit return system to be washed and refilled by bottlers for up to 25 loops for PET and 50 for glass. In 2020, 6.8 billion bottles were filled across all GDB systems.

Operations optimisation: GDB standardised bottles come alongside matching boxes, allowing for efficient transportation and logistics. Since GDB bottles and boxes are pool containers, used by multiple companies, the empty bottles are usually transported to the nearest mineral fountain and do not have to be returned to the original bottling company. This shortens transport routes and related costs and carbon emissions. In addition as the same bottle can be used by many different companies, sorting complexity — and related costs — is greatly reduced.

Benefits: GDB standardised bottles have up to 50% higher utilisation per year compared to non-standardised bottles due to easier handling and logistics. In other words, they can deliver the same amount of beverages using fewer bottles in this reuse model than in a single-use system; fewer reuse bottles are needed for the same amount of beverages produced. this not only saves resources but is also economically efficient. Finally, the GDB system secures and maintains the regional SME-structure of the German beverage sector, providing economic and social benefits across the country.

Coca-Cola (universal bottle)

Standardised packaging

A reusable PET bottle which is standardised across multiple soda brands in Latin America, introduced by Coca-Cola in 2018.

Users return empty bottles to retailers who store them and then give them back to Coca-Cola upon delivery of a new order. Coca-Cola takes the multi-branded mix of bottles back to a bottling facility where paper labels are washed off and bottles are cleaned, refilled, and rebranded with a fresh label.

Operations optimisation: Creating a universal bottle design across all brands simplifies logistics and reduces stock space. This has allowed new retail channels to accept reuse models.

Benefits: This return system avoids the production of 1.8 billion single-use bottles in Latin America per year while GHGs are reduced by up to 47% compared to single-use PET bottles, taking into account bottle production, increased transport, and water use during washing. Water use, including cleaning, is reduced by 45% compared to single-use PET bottles, because the major water footprint comes from the production of new bottles.

Milch-Mehrweg-Pool (MMP glass jars)

Standardised and pooled packaging | Shared logistics, sorting, and cleaning

A historical reuse system, traditionally used for yoghurts by several major dairy companies in Germany.

Today, innovators Bananeira, Unverpackt für Alle, and Fairfood are tapping into the existing infrastructure of glass reuse and using the MMP jars for dry and unchilled wet products. Products are primarily sold at organic stores and users can return the empty jars through a network of reverse vending machines at supermarkets. Wholesalers redistribute the jars to food producers, who are responsible for cleaning.

Operations optimisation: As jars and secondary crates are standardised, empty jars can be used by any participating food producer, which optimises operations for sorting and transportation.

Benefits: Although brands need to pay a fee to use the infrastructure (for reverse logistics and for the cleaning of jars) they still experience cost savings compared to a single-use alternative.

Swedish Return System

Standardised and pooled packaging | Shared logistics, sorting, and cleaning

A shared system of reusable crates and pallets for B2B between wholesalers and retailers, powered by Swedish Return System, which manages take-back, quality control, washing, and redistribution.

Swedish Return System is an example of how an industry-led collaboration can be a successful vehicle for driving efficiencies. It was established in 1997 and replaced a fragmented, inefficient model, which relied on single-use packaging and featured little or no collaboration between retailers. It came as a result of a project led by the Trade Association for Grocery of Sweden (SvDH) and the Swedish Food and Drinks Retailers Association (DLF). Today, Swedish Return System operates as a jointly owned, business-driven Extended Producer Responsibility (EPR) model. More than 1,500 businesses in Sweden participate in the scheme, which means that in total 50% of all fresh produce in the country is delivered in reusable crates.

Operations optimisation: Standardised design means producers and retailers know the exact measurements of crates, and can calibrate packing systems accordingly.

Benefits: The pallets weigh 10kg less than wooden pallets, lowering transport costs and increasing ease of handling. Filled crates are placed directly on the shelves, saving time by eliminating the need to unpack food products or handle waste — an average-sized store with a reuse system saves 160 working hours per year compared to single-use systems.

Dizzie

Standardised and pooled packaging | Shared logistics, sorting, and cleaning

Reusable pots made to be used again and again, UK-based Dizzie allows brands and retailers to introduce returnable packaging seamlessly to their range and operations stream.

Dizzie provides empty returnable packaging ready to be filled; finished and filled white labelled products ready for retail; packaging cleaning; and assistance with returns and tracking.

Operations optimisation: Pot standardisation unlocks a number of efficiencies, integrations, and value-adds, including: space efficiency (nestable/stackable packaging takes up far less space), reduced number of packaging formats, supply chain compatibility (fits existing fill/pack processes, fits into existing retail environments), and ease of cleaning (easy to clean shape, easy to remove labelling). These efficiencies lead to reduced costs throughout the reuse supply chain — reducing logistics, handling, and manufacturing costs. As Dizzie is implementing RFID tags on their pots, their system is gaining precision and efficiency.

Benefits: To date, this system has saved over 1 million pieces of plastic packaging and 140,000kg of CO_2 emissions.

Loop

Shared logistics, sorting, and cleaning

A global reuse platform launched by TerraCycle that enables brands and retailers to shift from single-use packaging systems to reusable ones in the most convenient way possible.

Loop is currently active in three continents — Asia, Europe, and North America — both in-store and online, partnering with major retailers and over 200 leading consumer goods companies.

Loop's pre-fill system enables a transition to reuse in the least disruptive way possible for businesses and customers: it is a flexible system that adapts to any type of businesses (consumer packaged goods or quick service restaurant, for example), categories (food or non-food), channels (in-store or ecommerce), packages (bespoke or standard), or materials (glass, alloys, or durable plastics).

Loop provides end-to-end services to its partners and fills the gaps in the reverse supply chain: it collects back the empty used containers, returns deposits, and sorts, stores, and can clean the containers.

Benefits: By enabling "buy anywhere, return anywhere", Loop creates the most convenient and scalable reuse system for brand manufacturers, retailers, and more importantly customers, which is why it is scaling today in over 100+ stores in both Japan and France, and plans to scale further in 2024 — adding more stores, more retailers, and more products.

Imagining a future of standardised returnable packaging?

The idea of standardisation in packaging design is not new.

Whether it's fully standardised designs (e.g. drinks cans or tinned food), or just products where brands have gravitated to very similar packaging forms (e.g. yoghurts tubs, breakfast cereal boxes), there are countless examples across almost every sector where a common packaging design has been used for decades to deliver products to users in an efficient and affordable way.

The term 'standardisation' can often conjure up the impact on iconic and uniquely recognisable packaging, but in practice, standardisation could most likely play a role where there is already harmonisation in packaging design and particularly for packaged products (e.g. flexible packaging) where the brand equity is differentiated by only printing, labels, or closures. With creativity and commitment by brands, harmonising the 3D structure of packaging can provide huge benefits and efficiencies in reusable packaging procurement, transport, sorting and cleaning, and storage.

So, how might we reimagine the future of returnable packaging?

To unpack the nuances of returnable packaging design and the role of standardisation and pooling, we brought together over 15 leading packaging designers, innovation managers, and sustainability experts from brands, retailers, and startups. Through a collaborative design workshop, we responded to the modelling conducted in this study and speculated on what future standardised reusable packaging might look like, working with brand and packaging design agency JDO to create future speculative designs.

> Participating in this study has highlighted the pivotal role that the design sector will play in harnessing the opportunity of reusable packaging. The journey towards circularity will take commitment, close collaboration and creative minds! As 'problem-solvers' at heart, the brand design team at JDO can help balance all stakeholder needs to unlock the best solutions. We look forward to working with retailers, manufacturers, brand-owners, NGOs and policy makers in achieving that goal.

Philip Stevenson
Managing Director JDO London

Single-use packaging

Returnable packaging

What if...

drinks manufacturers collaborated to create a material-efficient, highly durable, and brand agnostic returnable bottle that could be used across categories? With commonality already existing in the drinks market, moving to a pooled bottle with a wash-off label allows transport distances after sorting to be reduced by up to 80%. Agreeing to use one of the many standardised neck sizes and opting for a wide opening, allows for easy cleaning and minimal disruption to current filling lines.

All designs on this page have been created in collaboration with global brand design agency JDO

Single-use packaging

Returnable packaging

What if...

two laundry detergent brands came together to coalesce their knowledge from pilots to create a universal and open-source shared bottle design? This bottle is designed to be easy to clean, efficient to transport, and to age in the most subtle way. The shared design maximises the communication space on the front face, and allows for unique closures and brand-specific dosing.

All designs on this page have been created in collaboration with global brand design agency JDO

Single-use packaging

Returnable packaging

What if…

food products, from rice to coffee, had harmonised packaging dimensions to maximise transport efficiency in a two-way supply chain? Different packaging materials like plastic and stainless steel offer ways to elevate premium products within a range, or protect products that have specific requirements. A range of different volumes suits different brands and products, but a rationalisation of these allows them to be pooled as much as possible and, crucially, to be stacked and nested. Transporting nestable packaging design needs far fewer trucks on the road.

In the short term, it's important to recognise the costs of disruption when shifting to standardised packaging and the impact on the many manufacturing assets packaging interacts with, but the long-term operational savings from simplified packaging could be substantial. Creating a return system that can match the efficiencies of the highly optimised single-use system is a huge creative opportunity. It will require packaging producers to innovate, designers to envision new solutions, and marketers to experiment with new ways of engaging with customers.

All designs on this page have been created in collaboration with global brand design agency JDO

3.3

Return rates are a huge driver of environmental and economic performance. Collaborating to build a compelling and harmonised customer experience is key to make return work.

Our model has shown that high return rates are key to achieve economic savings and maximise environmental benefits. Spreading the production costs over as many loops as possible has a large impact on the economics. Our sensitivity analysis showed that return rates need to be at least 75% to 80% for personal care bottles and 80% to 90% for beverage bottles to maintain cost parity with single use in the System Change scenario (Figure 26). Environmentally, return rates as low as ~60% are sufficient to achieve initial GHG savings for most returnable packaging applications, except food cupboard (Figure 27).[44]

Customer return rate (% of returned packaging) and quality control loss rate (% of packaging considered too damaged to be reused) together determine the average number of loops that are achievable by a particular packaging type. For example, to achieve 10 loops, the return rate needs to exceed 90% — in other words, per loop, less than 10% of the packaging is lost, either due to customers not returning the container or removal by quality control during reverse logistics.[45] While some returnable packaging is cited to be reusable 100+ times, without a high return rate, this will never be realised. While high return rates should be aimed for, packaging should be optimised for just the amount of loops it is likely to be in use for (i.e. if a low return rate means packaging will likely only be reused 4 to 5 times, do not design it to withstand 100 uses which will require much more material).

Given the importance of high return rates, it is imperative for businesses to design returnable systems with customer ease in mind. The higher the level of customer convenience, the higher the return rates. By maximising customer understanding, convenience, and incentives, businesses can achieve economic savings and enhance environmental benefits.

Taken together, the scale of the system, the level of sharing of the collection infrastructure, and even packaging standardisation all affect customer convenience and, alongside the deposit amount, determine the achievable return rate. At high scale, when the range of products available in returnable packaging is wider, customers can consistently purchase more items in returnable formats — making the return of packaging a habit. High-scale and shared collection infrastructure ensure a dense collection point infrastructure, in which any item can be returned anywhere, so customers do not need to segregate. Standardisation of packaging design or on-pack labelling could support customer understanding and recognisability of returnable packaging, and nudge customers to return. Existing return and deposit-return schemes have proven that achieving >95% return rates[46] is possible.

Figure 26:
Sensitivity analysis of return rate on total cost in the System Change scenario

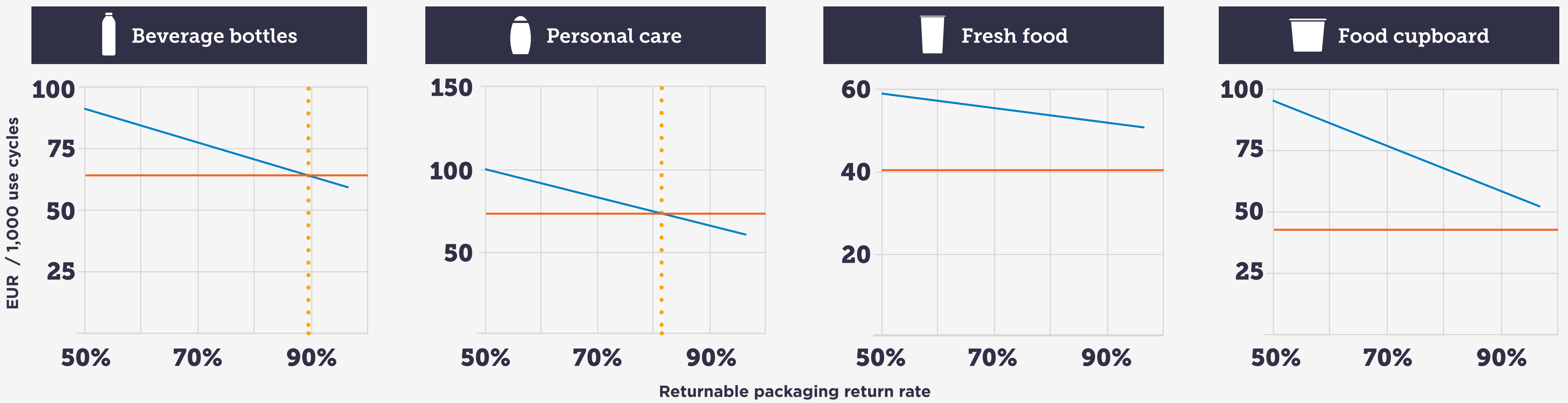
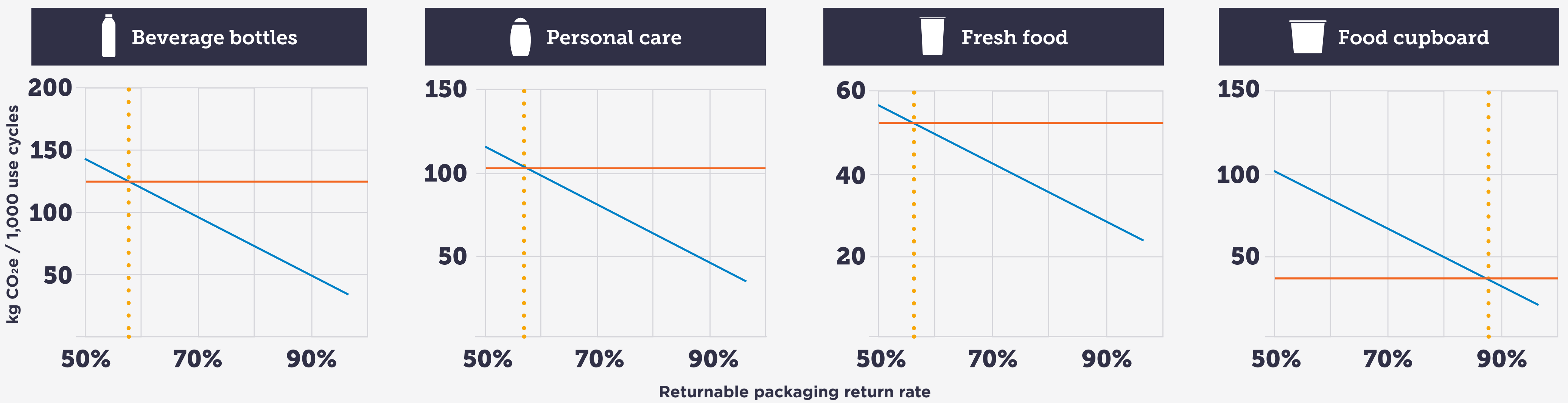


Figure 27:
Sensitivity analysis of return rate on GHG emissions in the System Change scenario



Part 4
Calls to action

Scaling returnable packaging is possible through collective actions by businesses, policymakers, and financial institutions

The previous sections provide insights on how to design a returnable packaging system that could deliver significant environmental benefits and compete economically with single use over time. To realise this full potential, and act on the three keys drivers of performance, all stakeholders must come together. We call for a new, collaborative, and systemic approach to scale return systems, kickstarting the transition with targeted applications and following through over time to expand these systems across a greater range of products, sectors, and geographies. Working together, a returnable packaging system can decouple business growth from plastic use, create new jobs, and enable the path to net-zero.

“Multi-stakeholder collaboration is a prerequisite to get reusable packaging systems scaled and seamlessly integrated into our daily lives. The concept of reuse in a circular economy relies on collaboration across businesses, policymakers, investors, customers, and many others, to ensure that the necessary shared infrastructure is in place for reusable packaging systems to flourish and keep valuable materials in play.

Kate Daly
Managing Director, Closed Loop Partners

Scaling returnable packaging is possible through collective actions by businesses, policymakers, and financial institutions

Scaling returnable packaging offers a major opportunity to unlock the next stage of a reuse revolution, which is critical to tackle the plastic pollution problem. Recycling will not solve the plastic pollution and waste crisis, but neither will reusable packaging alone. Alongside vital and complementary efforts in elimination, recycling, and material substitution, reuse systems represent the biggest opportunity to reduce virgin material use in packaging. Realising the potential benefits available will require collaborative action by the private sector, finance institutions, and public actors across all levels of regulation and geographies, locally and globally.

However, realising this potential will require a major transformation and a big shift from today's single-use model. This is true for both the required infrastructure (e.g. collection, sorting and cleaning) and mindset shift needed (e.g. packaging-as-a-service models). Additionally, these systems won't be entirely built from scratch or in a vacuum. While the majority of collection, sorting and cleaning infrastructure will need to be built and can, as such, be optimised by design, other parts of the value chain, such as product manufacturing and filling facilities, already exist and have not been designed to fit a reuse system. Evolving these will require a major transition with significant investments, and adaptation of established supply chains.

Scale is critical, so it will be crucial to strategically mobilise, and de-risk this transition period. Although environmental benefits can be achieved with relatively low-scale operations, the economic benefits are often only realised with a certain scale. Therefore, to reach the scale required as fast as possible and unlock the significant benefits that such a system offers, collaboration will be key.

There are clear indications of where to start and which existing efforts to build on. There are applications — such as plastic beverage bottles — where achieving economic parity with single use is easier, and can already happen at lower levels of scale. Additionally, there are some geographies — such as Latin America — with well-established systems for reuse that provide insights for how to scale. Lastly, there is deposit return infrastructure currently designed for recycling, that could be leveraged for reuse to reduce the investment needed to set up collection systems for returnable packaging.

> We are convinced that a circular economy at scale can only be possible thanks to an ecosystemic approach including public and private, local, national and international actors. As we redesign our production and consumption model, we need to have everyone around the table to start from the need: being coherent with ecological challenges while matching costs, hygiene and security. For example, the IFCO crate is now use in more than 80% of the supermarkets in Europe and North America because all the retailers have accepted to use the same crate to reduce cost and improve productivity of the logistics.
>
> **Eleonore Blondeau**
> New Projects Manager, Eternity Systems

> While a scaled reuse system will be a collaboration between new and existing players, the role of startups in the transition period will be vital. We can't design the detail of a return system and its components without the freedom to build with some new foundations and the opportunity to test and refine a range of ideas.
>
> **Ben Pattel**
> Founder, Dizzie

Calls to action

Adopt

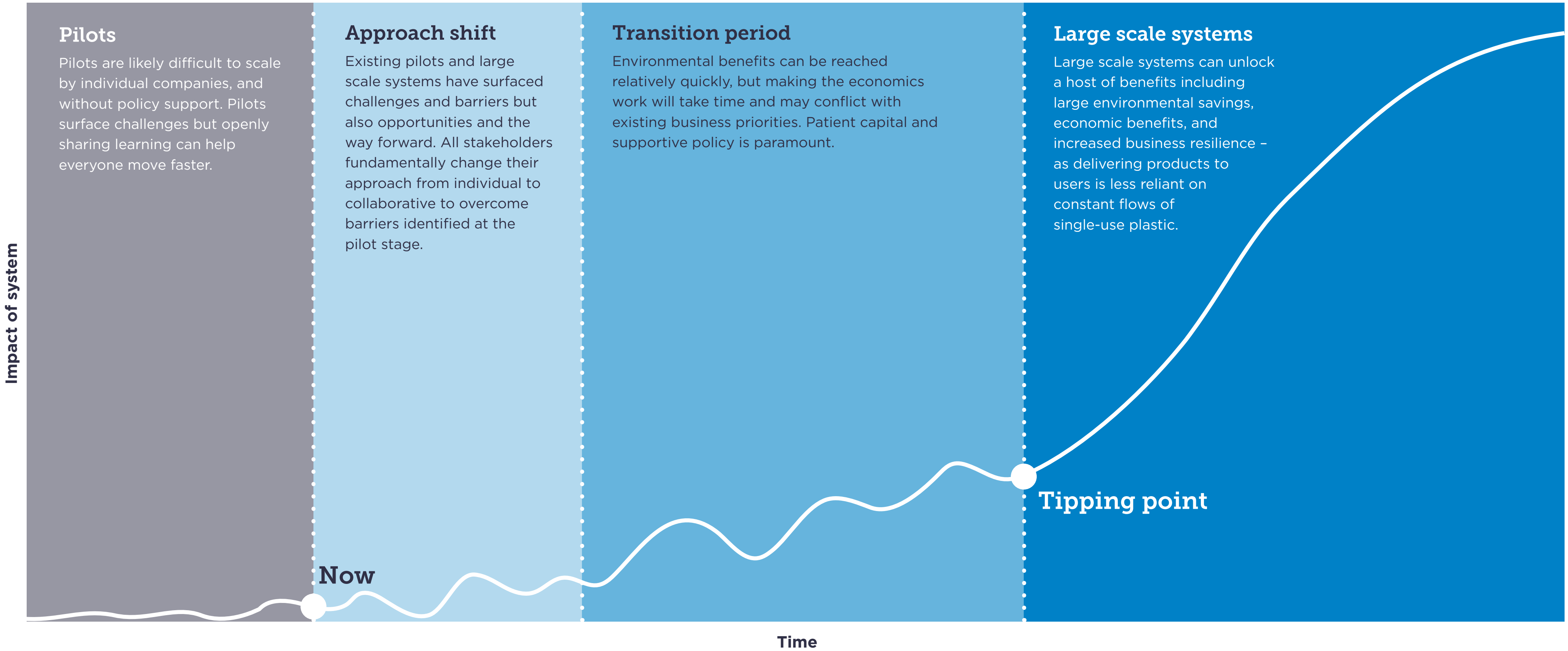
Rapidly adopt a fundamentally new approach to developing return systems – one that is collaborative and involves a larger number of stakeholders across the value chain.

Kickstart

With this new approach, urgently kickstart the transition by deploying collaborative multi-brand and multi-retailer systems – focusing in the short term on categories that most easily lead to economic parity, with the objective to reach the tipping point as soon as possible and start reaping benefits.

Follow through

Enlarge these systems across a greater range of products, sectors, and geographies – continue to expand existing return systems to fully realise their potential for a greater range of applications, and make the economics work for an increasing number of applications.



Calls to action for each stakeholder

	Businesses across the value chain (brands, retailers, service providers, startups)	Policymakers across all levels of government (municipalities, national governments, UN treaty negotiators)	Financial institutions	Civil society and citizens
Role	**Cultivating industry-wide collaboration and establishing scaling return systems as a key priority in packaging strategy, with dedicated resources, investments, and action plans, supported by targets and advocacy efforts.**	**Creating the enabling conditions by ensuring a level playing field, fostering industry-wide collaboration, de-risking the initial investments, and creating the right incentives for return systems (e.g. by leveraging the international legally binding instrument and EU PPWR).**	**Supporting the shift in business approach to scaling reuse, financing infrastructure investment and research projects through innovation funds with room to fail and long returns on investment, and redirecting long-term investment flows from single use to reuse systems.**	**Participating in new systems, and shifting demand from single use to reuse.**
Priority actions	Leverage combined technical expertise to plan and develop the establishment of shared logistics infrastructure for packaging collection, cleaning, and transport. Scale with shared infrastructure Bring packaging designers and marketers together to innovate towards standardised and pooled packaging for high priority products across a range of packaging materials and categories. Standardised and pooled packaging Retailers: scale up collection efforts. All actors: harmonise the customer experience and communication of how return systems operate to reduce friction to participate. High return rates	Set up and expand the adoption of Extended Producer Responsibility (EPR) systems — developed in collaboration with brands, retailers, and other industry stakeholders — with mechanisms (e.g. eco-modulation) to incentivise reuse. Scale with shared infrastructure Foster the uptake of reuse, for example by setting ambitious, evidence-based reuse targets. Scale with shared infrastructure Create and implement health, hygiene safety, and quality standards to ensure safe return systems. Standardised and pooled packaging Establish effective take-back systems such as deposit-return schemes (DRS) and develop guidelines for wider financial measures (e.g. EPR, taxes, subsidies) to ensure financial viability and incentivise widespread adoption and investment in shared return infrastructure. High return rates	Scale financial products and services that support the development of shared return infrastructure. Collaborate between public and private institutions on mechanisms such as blended finance, to offer guarantees, or de-risking, to crowd in sufficient capital. Scale with shared infrastructure Make capital available to businesses at favourable rates to support their transition to standardised and pooled packaging. Standardised and pooled packaging Support increasing return rates by linking financing to ambitious packaging return rate targets using mechanisms such sustainability-linked bonds and loans, where the cost of debt steps down if companies meet their targets. High return rates	Citizens: Return packaging to help achieve high return rates. Act as a watchdog to hold governments, businesses, and institutions to account. Raise awareness and call for strong regulation where it is required. Conduct advocacy and coordinate research to build evidence for how return systems can be designed effectively.

Actions

Develop and cultivate cross-value chain collaboration e.g. through developing a collaborative governance structure for operating shared systems that work for communities and businesses of all sizes.
Scale with shared infrastructure

Decarbonise transport to further reduce GHG emissions.
Scale with shared infrastructure

Identify 'quick win' products (e.g. fast-cycling products) and where the transition to standardised or pooled packaging is possible near term.
Standardised and pooled packaging

Foster and finance innovation across the return value chain, especially in cleaning processes for packaging applications that are more difficult to clean, which may improve returnable packaging's environmental and economic outcomes.
Standardised and pooled packaging

Create fit-for-purpose packaging return incentives that maximise return rates while ensuring inclusive affordability.
High return rates

Create guidelines for shared return infrastructure and sorting and cleaning centres to facilitate industry cooperation, ensure effective governance and guarantee return models are inclusive for large and small businesses, as well as customers.
Scale with shared infrastructure

Review competition policy to foster collaboration and potentially identify where environmentally beneficial coordination and communication between companies, particularly competitors, may be justified.
Scale with shared infrastructure

Provide financial support (e.g. grants) to foster the development of shared return infrastructure.
Scale with shared infrastructure

Legislate with a recognition of the different challenges and nuances between foods, beverages, personal care, home care, and others categories.
Standardised and pooled packaging

Develop consistent legal definitions and design standards to facilitate the scale up of return systems.
Standardised and pooled packaging

Review and harmonise resource classification in waste legislation to ensure an enabling regulatory environment for return systems.
Standardised and pooled packaging

Establish and support awareness-raising campaigns to build public trust in return systems.
High return rates

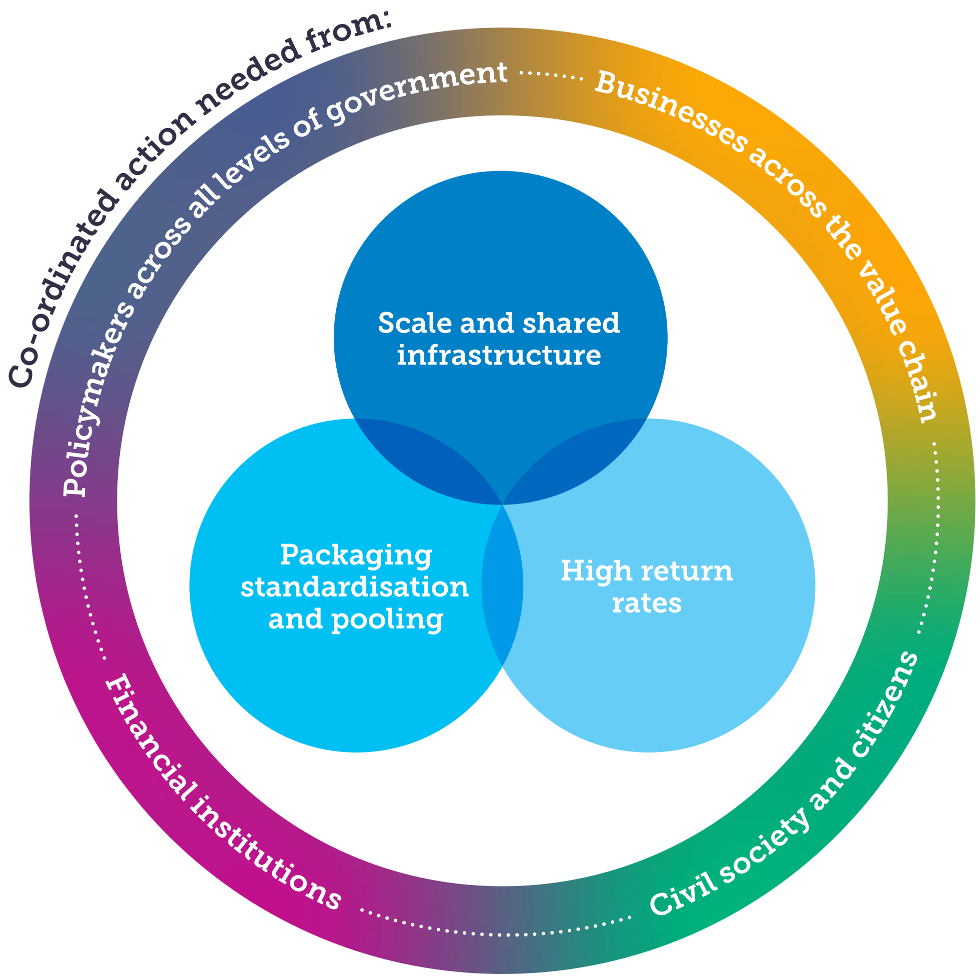
Scale Public Private Partnerships that enable governments and the private sector to work together to plan, procure, and/or pay for shared infrastructure projects.
Scale with shared infrastructure

Foster and finance innovation across the return value chain, and especially in cleaning processes for packaging applications that are more difficult to clean, which may further improve returnable packaging's environmental and economic outcomes.
Standardised and pooled packaging

Develop investment decision criteria based on harmonised packaging standards to enable the use of the shared infrastructure in practice.
Standardised and pooled packaging

> Reuse is key to realising a circular economy. This report shows that if businesses work together to build return systems, providing consumers with a simple and convenient way to reuse packaging, they can unlock not only economies of scale but also a greener future. Effectual collaboration is critical to making reuse a reality. The sooner this can be achieved, the sooner we and our planet will benefit from a reduction in plastic pollution.

Sarah Baulch
Principal Associate, The Pew Charitable Trusts



"

Reuse systems must be considered as a whole. The success of scaling up this new market and reaping the expected benefits, depends on our ability to embark on this journey collectively. With a collaborative approach complemented by a supportive policy, I truly believe that this new study will be a vital step to convince the private and public sector to shift now.

Celia Rennesson
Réseau Vrac et Réemploi, Cofondatrice et Directrice générale

"

With this new key piece of research, EMF has shown that the economic and environmental benefits of return systems lie in the creation of collective assets - from standardised packaging to shared infrastructure. This research is a clear call to arms for individual businesses within the supply chain to rethink their approach and move from individual trials to wide-scale collaborative projects if we are to unlock the benefits of return systems.

Catherine Conway
Reuse Lead, GoUnpackaged

"

A transition to reuse requires stakeholder collaboration and a prioritisation of actionable innovation that removes barriers to creating a commercially, operationally, and environmentally scalable reuse platform. We need everyone to get involved now to collectively make the progress that consumers and the planet demand.

Stuart Chidley
Co-Founder of Reposit, Reposit World

Call for further research and innovation

The development of these insights has surfaced many opportunities for further research or innovation that brands, retailers, startups, NGOS, academics, and others may need to conduct to provide further evidence on how to scale demonstration projects effectively. For example:

- The economic and environmental analysis of other return models (e.g. kerbside, return from home via online grocery delivery), other packaging materials (including metal packaging and single-use to reusable glass packaging), and for other product applications (e.g. home care, products bottled at source)
- Analysis for other regions and geographies, including the Global South
- Testing and validating the safety and human health impact of using different plastics for multiple use and washing cycles
- Testing the efficiency of washing and drying products not currently proved in existing systems (e.g. items that are sticky, oily, have foaming properties, or have allergens)
- Understanding what levers drive the necessary customer behaviour to reach high return rates (e.g. deposits, penalties, education campaigns, shopping experiences, etc.)
- The economic and environmental case for products produced regionally with long cross-border transportation
- The feasibility of storage space within retailer units prior to collection (especially small-format stores)
- The feasibility of backhauling collected packaging through existing routes to distribution centres
- The feasibility of adapting existing manufacturing assets and filling lines for returnable packaging and the impact of standardisation on this process
- The ability and timeframe to decarbonise transport
- The requirements and costs to set up data systems to track returnable packaging
- The design of lids, caps, pumps, triggers, and other closures that can be economically and safely cleaned, tracked, and reused
- Glue technology that can be easily and safely removed at the washing stage
- The customer response to standardised returnable packaging


What role will you play to make it happen?

Project team

Ellen MacArthur Foundation

Core project team

Dilyana Mihaylova
Programme Manager, Plastic initiative

Maël Arribas
Senior Research Analyst, Plastic initiative

Mark Buckley
Strategic Design Manager, Circular Design, Plastic initiative

Rob Opsomer
Executive Lead, Systemic initiatives

Sander Defruyt
Lead, Plastic initiative

Wider team

Lena Gravis
Senior Expert, Editorial

Joanna de Vries
Editorial Lead

Laura Collacott
Consultant Editor

Sarah O'Carroll
Governments and Cities Lead

Bahar Koyuncu Caylak
Senior Policy Officer

Eline Boon
Senior Policy Manager

Joe Rodgers
Programme Manager, Finance Initiative

Emily Healy
Finance Initiative Lead

Gabriella Hewitt
Communications Manager

Anna Sheehan
Senior Communications Executive

Iulia Strat
Communications Consultant

Steven Duke
Media and Messaging Lead

Matt Barber
Graphic Designer

James Wrightson
Creative Lead

Dan Baldwin
Senior Designer, Digital

Supported by

Systemiq

Yoni Shiran
Partner

Canan Akguen
Associate, Project Manager

Felix Philipp
Associate, Modelling Expert

Christiana Dujardin
Associate, Modelling Lead

Elena Georgarakis
Associate, Data Collection Lead

Sanchi Singh
Associate

Eunomia

Joe Papineschi
Founder

Helene Lanctuit
Principal Consultant

Maxine von Eye
Principal Consultant, Modelling Lead

Rich Grousset
Consultant

JDO

Natasha Arthur, Matt Blaylock, Paul Drake, Sara Faulkner, Phil Marlow, Liza Neudegg, Malcolm Phipps, Toby Rivett, Ed Silk, Racheal Skingle, Philip Stevenson, Jorja Taylor

yokedesign.studio

Acknowledgements

We, at the Ellen MacArthur Foundation, are very grateful for the support we have received in producing this study.

The Plastic initiative's Advisory Board has supported the Foundation's work since 2016, helping to conceive and launch the Global Commitment and Global Commitment Progress Reports, the Plastics Pact network, as well as the *Reuse – Rethinking Packaging book* and the *Upstream Innovation Guide* that lay the foundation of this study. Many of the organisations in the Advisory Board, with the addition of others, participated in this project's Advisory Group, which supported us throughout this work and provided invaluable data, insights, and feedback.

Thanks also go to all organisations and individuals across policy, industry, and academia, as well as those from NGOs and think tanks, who contributed to this study with insights and constructive input, through interviews, in person, and online workshops.

Scaling Returnable Packaging Project Advisory Group

L'Ademe
Amazon
Amcor
Beiersdorf
Carrefour
The Coca-Cola Company
Colgate-Palmolive
The Consumer Goods Forum
Danone
The European Investment Bank
TerraCycle / Loop
Mars, Inc
Nestlé
PepsiCo
L'Oreal
Schwarz Group
Unilever

Contributor organisations

The Ellen MacArthur Foundation would like to thank the organisations who contributed to the study for all their constructive input. Please note that contribution to the study, or any part of it, or any reference to a third-party organisation within the study, does not indicate any kind of partnership or agency between the contributors and the Foundation, nor an endorsement by that contributor or third party of the study's conclusions or recommendations.

Again
Auchan Retail
ANZPAC Plastic Pact (Australian Packaging Covenant Organisation)
Break free from plastics
Closed Loop Partners
Circolution
Citeo
The City of Paris
The City of Copenhagen
Delete cups
DS Smith
The Dutch government
European Environment Agency
European Environmental Bureau
Dizzie
Eternity Systems
The French government
Fyllar
Henkel
Genossenschaft Deutscher Brunnen (GDB)
Former Chile Environment Ministry representative
Greenpeace
GS1
India Plastic Pact (Confederation of Indian Industry)
InOff Plastic
JRC
Krones
Minderoo
OECD
Perpetual
The Pew Charitable Trusts
Mehrwegverband Deutschland (German Association for Reusable Packaging)
Portsmouth University
ReLondon
Reposit
Reath
ReFrastructure
Réseau Vrac et Réemploi
Resolve - PR3
Reusable Packaging Association
Searious Business
SC Johnson
Tomra
GoUnpackaged
UNEP
UNPRI
Upstream
U.S. Plastic Pact
WEF
Wrap
WWF

ELLEN MACARTHUR FOUNDATION

The Ellen MacArthur Foundation is an international charity that develops and promotes the circular economy in order to tackle some of the biggest challenges of our time, such as climate change, biodiversity loss, waste, and pollution. We work with our network of private and public sector decision makers, as well as academia, to build capacity, explore collaborative opportunities, and design and develop circular economy initiatives and solutions. Increasingly based on renewable energy, a circular economy is driven by design to eliminate waste, circulate products and materials, and regenerate nature, to create resilience and prosperity for business, the environment, and society.

Further information:
www.ellenmacarthurfoundation.org
@circulareconomy

SYSTEMIQ

Systemiq, the system-change company, was founded in 2016 to drive the achievement of the Sustainable Development Goals and the Paris Agreement, by transforming markets and business models in five key systems: nature and food, materials and circularity, energy, urban areas, and sustainable finance. A certified B Corp, Systemiq combines strategic advisory with high-impact, on-the-ground work, and partners with business, finance, policymakers and civil society to deliver system change. In 2020, Systemiq and The Pew Charitable Trusts published "Breaking the Plastic Wave: A Comprehensive Assessment of Pathways Towards Stopping Ocean Plastic Pollution", an evidence-based roadmap that shows how industry and governments can radically reduce ocean plastic pollution by 2040. Systemiq has offices in Brazil, France, Germany, Indonesia, the Netherlands, and the UK.

Further information:
plastic@systemiq.earth
www.systemiq.earth

eunomia

Eunomia Research & Consulting has been working to address triple planetary crisis of climate change, biodiversity loss, and pollution since 2001, through supporting the transition to a circular and regenerative economy. Combining real world practical experience and deep technical knowledge with an active role in policy, Eunomia provides appliable, science-led solutions and insights that drive a positive, regenerative impact on the planet. Eunomia's role in reuse is providing market and technical analysis, sophisticated modelling and advice to policymakers, cities, businesses, and civil society.

Further information:
www.eunomia.co.uk

Disclaimer

This report has been produced by the Ellen MacArthur Foundation (Foundation) with modelling and analysis by Systemiq and Eunomia.

Whilst care and attention has been exercised in the preparation of the report and its analyses, relying on data and information believed to be reliable, the Foundation makes no representations and provides no warranties in relation to any aspect of the report (including as to its accuracy, completeness, or the suitability of any of its content for any purpose). Products and services referred to in the report are provided by way of example only and are not endorsed by the Foundation. The Foundation is not responsible for any third-party content referred to in the report nor any link to any third-party website, which is accessed at the reader's own risk.

Neither the Foundation, Systemiq, or Eunomia nor any of its related people and entities and their employees or appointees shall be liable for any claims or losses of any nature arising in connection with this report or any information contained in it, including, but not limited to, lost profits or punitive or consequential damages.

Endnotes

1 Ellen MacArthur Foundation, From single-use to reuse: A priority for the UN Treaty (2023)

2 The Pew Charitable Trusts and Systemiq, Breaking the Plastic Wave (2020)

3 Led by the Ellen MacArthur Foundation, in collaboration with the UN Environment Programme, the Global Commitment – together with a network of Plastics Pacts – has united more than 1,000 organisations behind a common vision of a circular economy for plastics. Driven by the goal of tackling plastic pollution at its source, companies representing 20% of all plastic packaging produced globally have committed to ambitious 2025 targets to help realise that common vision. Learn more here.

4 The Global Commitment Five Years In: Learnings to Accelerate Towards a Future Without Plastic Waste or Pollution

5 Ellen MacArthur Foundation, From single-use to reuse: A priority for the UN Treaty (2023)

6 Food Packaging Forum, Reuse Factsheet

7 Investors call for urgent action to reduce plastics from intensive users of plastic packaging

8 Scaling reuse is the biggest opportunity to reduce packaging demand, as other levers all have significant limitations. Source: The Global Commitment Five Years In

9 Pivotal hurdles to solve plastic pollution include: scaling reuse, flexible plastic packaging in high-leakage countries, and lack of infrastructure to collect and circulate packaging. Source: Ibid

10 The Pew Charitable Trusts and Systemiq, Breaking the Plastic Wave (2020)

11 Reuse of packaging: Operation by which packaging is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market, enabling the packaging to be refilled - ISO 18603: 2013, Packaging and the environment - Reuse, modified.

12 Reusable packaging: Packaging which has been designed to accomplish, or proves its abilities to accomplish, a minimum number of trips and loops in a system for reuse - ISO 18603 Packaging and the environment - Reuse, modified.

13 Ellen MacArthur Foundation, Reuse - Rethinking Packaging (2019)

14 Worldometer, *France population*, 2023

15 Ibid.

16 World Bank, *Population density*

17 World Bank, *Urban population*

18 Assuming return cycle transport emissions become negligible due to electrification

19 Assuming the same level of recycled content in both single-use and reusable packaging alternatives

20 In the System Change scenario. The lowest water saving compared to single use is fresh food, which has high cleaning water use because it is relatively hard to clean (due to potential product setting). The highest water saving is dry food because the reusable pack is big (1.5 litres) so takes more water use in production and conversion, and dry food is assumed to be relatively easy to clean

21 Defined as the weight of packaging that is dealt with through non-circular waste management pathways – incineration, landfill, and lost to the environment

22 A unit of utility is a unit of 'service' provided to the customer, e.g 1 litre of beverages, or 250g of yoghurt. Serving one unit of utility in single use means producing one unit of packaging. For returnable, it means producing packaging for the first loop and reusing this same packaging for the subsequent loops.

23 Countries with DRS achieve higher collection and recycling rates than countries only relying on kerbside collection. Source: Reloop, *What we waste* (2021)

24 Ibid

25 Denmark: EUR 0.20 deposit, return rate: 93%. Norway: EUR 0.30 deposit, return rate: 92%. Germany: EUR 0.25 deposit, return rate: 98%. Source: Reloop, *Fact Sheet: Deposit return systems: How they perform* (2022)

26 Supermarkets are defined as retail store of at least 400 sq m, as defined by INSEE

27 The World Bank, Carbon Pricing Dashboard

28 Article 1 of the French law on Energy Transition for Green Growth Act

29 European Commission, Plastics own resource, 2021

30 OECD, Global Plastics Outlook: Policy Scenarios to 2060, 2022

31 FostPlus EPR fees for 2024. Source

32 ADEME, Environmental assessment of the deposit for the reuse of glass packaging in France, 2023

33 Ministry of Ecological Transition, *Key indicators for monitoring of the circular economy* (2021):

34 GoUnpackaged, *A Just Transition to Reusable Packaging* (2022)

35 https://www.statistiques.developpement-durable.gouv.fr/la-depense-de-gestion-des-dechets-en-2019

36 https://www.eastman.com/en/media-center/news-stories/2022/eastman-invest-accelerate-circular-economy

37 https://www.eib.org/en/publications/20220248-cutting-plastics-pollution

38 https://plasticseurope.org/media/european-plastics-manufacturers-plan-7-2-billion-euros-of-investment-in-chemical-recycling-2/

39 We included all supermarkets with a minimum of 400m2 in our analysis

40 Ellen MacArthur Foundation, *Circular Example: Swedish Return System*

41 University of Portsmouth, *Making Reuse a Reality: A systems approach to tackling single-use plastic pollution* (2023)

42 Consumers Beyond Waste, World Economic Forum, *Safety guidelines for Reuse*, 2021

43 PR3, *Standards* (outlining core requirements for aligning reuse systems between companies and brands)

44 PET beverage bottles, wet food packaging, and personal care bottles

45 Return rates are directly linked to the average number of loops achieved by a particular packaging type and are separate to the theoretical maximum number of loops possible with a particular material. The return rate and quality control loss rate determine the 'effective return rate' of reusable packaging, otherwise described as the proportion of packaging that makes it back to be refilled. The average number of loops then is related to the effective return rate.

46 E.g. in Germany: Giz, *Deposit-Refund Systems (DRS) for Packaging* (2018)

ELLEN MACARTHUR
FOUNDATION

www.ellenmacarthurfoundation.org

Charity Registration No.: 1130306
OSCR Registration No.: SC043120
Company No.: 6897785