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# THE RISE OF REUSABLE PACKAGING

**UNDERSTANDING  
THE IMPACT AND  
MAPPING A PATH  
TO SCALE**



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# Glossary

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## **BASE CASE**

A fixed point of reference, representative of the current scenario, that is used for comparison purposes.

## **CARBON DIOXIDE EQUIVALENT (CO<sub>2</sub> eq)**

A metric measure used to compare the emissions from various greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. The terms CO<sub>2</sub> eq and carbon emissions are used interchangeably hereafter.

## **CENTRALISED REUSABLE SYSTEM**

A reusable system that utilises an additional node for packaging to pass-through for cleaning, maintenance or other purposes - separate from the distribution centre. It is usually operated by the reusable packaging provider.

## **CYCLE**

The process of a packaging being sent from the Distribution Centre (DC), to the consumer and then returned back to the DC. In the Centralised reusable system, it includes an additional stage in travelling to the cleaning and maintenance node.

## **DECENTRALISED REUSABLE SYSTEM**

A reusable system that does not utilise an additional node for packaging - all cleaning or maintenance takes place within the distribution centre, i.e. is not centralised in one place.

## **DISTRIBUTION CENTRE (DC)**

A specialised building that's designed to store products for retailers and wholesalers, to be redistributed to another location or directly to customers. Distribution centres are an integral part of the order fulfilment process, especially for online retailers.<sup>1</sup>

## **ECO-COSTS**

Eco-costs are a measure to express the amount of environmental burden of a product on the basis of prevention of that burden. It is the costs which should be made to reduce the environmental pollution and materials depletion in our world to a level which is in line with the carrying capacity of our earth. The practical use of eco-costs is to compare the sustainability of different products and/or services with the same functionality.<sup>2</sup>

## **E-COMMERCE**

Refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions.<sup>3</sup>

# Glossary

## **FAST TRACK LCA**

The 'Fast Track' LCA is where the output of the classical LCA (materials with existing quantified environmental impact) is input for the Fast Track calculation, and where the methodological focus is on the comparison of design alternatives.<sup>4</sup>

## **LAST MILE**

Last mile logistics refers to the final step of the delivery process from a distribution center or facility to the end-user.<sup>5</sup>

## **LIFE CYCLE ASSESSMENT (LCA)**

A methodological framework for estimating and assessing the environmental impacts attributable to the life cycle of a product. It provides a systematic framework that helps to identify, quantify, interpret and evaluate the environmental impacts of a product, function or service in an orderly way.<sup>6</sup>

## **LOW DENSITY POLYETHYLENE (LDPE) MAILER**

Self-sealing envelopes that are commonly used in the shipment of apparel in e-commerce.

## **NODE**

An additional connection point between two parts of the supply chain. In this context, it is used to refer to the cleaning and maintenance stage in the centralised reusable system.

## **NON-RETURN RATE**

The rate at which reusable packaging is not returned from the consumer back to the brand. Expressed as a percentage of total number of packages sent.

## **REVERSE LOGISTICS**

The process of moving goods from their typical final destination (to the distribution centre or manufacturer) for the purpose of capturing value, or proper disposal.<sup>7</sup>

## **SYSTEM BOUNDARY**

The system boundaries determine which unit processes to be included in the LCA study. Defining system boundaries is partly based on a subjective choice, made during the scope phase when the boundaries are initially set.<sup>8</sup>

## **SINGLE-USE PLASTIC**

Goods that are made primarily from fossil fuel-based chemicals (petrochemicals) and are meant to be disposed of right after use. Single-use plastics are most commonly used for packaging and serviceware, such as bottles, wrappers, straws, and bags.<sup>9</sup>

## **THIRD-PARTY LOGISTICS (3PL) COMPANIES**

A provider that offers outsourced logistics services; which encompass anything that involves management of one or more facets of procurement, distribution and fulfillment activities.<sup>10</sup>

# Executive Summary

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**Packaging, in all its different forms, is ubiquitous across the fashion industry. This is no more evident than the single-use plastic and cardboard packaging that enables the burgeoning e-commerce market.**

Fashion e-commerce makes up the largest segment of all e-commerce worldwide, with 10% annual growth expected between now and 2024. Its significance is further accentuated by the ripple effects of the COVID-19 pandemic - the closure of brick and mortar stores is pushing consumers online where sales are sky-rocketing. Coupled with the proliferation of e-commerce sales is the growth of single-use packaging used to ship these orders, demanding the extraction of virgin raw materials for their creation and generating vast quantities of waste once their purpose is fulfilled.

## **REUSABLE PACKAGING - AN OUTLINE**

Reusable options, which aim to transform packaging from single-use to multi-use assets, are being implemented to counter the rise of single-use packaging. Rather than being disposed of after reaching the consumer, reusable packaging is returned, and recirculated over many trips. Transitioning from single-use to reusables can help to alleviate the (environmental) burden, decreasing dependence on virgin resources by lowering material production, reducing plastic waste and pollution by eliminating waste after use, as well as offering significant reductions in greenhouse gas (GHG) emissions. The potential reduction of GHG is thanks to the emissions associated with the processing of raw material being spread out over the many uses and lifespan of reusable packaging, in addition to a reduction in disposal emissions due to less waste being generated. Aside from the environmental benefits, the multi-use nature of reusable packaging allows greater investments to be made in the asset, with suppliers creating innovative packaging that creates a unique customer experience.

## **THIS STUDY - IMPACT ANALYSIS ACCOUNTING FOR KEY VARIABLES**

Whilst the benefits of reusables may seem plentiful, there are a number of factors that must be considered when assessing its impact compared with the incumbent Low Density Polyethylene (LDPE) packaging. The aim of this report is to bring some colour to the current discussion regarding impact; using a Fast-Track LCA methodology to account for crucial variables that influence the environmental impact of the system. For example, reusable packaging is reliant on customers returning the packaging - how then do different rates of return affect the viability of the system? Moreover, brands and retailers are becoming increasingly cognisant of the threat of single-use packaging and are integrating recycled content into their e-commerce packaging - how does that affect the comparison of single-use packaging with reusables?

# Executive Summary

## THE FINDINGS OF THIS ANALYSIS

The impact analysis compared the CO<sub>2</sub> eq emissions associated with a single-use versus reusable packaging system, accounting for key variables. In single-use LDPE mailers, over three quarters of the carbon emissions stem from the raw material processing phase - demonstrating the importance of choosing sustainable material options in the production, for example LDPE with high recycled content. However, with reusable packaging, a much greater proportion (between 40% - 60%) of the emissions stem from the transportation phase, given that the manufacturing emissions are spread over many uses. A comparison of the single-use and reusable systems on a per cycle basis can be found below:

### Carbon emissions in the reusable system

- Reusable packaging has 39% fewer carbon emissions per cycle compared with a 30% recycled content LDPE mailer
- Reusable packaging has 57% fewer carbon emissions per cycle compared with a virgin LDPE mailer

### Carbon emissions in the decentralised system

- Reusable packaging has 72% fewer carbon emissions per cycle when compared with a 30% recycled content LDPE mailer
- Reusable packaging has 82% fewer carbon emissions per cycle when compared with a virgin LDPE mailer

### Plastic waste reduction

In both scenarios, **87% less plastic waste (by weight) is generated when using reusable mailers rather than single-use plastic mailers**, regardless of the recycled content of plastic packaging.

# Executive Summary

## **THE PATH TO SCALE**

There is a clear impact case for reusable packaging, as well as myriad associated benefits. However, specific actions must be taken by all stakeholders in the value chain to ensure that reusable packaging scales in an environmentally and economically viable manner. The path forward can be summarised by three key actions which should be pursued in parallel:

### **Education to maximise return rates**

Communication is key. Maximising return rates requires a change in behaviour from the consumer, as such guidance must be provided. Brands and retailers should give simple and clear instructions on how to return the packaging, as well as educating consumers more broadly on the benefits of reusable packaging.

### **Collaboration across the value chain**

Transitioning to reusable packaging is a systems-level change that requires buy-in from all stakeholders across the value chain. Brands and retailers should pilot with reusable packaging innovators and 3PL companies to test and iterate on applicable processes to fit their supply chain needs.

### **Innovation to optimise product and reuse process**

Given the relative nascency of reusable packaging in the fashion e-commerce sector, more can be done to optimise the product and reuse process offered. Increasing the recycled content to 100%, increasing the number and types of drop-off points, and bringing all cleaning and maintenance into the distribution centre can all contribute significantly to environmental savings - further supporting the impact case for reusable packaging.



# The Growing Plastic Problem

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**Images of plastic contaminating the marine environment, causing harm to wildlife and the ecosphere are embedded in the public consciousness. There is a growing consumer focus on reducing plastics, most notably single-use plastic packaging. The sense of urgency to tackle this issue is increasing from all sectors of society. This is no different in the fashion industry - single-use packaging is ubiquitous.**

From business-to-business (B2B) pallet wrap, to polybags and e-commerce packaging, plastic can be found across the whole industry. In a previously published report, 'Polybags in the Fashion Industry', Fashion for Good delved into the issue of polybags in the fashion industry - providing a detailed overview of the topic and evaluating the options for more sustainable alternatives. A resulting area of investigation from this research was to turn to reusable packaging in e-commerce, given its significant potential for climate and broader environmental benefits. **Transitioning from single-use to reusables helps to eliminate plastic waste and pollution, as well as potentially offering significant greenhouse gas (GHG) reductions.**<sup>11</sup>

## **WHY NOW**

Packaging, in all its many forms, accounts for a huge amount of virgin paper and plastic material usage globally. Recent figures suggest that 50% of paper and 40% of plastic produced annually is used for packaging, while packaging (across all industries) generally represents 36% of municipal solid waste.<sup>12,13,14</sup> The recent growth in e-commerce is set to accelerate this trend in the coming years. E-commerce has been steadily rising in the fashion sector over the last decade, and the fashion industry now finds itself as the largest e-commerce market segment.<sup>15</sup> The fashion industry e-commerce alone is valued at over \$520 billion annually and is expected to grow by almost 10% annually to over \$1 trillion by 2025.<sup>16</sup> The growth of e-commerce has been accelerated by the COVID-19 pandemic - the closure of brick and mortar stores has pushed consumers to e-commerce. **The USA experienced the same level of e-commerce growth in the second quarter of 2020 as it had over the previous 5 years.**<sup>17</sup> Again, the trend is similarly applicable within the fashion industry, with German online platform (for fashion) Zalando welcoming over 3 million new customers in the second quarter of 2020 alone.<sup>18</sup> Accompanying the growth of e-commerce sales is the amount of single-use packaging used to ship these orders, further propelling the issue of single-use packaging into the spotlight.

As mentioned, consumers are becoming increasingly concerned about the impact of plastic on the environment, driving the demand for alternative packaging solutions. A recent survey from the International Post Corporation found that over 60% of respondents want parcels to use sustainable packaging.<sup>19</sup> This sentiment was echoed by DHL (2019), who stated that transitioning to sustainable packaging materials is the top priority for the future logistics industry, with the implementation of reusable solutions across the industry as second.<sup>20</sup>

# The Growing Plastic Problem

Brands are also becoming increasingly engaged and setting bold commitments to reduce their plastic usage in the coming years. An example of one such public commitment is The Ellen MacArthur Foundation's (2018) 'New Plastics Economy Global Commitment', signed by H&M Group, Inditex, Stella McCartney and more, which requires brands and retailers to<sup>21,22</sup> :

- i) Take action to eliminate problematic or unnecessary plastic packaging by 2025
- ii) **Take action to move from single-use towards reuse models where relevant by 2025**
- iii) **100% of plastic packaging to be reusable, recyclable, or compostable by 2025**
- iv) Set an ambitious recycled content percentage across all plastic packaging used by 2025

The most recent Global Commitment progress report (2020) found that, whilst signatories had made significant progress on eliminating problematic or unnecessary packaging and setting ambitious recycled content targets (commitments i & iv), limited progress has been made on shifting towards reusable packaging. Specifically, reusable packaging accounts for under 2% of signatories total packaging, with just a 0.1% increase from 2019.<sup>23</sup> However, over half (56%) of signatories reported that they have planned pilots testing reuse models in the coming year.<sup>24</sup> **As reuse models become more mainstreamed, it is crucial that supporting analysis outlining its potential impact and the associated key variables are scrutinised.**

## REUSE OPPORTUNITY

Theoretically, through retaining the functional qualities of a material, reusable models provide the opportunity to reduce the need for virgin materials and reduce the environmental footprint of materials used.<sup>25</sup> **From a business opportunity perspective, The Ellen MacArthur Foundation (2019) forecast that by converting just 20% of packaging to reusable systems presents a \$10+ billion opportunity - as well as providing a myriad of associated benefits.**<sup>26</sup> For example, innovative reuse models can provide a unique user experience and respond to the more sophisticated customer demands found in the e-commerce driven market. The report highlighted five other opportunity areas that reusable systems contribute to<sup>27</sup>:

1. it allows brands to provide customisation to individual needs
2. build brand loyalty
3. gather user insights
4. save costs
5. optimise operations.

# The Growing Plastic Problem

## WHAT'S BEEN DONE

There is currently a lack of case-studies providing detailed analysis on the environmental impacts of reusable packaging. Of the studies that have been done, there has been greater emphasis on those in the B2B packaging industry, demonstrating the need for enquiry on the business-to-consumer (B2C) side.<sup>28</sup> Whilst some work has been published outlining the theoretical environmental and economic benefits of B2C reusable systems, focused analysis assessing the environmental impact of reusables versus single-use packaging, accounting for some key factors, is much needed. **This type of analysis is crucial in helping brands, retailers and consumers make informed choices.**<sup>29</sup> Reusable packaging is not a silver bullet solution to all of the packaging challenges faced today - there are industries, business models and even locations that are better suited to adopting this product. Thus understanding these factors is central to propelling the scaling of reusable packaging in fashion e-commerce in a viable manner.

Closed Loop Partners' (2021) report 'Bringing Reusable Packaging Systems to Life' provides detailed earnings from their multi-year reusable cup programme - sharing guideposts and best practices for implementation.<sup>30</sup> However, as noted, reusable systems look very different across industries and contexts, highlighting the need for greater investigation in the fashion e-commerce sector. What is more, the report raises the issue of measuring impact and success; urging quantitative studies to demonstrate the net positive impact of a reusable system. **This is exactly what this report aims to do - measuring the key variables that influence reusable packaging's success to build a more complete picture of the system.**

As stated, there are a number of factors that can affect the feasibility of a reusable system; from the distance the package travels from the Distribution Centre (DC) to the consumer and back, to the return rate of reusable packaging and more. Furthermore, existing analyses often focus on a comparison between reusables and one, single-use packaging alternative, usually composed of 100% virgin material. Brands and retailers are becoming more cognisant of the threat single-use plastics present, and are integrating recycled content into their packaging, or switching to cardboard packaging - how does this affect and compare to the feasibility of reusable packaging? Finally, despite the relative nascency of reusables in fashion e-commerce, there are already a few different systems being developed, commanding analysis between the two. **In doing so, this report aims to bring clarity around the key factors affecting the viability of reusable packaging from an environmental impact perspective in fashion e-commerce. What is more, it provides tangible actions that stakeholders can pursue to ensure maximum effectiveness when implementing reusables.**

The report will do so by following the structure presented below:

1. Provide an outline of the different models used in both the single-use and reusable system, thus providing context for the comparison
2. Conducting a comparison of single-use packaging versus reusable packaging in terms of environmental impact, accounting for key variables in both systems using a Fast Track LCA method
3. From the environmental impact comparison, coupled with qualitative data provided by industry experts, offer key considerations for implementing reusable packaging into the fashion industry e-commerce context

# Single-use vs Reusable System

## THE SINGLE-USE SYSTEM

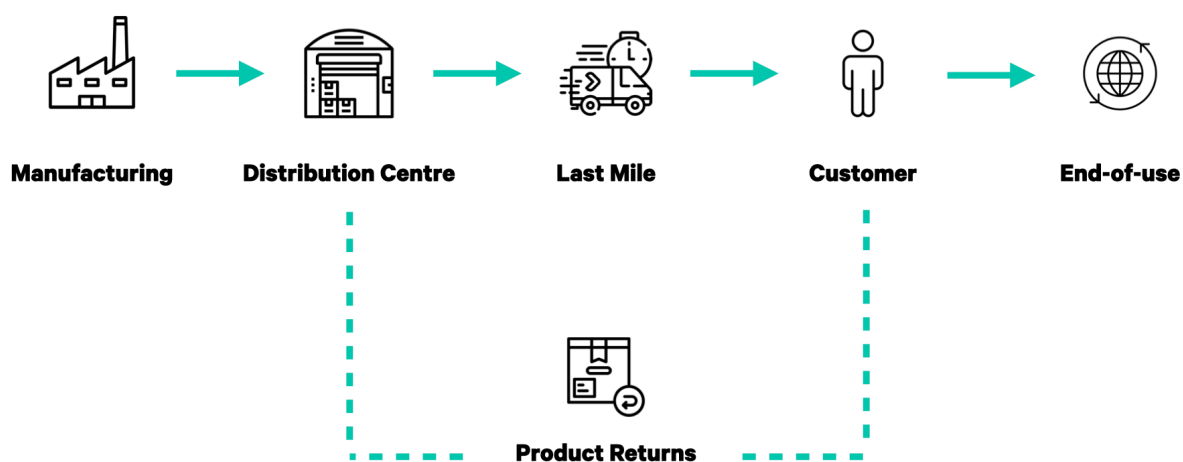


FIGURE 1

The diagram above shows the journey of a package from the point of manufacturing through until its end-of-use in e-commerce. Globalisation has meant that packages are travelling further, through longer and more complex logistics networks.<sup>31</sup> Customers are increasingly demanding faster, more convenient shipping methods whilst brands are jostling for a competitive advantage through providing unique experiences in the unboxing process. In this e-commerce driven market, packages are handled 20 times more frequently than in a traditional retail market, where an item moves from the manufacturing to a retail store on a pallet.<sup>32</sup> Whilst the current system is highly optimised and convenient in delivering packages to the consumer, the infrastructure does not yet exist to ensure the packaging used is reused or recycled.

Resealable Low Density Polyethylene (LDPE) mailers have become the standard packaging solution across most e-commerce categories, with the fashion sector being no different.<sup>33</sup> While presenting a low-cost, protective and lightweight solution, such mailers have a very short lifespan and are not designed to be reused multiple times. Moreover, robust recycling solutions do not exist on a global scale, with very few effective biodegradable alternatives, thus resulting in the generation of a huge amount of landfill waste.

# Single-use vs Reusable System

## THE REUSABLE SYSTEM

The reusable system of e-commerce packaging represents a closed-loop process, transforming packaging from a single-trip to a multi-trip asset. Despite the nascency of innovation, there are two slightly different models being implemented at this time. In both contexts, the packaging follows the same journey as single-use packaging to the point of the customer - from manufacturing, to distribution centre and through last mile delivery. However, once the customer receives the package, they are instructed to return the package, either via a mailbox or drop-off point. In the **centralised system**, this package is first transported to an additional node where it is cleaned and any necessary repairs are made. From that point, it is sent back to the brand's distribution centre and the cycle starts again. This approach is being used by RePack, who have their European Returns hub located in Estonia.<sup>34</sup>

**RePack** (Finland) leases packaging for products in B2C e-commerce. Once the consumer receives the product - the packaging, which comes with a return label offered by RePack, is folded and sent to the company by regular mail. RePack then cleans and checks the quality of the packaging before directing it back to stores/DCs. RePack offers its customers a discount coupon towards the next purchase in any partner store. The brands choose how the reusable packaging is offered to customers, e.g. as a paid option at checkout, for free over and expended amount, or for free with the company absorbing the delivery cost.

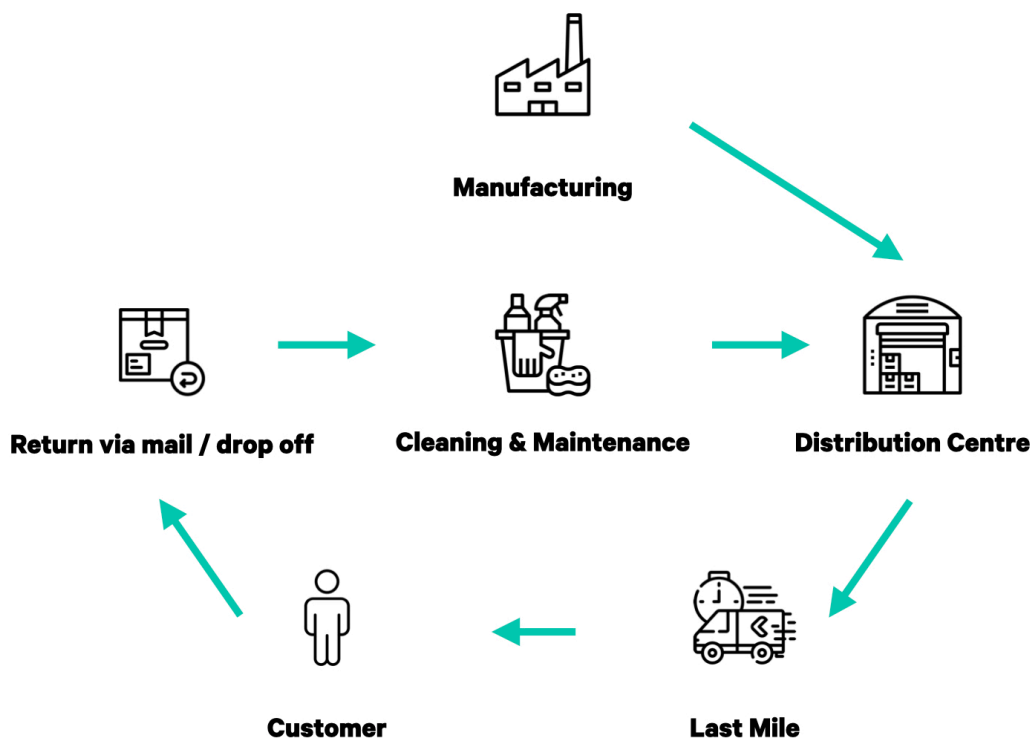


FIGURE 2





Images courtesy of RePack

# Single-use vs Reusable System

In the **decentralised system**, the packaging moves directly back to the distribution centre, with cleaning and maintenance taking place at the DC. This approach is being employed by Returnity and LimeLoop.

**Returnity** (US) sells reusable boxes, bags and envelopes. The company produces customised B2B packaging, in which the packaging is kept in circulation. Returnity primarily serves (what they refer as) the ‘circular-adjacent’ economy - that is, customers who have an element of circularity inherent in their process. For example, from the DC to store, back to DC. It had also tested in B2C market segments, most prominently serving clients with circular business models - such as rental or leasing models for apparel. This provides greater assurance that the package is going to be returned.

**LimeLoop** (US) is aiming to realise the bigger vision of sustainable shipping logistics for e-commerce through data-driven logistics and reusable shippers. GPS sensors are placed in the packaging, providing an overview of where shipments are, and where/when they have been opened, providing inventory security and visibility to the supply chain. This approach helps to marry sustainability and profitability - reducing the impact and plastic wastage through reusables and helping customers to reduce their inventory loss. Customers rent the standardised reusable packaging from LimeLoop, which also gives access to the data.

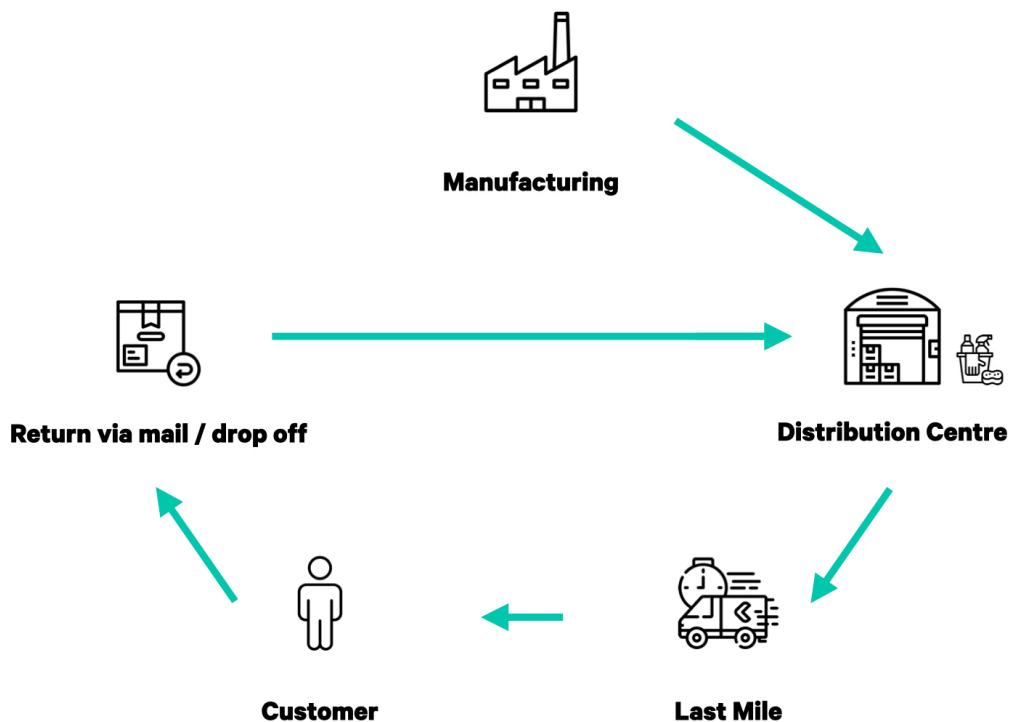


FIGURE 3







## Single-use vs Reusable System

The reusable and returnable packaging being developed by innovators are durable, water-repellent and secure, commonly manufactured with a high quantity of recycled content (material used is dependent on innovator). Given the longevity of the packaging, it allows for greater investment in the asset, creating a better user experience and helping brands to gather data that is not possible through single-use packaging. For example, the French LivingPackets have created a package that can withstand 1,000 journeys - incorporating sensors, a secure locking system, and a camera to monitor the shipment contents and conditions during transit.<sup>35</sup>

**LivingPackets (France)** are bringing smart packaging technology to market. They have launched a foldable smart shipping box ("The Box") for consumer per-to-peer shipments with a design life of 1,000 journeys. The Box incorporates an integrated load securing systems, an e-ink display to update address data and logistics-relevant information, sensors and an integrated camera to monitor the shipment contents and environmental conditions (temperature, humidity and shock) during transit.



# Methodology

For the purposes of this study, the 'Fast-Track' Life Cycle Assessment (LCA) methodology, developed by the Technical University of Delft, was used to compare the environmental impact of single-use versus reusable packaging systems.

**Life Cycle Assessment (LCA) is a methodological framework for estimating and assessing the environmental impacts attributable to the life cycle of a product. It provides systematic framework that helps to identify, quantify, interpret and evaluate the environmental impacts of a product, function or service in an orderly way. It is a tool which can be used to compare existing products or services with each other, which may indicate promising areas for improvement in existing products and which may aid in the design of new products.**

**- European Commission (2020)**

It was selected as an appropriate methodology as it enables the comparative analysis of different systems. In this context, a reusable packaging system is not a material innovation, as it uses known materials with existing impacts, therefore a full LCA that carries out a comprehensive audit of the production was not necessary. In other words, a Fast-Track LCA focuses on what impact to calculate, rather than how to calculate impact.<sup>36</sup>

Impact data regarding the material production, transport and end-of-life was taken from IDEMAT - an open-source set of peer-reviewed databases containing Life Cycle Inventory information from TU Delft.<sup>37</sup> A combination of proprietary analysis and publically available data was used to best estimate data-points such as percentages of packages returned, proportion of packaging landfilled versus incinerated (in the single-use context) and so on. Therefore, as with any LCA, there are a series of assumptions that underpin the analysis; however, all steps were taken to ensure the rigour of the data used.

The functional unit for this study was 1000 e-commerce deliveries, with the appropriate sizing to cover a small e-commerce order (3 t-shirts packed efficiently).<sup>38</sup>

**The functional unit is a key element of LCA which has to be clearly defined. The function unit is a measure of the function of the studied system and it provides a reference to which the inputs and outputs can be related. This enables comparison of two essential differs systems.**

**- European Commission (2020)**

# Methodology

The system boundaries for the Fast-Track LCA comparison is based on a Cradle to Grave system - that is, measuring the unit processes within the material and manufacturing phase (cradle), transportation, use phase, and finally end-of-life phase (grave). A more detailed overview of the system boundaries for both the single-use and reusable case can be found in the Appendix.

## THE BASE CASE

Linear (Single Use) Packaging Variable
Plastic packaging: LDPE Mailer 30% Recycled 0.6 um thick
Cardboard packaging: Corrugate Box 40mm thick, 89% Recycled
Sizing Set Garment Size without excess space
Manufacturer in China

Reusable Variables
Reusable Packaging: Polypropylene 70% Recycled
5% Non-Return per Cycle
End of Life in Europe
Manufacturer in China
Cleaning Node 1500km from consumer
Number of cycles (n) = 30

In order to conduct a comparative analysis assessing the impact in changing one (or more) variable(s), it is necessary to agree on a certain set of variables that stay consistent throughout - otherwise known as the base case. These can be seen in the figure above.

# Methodology

In the single-use packaging example, the recycled content was set at 30% in the Low Density Polyethylene (LDPE) mailer. Despite there being no publicly available data on the average of recycled content used in e-commerce packaging, upcoming UK legislation is mandating at least 30% recycled content in all plastic packaging - thus representing an aspirational but achievable figure to use.<sup>39</sup> When making the comparison between cardboard and reusables, a 40mm thick, 89% recycled cardboard example was used. This is in keeping with European Federation of Corrugated Board Manufacturers' (FEFCO) finding of average recycled content of corrugated cardboard as of 2017.<sup>40</sup>

In both contexts, a 'small' package was used - that is, a package of 3 t-shirts packed with no excess space, optimising the size of the package. It is worth noting that packaging optimisation is a crucial barrier to lowering the environmental impact of single-use packaging - with DHL (2019) estimating over a quarter of packaging is empty space in fashion e-commerce packages, due to the lack of structural rigidity of packages.<sup>41</sup> However, for purposes of consistency, optimised packaging sizes were used.

In the reusable context, we averaged data from innovators and came to a figure of 70% recycled polypropylene (PP) as the material composition for the packaging. In the centralised model, the cleaning node was set at a distance of 1500km, accounting for a distance across multiple European countries - or across approximately one third of the USA. In this model, the manufacturing of the package occurred in China, therefore transportation emissions from that point to the distribution centre were included. In the base case, a 5% non-return rate was used. A 5% non-return rate would suggest that, across a cycle of 1000 packages, 950 packages would be returned. Return rates can vary significantly between different reusable packaging systems and use-cases, but 5% is an ambitious and aspirational target.<sup>42</sup>

# Methodology

In setting the base for reusable packaging, a hypothetical number of cycles had to be chosen to represent the 'life' of a reusable packaging. Whilst reusable packaging innovators promote the ability for their package to be able withstand hundreds, even thousands of cycles, there is a point at which the per cycle reduction of carbon emissions of reusable packaging versus single-use packaging levels off.

From the graph below, it is clear that there are diminishing returns for the reduction of CO<sub>2</sub> eq in the reusable system versus single use plastic mailers for each additional cycle. After approximately 30 cycles, the CO<sub>2</sub> eq savings compared with a single-use plastic mailer plateaus. For that reason, 30 cycles was selected as an appropriate base case for reusable packaging. **Also of note from this graph is that, presuming a 5% non-return rate, a reusable package must fulfil more than 4 cycles before it presents a reduction of CO<sub>2</sub> eq emissions compared with a LDPE mailer with 30% recycled content.**

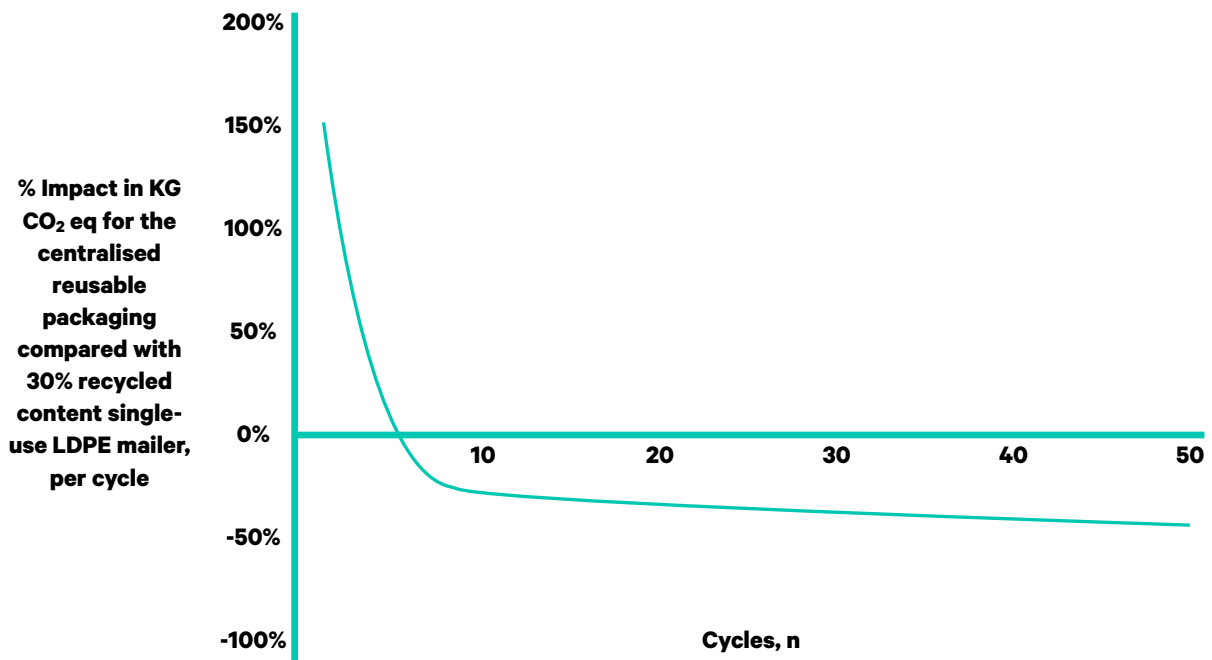


FIGURE 4

# Findings

## IMPACT HOTSPOTS

The first test was to demonstrate where within the life-cycle of each system the impact occurs - known otherwise as the impact hotspots. In doing so, the absolute difference in emissions and eco-costs associated with each system were clarified.

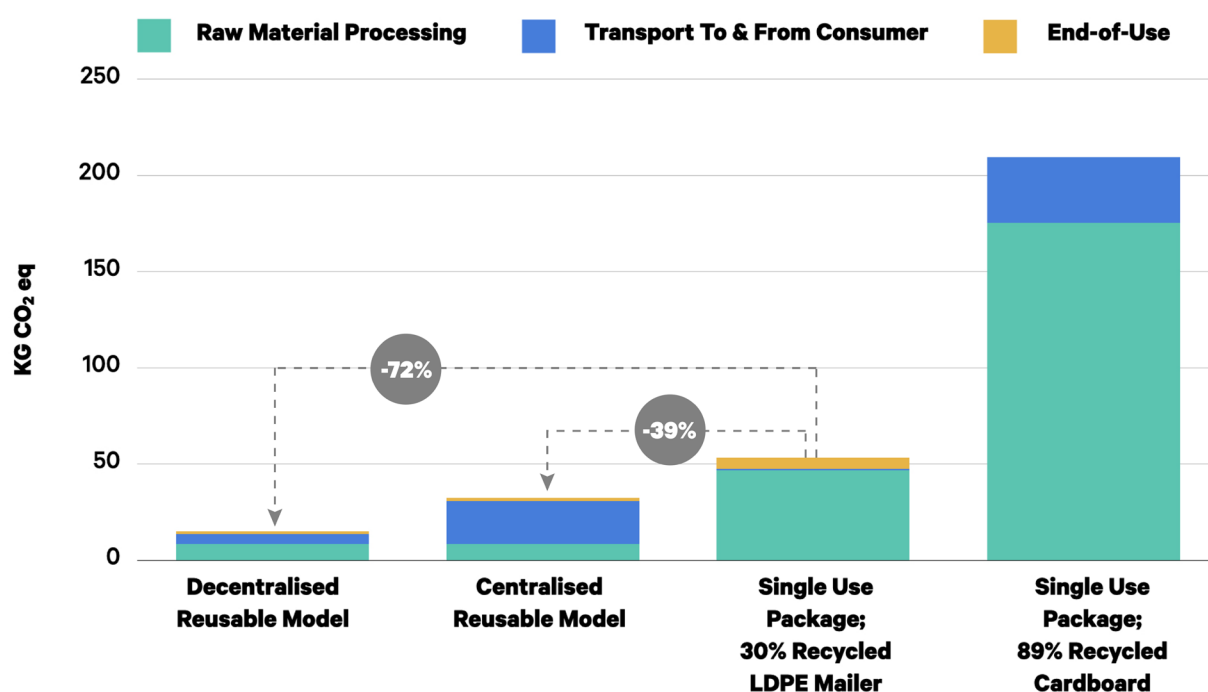


FIGURE 5

Eco-costs are the costs which should be made to reduce the environmental pollution and materials depletion in our world to a level which is in line with the carrying capacity of our earth. Eco-costs can be considered as 'virtual costs', as they take into consideration the integration of environmental costs that are not integrated in the real life costs of current production chains. It is a composite measure, involving 17 indicators, that measure a range of impact categories: including resource scarcity, carbon footprint, ecosystem and human health. The output of the calculation is expressed in a monetary value - providing a simple and concise means to compare impact holistically.

- TU Delft (2020)



## Findings

From the above, it is clear that the decentralised reusable model has the lowest emissions of any of the models, with a relatively higher portion attributed to the raw materials and processing stage compared with the centralised model. This is because the centralised package has the extra transport emissions associated with travelling to and from the cleaning/maintenance node. In the centralised reusable model, both the CO<sub>2</sub> eq emissions and eco-costs are considerably lower than in either of the single-use examples, with a much greater proportion of emissions coming from the transportation phase. This is to be expected, given reusable systems are built off the same package (asset) being transported to and from consumers over multiple cycles - thus dividing the raw materials and processing phase over many cycles.

Another noteworthy finding lies in the amount of emissions per cycle attributed to cardboard versus the LDPE mailer. The LDPE mailer, in terms of carbon emissions, has a quarter of that in cardboard (54kg vs 210kg respectively). What is more, LDPE mailers have roughly half of the eco-cost compared with cardboard (€~23 vs €~43) - given the eco-cost is a composite indicator that accounts for more than just carbon emissions.

In this context, the reason for the increased emissions associated with cardboard over LDPE mailers is due to the weight of the package required. The weight of the cardboard is over ten times that of a LDPE mailer, generating greater carbon emissions in the raw materials and processing phase. Moreover, the extra weight has significant implications on the transportation phase - with cardboard having over thirty times more carbon emissions compared with the LDPE mailer during this phase, per cycle.

Despite the greater carbon emissions of cardboard, environmental impact is a multifaceted issue that must be evaluated as such. LDPE mailers are a fossil-fuel derived, non-renewable resource that pose grave threats to the environment beyond the carbon emissions. Plastic packaging, in all its forms, has much lower recycling rates than paper and cardboard. In fact, it was recently reported that more than double the proportion of paper and cardboard packaging (>80%) is sent for recycling compared with plastic packaging (40%) in Europe.<sup>43,44</sup> On a global level, that figure is much lower, with The Ellen MacArthur Foundation (2017) suggesting that only 14% of plastic packaging is recycled.<sup>45</sup> Moreover, (most) plastics are non-biodegradable and can take centuries to decompose, discharging into the natural environment. This is exemplified by estimates that suggest over 8 million tonnes of plastics find their way into the ocean annually and, with a business-as-usual approach, there will be more plastic (by weight) than fish in the ocean by 2050.<sup>46</sup> Therefore, whilst LDPE mailers have a lower carbon footprint, the lower recycling rates suggest they are further from achieving key circularity ambitions.

Now that the impact within and between each model has been demonstrated, the following section turns to assessing the sensitivity of select variables on the reusable versus single-use context.

# Findings

## **SENSITIVITY ANALYSIS**

In order to assess the feasibility of reusable packaging for fashion e-commerce, the main factors that affect the environmental impact of the system were identified.<sup>47</sup> These factors present potential trade-offs in impact between material production and disposal on one hand, with the impacts associated with increased transportation on the other.<sup>48</sup> Moreover, the factors also consider the disposal and recycled content of the packaging used in the single-use system.

These are as follows:

- 1. Sensitivity test #1:** The impact of increasing the distance travelled from the consumer to the cleaning node in a centralised reusable system versus a single-use LDPE mailer with 30% recycled content
- 2. Sensitivity test #2:** The impact of increasing the non-return rate of packages in a centralised reusable system versus a single-use LDPE mailer with 30% recycled content
- 3. Sensitivity test #3:** The impact of increasing the non-return rate of packages in a decentralised reusable system versus a single-use LDPE mailer with 30% recycled content
- 4. Sensitivity test #4:** The impact of changing the type of packaging material used in single-use packaging compared with a centralised reusable packaging system:
  - a. LDPE plastic mailer with no recycled content
  - b. LDPE plastic mailer with 80% recycled content
  - c. Cardboard packaging with 89% recycled content

In each instance, the variable of average distance from distribution centre (DC) to consumer is used on the y-axis. This is to demonstrate the effect that changing overall transportation distances can have on each system, and to account for one of the three impact hotspots across all systems - transportation emissions.



# Findings

## Sensitivity test #1

The impact of increasing the distance travelled from the consumer to the cleaning node in a centralised reusable system versus a single-use LDPE mailer with 30% recycled content.

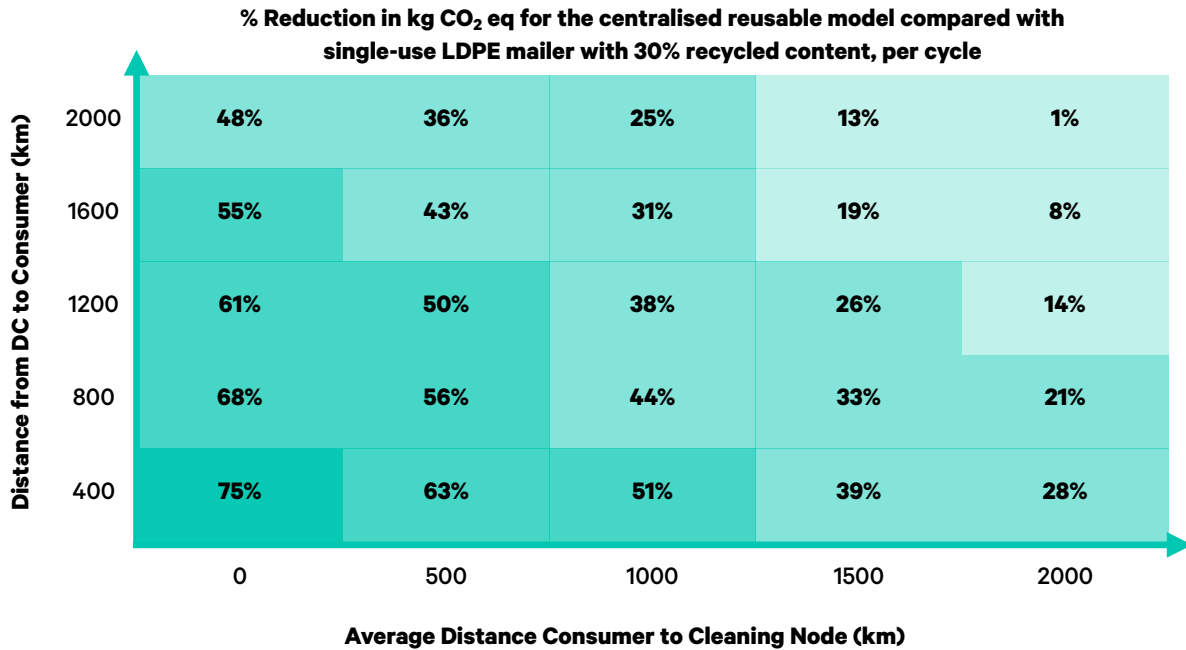


FIGURE 6

### FINDING:

The purpose of this analysis was to evaluate the impact that total distance travelled has on the viability of the reusable system. The above table demonstrates that, the further the reusable package travels from the consumer back to the cleaning node, the lower the reduction in CO<sub>2</sub> eq emissions compared with LDPE single-use packaging. This is simply due to the emissions associated with greater transportation distances. However, even with the package travelling a total distance of 4000km (2000km distance from DC to consumer plus 2000km distance consumer to cleaning node), there is a 1% carbon emission reduction compared with single-use plastic, thus highlighting the environmental impact viability of the system even across long-distances. Looking at the centralised base example (1500km from consumer to cleaning node, 400km from DC to consumer), it has a 39% carbon emission reduction compared with a LDPE plastic mailer, per cycle.

# Findings

## Sensitivity test #2

The impact of increasing the non-return rate of packages in a centralised reusable system versus a single-use LDPE mailer with 30% recycled content.

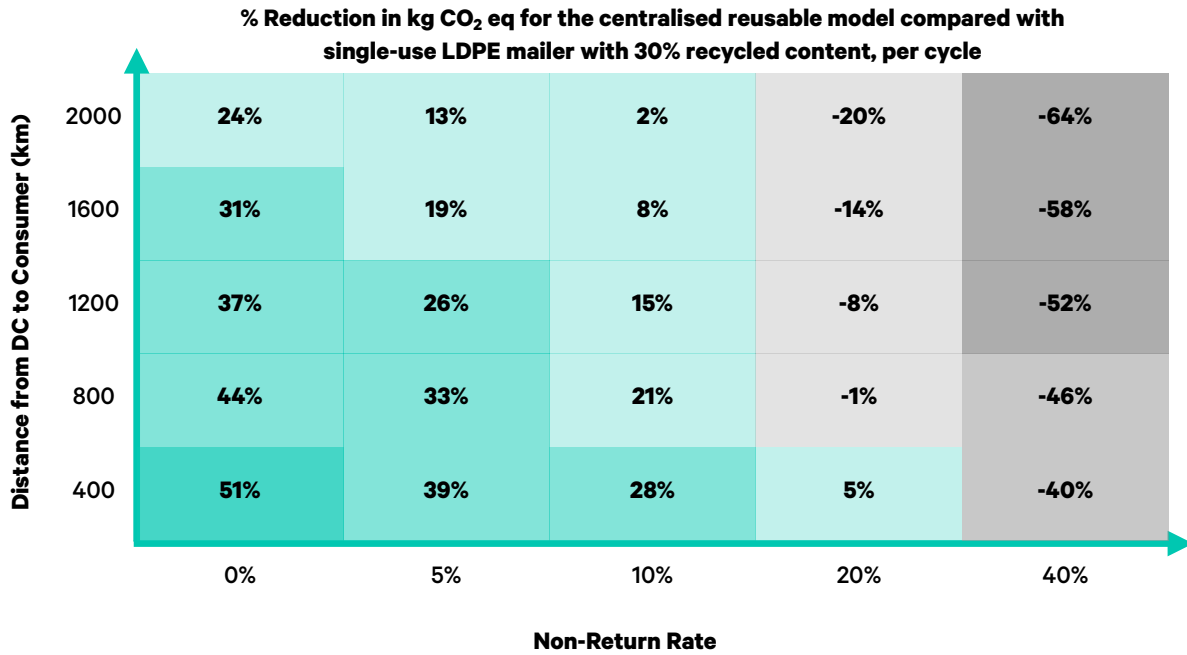


FIGURE 7

### FINDING:

The purpose of this test was to evaluate the significance of the non-return rate on the viability of the reusable system. From this analysis, we can see that the return rate of reusable packaging is central to its feasibility. Beyond a 20% non-return rate, the reusable package must travel a maximum of 400km from the DC to the consumer to present a reduction of CO<sub>2</sub> eq emissions compared with a 30% recycled LDPE mailer. This is because, in theory, the manufacturing and processing impact of reusable packaging is divided over multiple cycles; however, if the non-return rate is above a certain point (20% in this instance), the impact associated with having to replace those packages outweighs the benefits associated with the reusable system.

# Findings

## Sensitivity test #3

The impact of increasing the non-return rate of packages in a decentralised reusable system versus a single-use LDPE mailer with 30% recycled content.

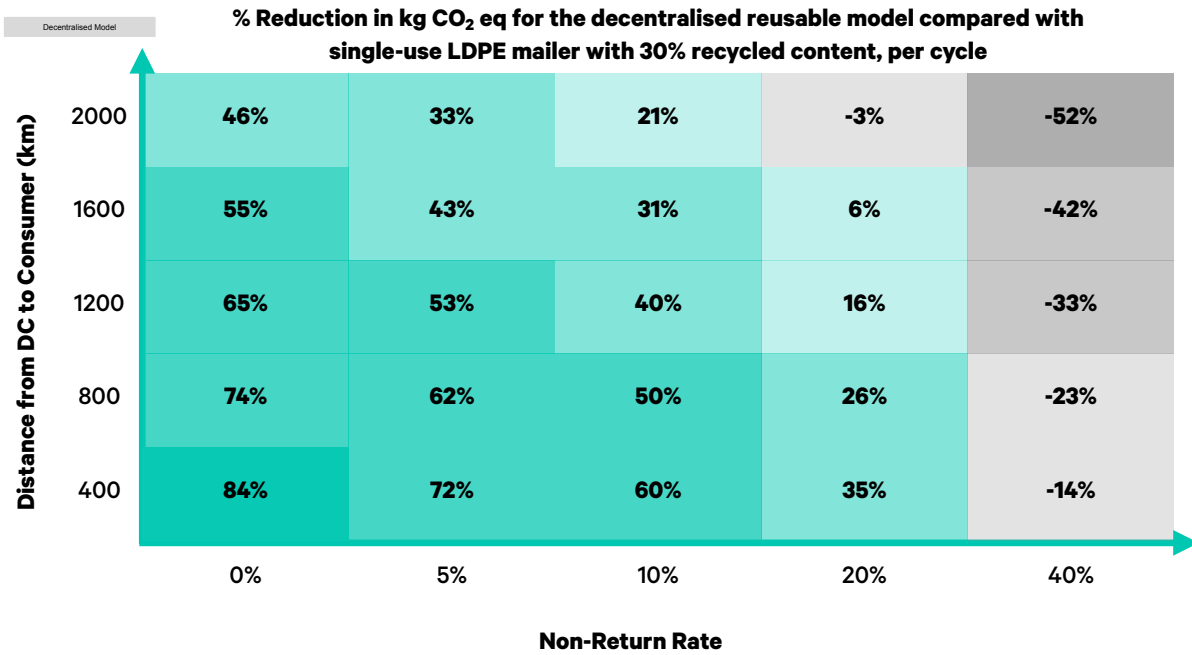


FIGURE 8

### FINDING:

In this example, the cleaning node was removed from the analysis. As mentioned, many reusable systems are emerging, one of which is the decentralised system. In this scenario, the cleaning/maintenance of the packaging takes place in the brand's DC, thus eradicating the need to transport the package to an additional node. Removing the centralised cleaning node has less transport emissions associated, thus it was found that reusable packaging has an improved carbon impact compared with the centralised system. Looking at the base case, there is a 72% reduction in carbon compared with the single-use LDPE mailer, per cycle. What is more, this system affords greater tolerance for higher non-return rates - which can be as high as 30% and still present a favourable case from a carbon emissions perspective. The same sensitivity analysis was conducted for the decentralised system versus a single-use LDPE mailer with no recycled content. It was found that there is an 82% reduction in CO<sub>2</sub> eq emissions compared in the decentralised reusable system compared with virgin LDPE packaging, using the base case variables.

# Findings

## Sensitivity test #4

The impact of changing the type of packaging material used in single-use packaging compared with a centralised reusable packaging system:

- a. **LDPE plastic mailer with no recycled content**
- b. **LDPE plastic mailer with 80% recycled content**
- c. **Cardboard packaging with 89% recycled content**

### a. LDPE plastic mailer with no recycled content

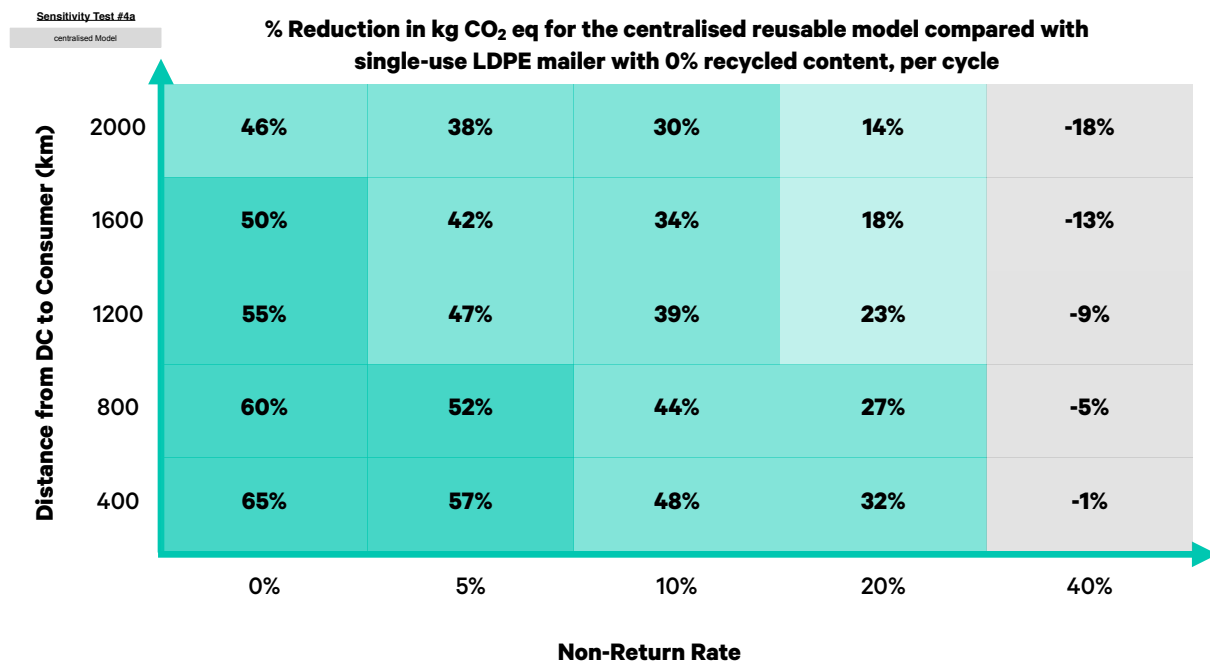


FIGURE 9

### FINDING:

Whilst the base for the analysis was grounded on single-use packaging with 30% recycled content, in-keeping with incoming UK legislation, the same comparative analysis was conducted using single-use packaging with 0% recycled content.<sup>49</sup> Changing the base scenario to LDPE packaging with 0% recycled content further improves the viability of reusable packaging. The impact hotspot demonstrates that over three quarters of the associated emissions in single-use packaging come from the raw material and processing phase, and so changing the composition of the packaging has significant implications on the total carbon emissions. In this instance, a 40% reusable packaging non-return rate still reduces the CO<sub>2</sub> eq impact by 2% when travelling 200km from DC to consumer, thus tolerating 20% higher non-return rates than in Sensitivity test #2. Moreover, the point at which reusable packaging increases CO<sub>2</sub> eq emissions in Sensitivity test #2 (20% non-return rate, 800km distance from DC to consumer), boasts a 23% reduction in CO<sub>2</sub> eq emissions per cycle in this context - clearly demonstrating that recycled content of the single-use packaging influences the viability of the reusable system.

# Findings

## b. LDPE plastic mailer with 80% recycled content

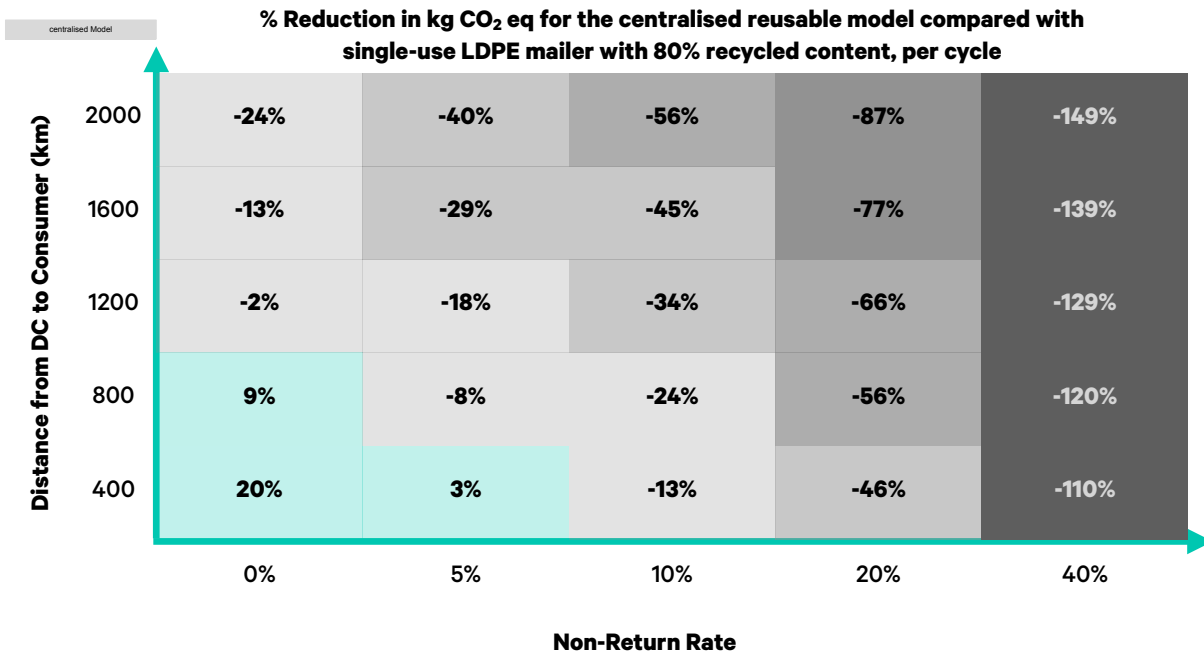


FIGURE 10

### FINDING:

On the other hand, from the graph above, it is clear that increasing the recycled content of single-use packaging is an effective means to lowering the associated carbon emissions. 80% recycled content was chosen for this analysis as it is the minimum required to fulfill the 'Blue Angel' (Blauer-Engel) EcoLabelling standard, thus providing a realistic benchmark.<sup>50</sup> In this instance, with 80% recycled content LDPE packaging, reusable packaging only reduces CO<sub>2</sub> eq emissions when the non-return rate is 5% or less. The package also cannot travel further than 1000km from DC to consumer without an increase in CO<sub>2</sub> eq emissions, even with a 0% non-return rate. The base case of 5% non-return rate and 400km distance from DC to consumer presents a 3% reduction of emissions compared with single use packaging. This is a 36% reduction difference with Sensitivity #2 and 54% reduction difference with Sensitivity #4a - highlighting the influence that high recycled content of LDPE packaging has on the viability of the reusable system.

# Findings

## c. Cardboard packaging with 89% recycled content

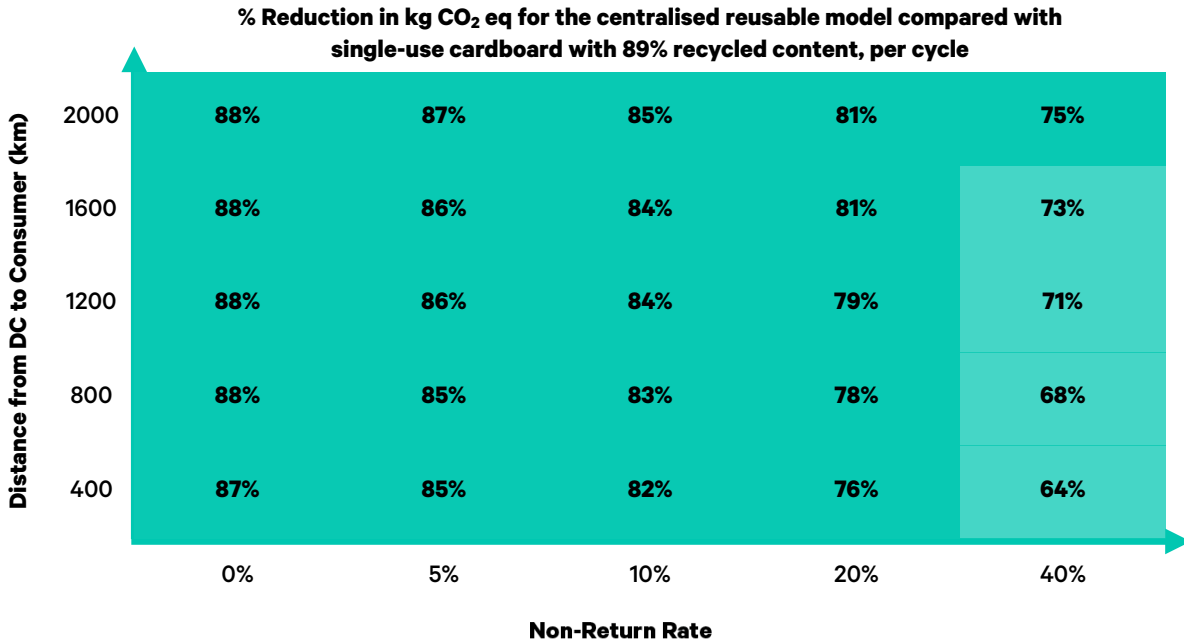


FIGURE 11

### FINDING:

When comparing the reusable system with cardboard with 89% recycled content, it is clear that reusable packaging reduces carbon emissions drastically (between 64% - 88%) per cycle. Reusable packaging can tolerate non-return rates of 40% and travel distances of 2000km+ between DC to consumer and still reduce carbon emissions by over 60%. Interestingly, in this context, the % reduction in CO<sub>2</sub> eq emissions actually increases as the distance travelled by the package increases, contrary to that in the LDPE mailers context. This is because, as previously mentioned, the weight of cardboard makes the transportation phase a key source of emissions. Therefore, despite the emissions associated with the return transport phase in the reusable context, the CO<sub>2</sub> eq emissions from cardboard packaging remain greater.

# Considerations for Implementation

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The purpose of this section is to take the findings from the impact assessment and present the key considerations for implementing a reusable system to ensure its future potential success.

The above analysis has demonstrated that certain factors can drastically influence the viability of reusable packaging for fashion e-commerce, whilst having significant consequences from an economic perspective too. Therefore, considerations must be made and action must be taken to ensure reusables are implemented in an effective manner. In addition to the impact assessment, interviews were also conducted with Fashion for Good brand partners and innovators who have piloted reusable packaging solutions to understand the key lessons learnt from implementation.

Adopting reusable packaging is a systems-level change that requires buy-in from all stakeholders across the value chain - including innovators, brands, 3PL companies, consumers and policy-makers.<sup>51</sup> Only with the participation and collaboration of all parties will we be able to see the potential impact of reusables come to fruition.



**Packaging is really about systems. It's not about the product, it's also about process and participation. Only with that perspective in mind are you going to see how reusables work on a system level.**

Michael Newman, Founder, **Returnity**

# Considerations for Implementation

## MAXIMISING RETURN RATES

### ISSUE:

**Ensuring high rates of return for the packaging is central to both the environmental and economic viability of reusable packaging.**

From Sensitivity test #2, we can see that a 0% non-return rate can cause a 51% reduction in CO<sub>2</sub> eq compared with single-use packaging; however, a 40% non-return rate increases CO<sub>2</sub> eq emissions by 40% (travelling 400km from DC to consumer).

However, getting packaging returned is more complicated than it initially may seem; it is a behavioural change that requires a fundamental re-thinking of how we currently interact with packaging. Given the nascency of the innovation, coupled with the ubiquity of single-use packaging, many consumers have not engaged with reusable packaging in the fashion e-commerce context.

**Reusable packaging is more complicated than just sending a package back and forth - there is a key consumer education piece to increase return rates.**



Karla Jabben, Corporate Responsibility Manager, **Otto**

**Therefore, a central part of the undertaking in transitioning to a reusable system is to inform consumers, communicate its importance, and help them through the process.** It may seem obvious, but simple messaging that clearly informs the consumer on how to return the empty package, or how to return the package containing product returns, was cited as a crucial lever to increase return rates of packaging.

**Innovators must collaborate with brands to think about communication;** how to communicate with consumers, what to communicate, where to communicate and when to do it. There is not one silver-bullet approach to communication, but instead it is specific to the brand's consumer group and therefore requires collaboration between the brand and the innovator to implement it. **Communication more broadly has a role in educating consumers on the potential benefits of reusable packaging.** In doing so, interviewees cited that consumers become more motivated to engage in the process, thus leading to an increase in the return-rate. Informing consumers on the importance of reusable packaging is a crucial step-change in transitioning to a system whereby reusables are commonplace.



## Considerations for Implementation



**To make [reusable packaging] work, it's not something that Zalando can do by itself, it requires packaging innovators and the consumers.**

Andrea Roxin, Manager Environmental Sustainability, Zalando

Beyond communication, **incentivisation is commonly used as a method to motivate consumers to return the packages.** One incentivisation example being implemented by brands and retailers is the use of a reward system. RePack are the biggest proponents of this approach - they have created a marketplace where consumers can redeem a discount code on future purchases once their package has been returned. The marketplace features all RePack participating brands and retailers - encouraging consumers to discover other brands utilising reusable packaging. The discount code can also be redeemed in the form of a charitable donation, if preferred. It is difficult to quantify the impact on return rates that the discount-code incentivisation presents; however, RePack cited that it was significant in increasing returns, whilst improving the customer experience of using reusable packaging.

The use of discount codes for incentivising returns can be considered one tool amongst many to engage and motivate consumers in the short-term; however, other considerations are crucial when thinking about scaling reusable packaging in the future. The most commonly cited of those was to increase the number and type of return points. **The benefit in doing so is multi-faceted; on one hand it increases the convenience for consumer returns, whilst also helping to reduce the costs associated with the reverse logistics.** It facilitates the pooling of packages before being sent back to the DC, increasing the scale and thus reducing the per unit cost of the returns. The aggregation of packages also has positive consequences on the environmental impact, reducing transportation emissions. **It requires collaboration between innovators, 3PL companies and brands to increase the density of return points, placing customer-centricity at the heart of the reusable system.**



**Scale allows the system to thrive - a system with high densities of convenient drop-off points with agnostic shippers becomes a fluid system that normalises reusable packaging.**

Ashley Etling, CEO & Co-founder, LimeLoop

One such example of a similar model operating in the fashion industry, but outside of reusable packaging, is the US-based Happy Returns. Happy Returns' 'Return Bar' system allows users to return their order in over 2,500 locations across the USA, initiating the exchange, refund or store credit immediately.<sup>52</sup> Once collected, the returns are aggregated and shipped to regional Return Hubs for sorting and processing.<sup>53</sup> Although it is currently focused on e-commerce returns, this type of innovation could be applied in the returning of reusable packaging in the future.

# Considerations for Implementation

## INTEGRATION INTO BRAND'S DISTRIBUTION CENTRE (DC)

### ISSUE:

Reusable packaging can present challenges in integrating into the brand's DCs, given their optimised systems are set-up for single-use packaging.

Many (large) brands have optimised systems and automated processes for fulfilling e-commerce orders in their distribution centres. The introduction of reusable packaging can require changes to be made to the incumbent processes, sometimes at the expense of operational productivity.<sup>54</sup> Warehouse workers may have to spend a longer time packing, leading to increased total labour costs.<sup>55</sup>

There is no doubt that the introduction of reusable packaging will lead to changes in the operations and logistics for brands. Moreover, given that each brand has a unique approach to fulfilling e-commerce orders, there is no one-size fits all solution to overcoming this challenge.



**Crucial to Returnity, given the brand is purchasing the asset, is making the integration into their [the brand or retailer's] current system as seamless as possible.**

Micheal Newman, Founder, **Returnity**

Regardless of the current system, creating a seamless integration into existing processes is crucial for the scalability of reusable packaging. One such innovator aiming to overcome the challenges with warehouse integration is LimeLoop. From the outset, LimeLoop has been creating 'layers of technology' to make a more seamless integration into the brand's warehouse management system, as well as integrating into the e-commerce system. **Innovation in integration of reusable packaging, especially where it fits into current equipment and processes, should be a top priority by innovators to save on manual labour costs. The integration of reusables requires brands to pilot the technology and open up their distribution centres, allowing innovators to see how their current systems operate and then deliver a product to fit that.** The experience of piloting and bringing product to market will help to reveal the challenges with the current system, allowing innovators and brands to iterate and improve the offering. Only with this level of collaboration and co-development will all stakeholders benefit from the innovation.

**Piloting with brands is the best way to understand the success areas and challenges. It is super important that the brands are willing to test, fail and try again.**



Clémence Avignon, Sales Marketing Manager, **RePack**

# Considerations for Implementation

## INEFFICIENCY IN THE CURRENT REUSABLE SYSTEM

### ISSUE:

There are some inefficiencies in the reusable system that should be overcome to further optimise the offering.

Given the nascency of reusable packaging for e-commerce in the fashion industry and the complexity of the system, there are still some inefficiencies that can be eradicated to further optimise the reusable packaging system. These can be summarised as follows:

- 1. Transition from centralised to decentralised system** - by moving to a decentralised system, thus integrating cleaning and maintenance within the DC, transportation distances are reduced. In turn, so are transportation emissions, reducing the overall environmental impact of the reusable system. From the diagram below, we can see that integrating the cleaning node into the DC can reduce per cycle CO<sub>2</sub> eq emissions by over 50%.
- 2. Increase the recycled content of the package** - in the decentralised model, we can see that the raw materials and processing emissions account for over 60% of the total per cycle emissions. Given in this context the recycled content is set to 70%, there is room to further innovate and integrate more recycled content into the product to reduce the emissions associated with the raw materials and processing stage. For example, LimeLoop is making their reusable packing from 100% recycled billboard vinyl material, diverting waste from landfill and reducing the burden on virgin resources.

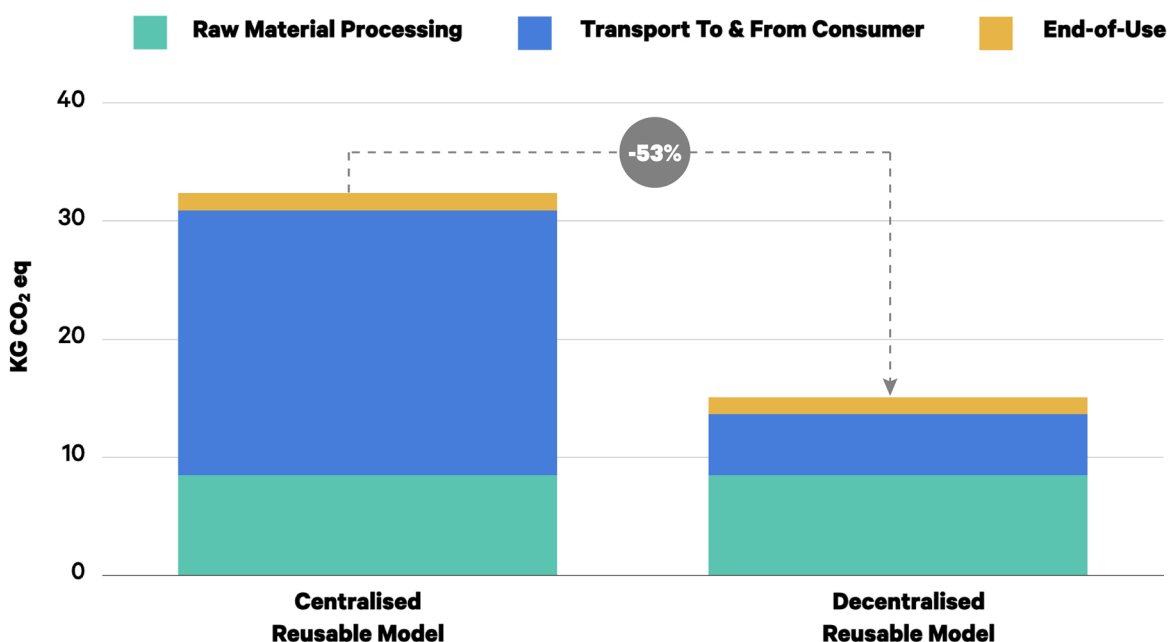


FIGURE 12

# Conclusion

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The exponential growth of e-commerce, coupled with optimised global supply chains has meant that we are consuming more packaging than ever.<sup>56</sup> Whilst the current system of single-use plastic provides a low-cost and highly functional solution, it often comes at the expense of the environment. Increased consumption of packaging is fuelling the continued extraction of fossil-derived raw materials, whilst low recycling rates for flexible plastic packaging are leading to the generation of huge amounts of plastic waste.

Fortunately, there is unprecedented interest in new packaging materials, new business models and new technologies that are spearheading the transition towards a more sustainable and circular packaging industry.<sup>57</sup> At the forefront of this are closed-loop reusable systems, which reorient packaging from a linear model of 'take-make-dispose' into a circular multi-use asset that is returned and reused on multiple occasions.

This research demonstrated the clear impact case for reusable packaging, in some instances presenting more than an 80% reduction in CO<sub>2</sub> eq emissions compared with a single-use alternative. However, it also shed light on the nuance in the system - there are a number of variables that have the capacity to drastically influence its impact:

- **Overall transportation distances** - shorter transportation distance from DC to customer, and customer back to the cleaning node in the reusable system reduces overall carbon emissions
- **Return rates of reusable packaging** - high rates of return keep reusable packages in circulation for longer - dividing the material impact over multiple cycles thus reducing the carbon footprint
- **Centralised versus decentralised system** - bringing cleaning and maintenance in-house within the reusable system reduces transportation distances and carbon emissions
- **Type of single-use packaging used** - if single-use packaging is to be used, packaging with high recycled content should be used to reduce emissions associated with the manufacturing stage.

# Conclusion

## CALL TO ACTION

Specific actions must be taken by all stakeholders in the value chain to ensure that reusable packaging scales in an environmentally and economically viable manner. The path forward can be grouped into three actions that should be pursued simultaneously:

### EDUCATION

The most important factor influencing the viability is the return rate of reusable packaging. Maximising return rates requires a fundamental change in behaviour from consumers so assistance and education must be provided.

- Brands and retailers should give simple and clear instructions on how to return the packaging, as well as educating consumers through compelling programmes on the importance of reusable packaging more broadly.

### INNOVATION

Given the relative nascency of reusable packaging in the fashion e-commerce sector, more can be done to optimise the offering.

- Innovators should work to increase the recycled content of the reusable packaging to 100% and bring all cleaning and maintenance in-house to further improve the environmental case.
- Working to integrate cleaning and maintenance within the DC also requires significant collaboration between innovators, brands and 3PL companies - thus highlighting the interrelatedness of the actions that must be pursued.
- The whole value chain should work together to increase the density of drop-off points to enhance convenience - putting customer-centricity at the heart of the system.

### COLLABORATION

Transitioning to reusable packaging is a systems-level change that requires buy-in from all stakeholders across the value chain.

- Brands and retailers should pilot with reusable packaging innovators and 3PL companies to test and iterate on applicable processes to fit their supply chain needs. No one company or innovator can instigate the change alone — it requires collaboration with all relevant stakeholders to move the needle forward.

## **THE IMPACT CASE IS THERE.**

**It now requires education, innovation and collaboration throughout the value chain to bring reusable packaging to scale.**

# Appendix

## SYSTEM BOUNDARY - THE LINEAR SYSTEM

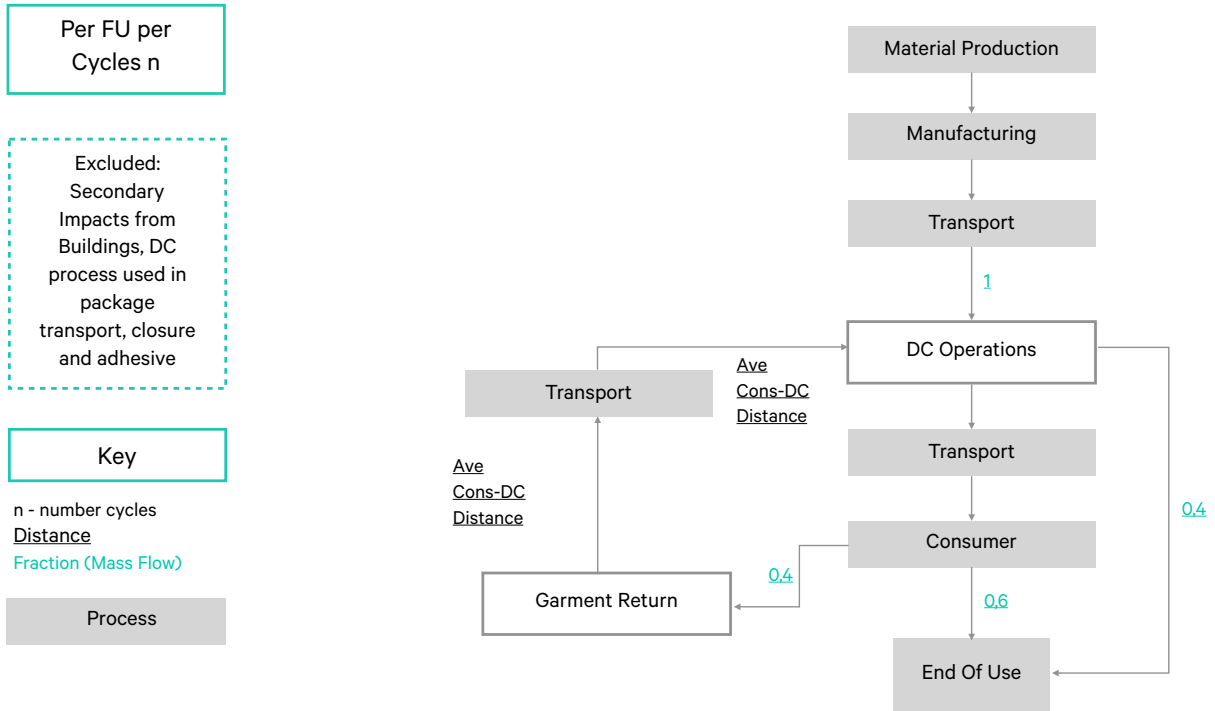


FIGURE 13

## SYSTEM BOUNDARY - THE REUSABLE SYSTEM

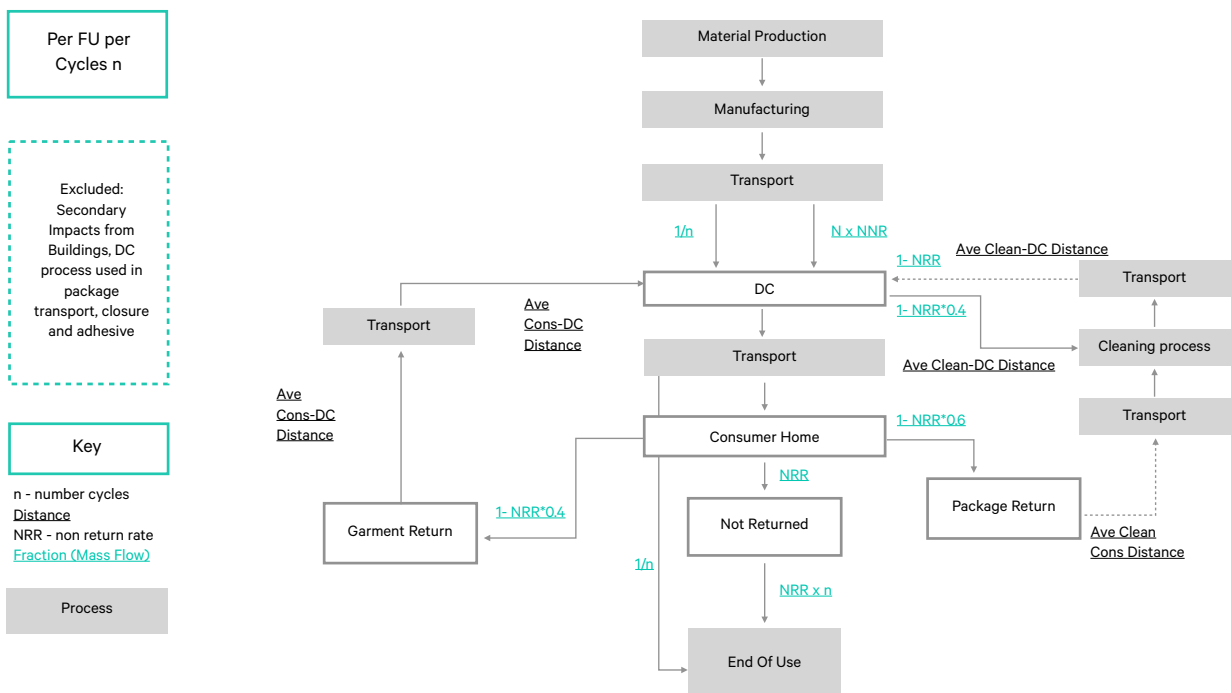


FIGURE 14

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