Mitigating Growing E-Commerce Packaging Waste

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Background

E-commerce has steadily increased over the past ten years and grown exponentially during the COVID-19 pandemic (Rheude, 2021), where e-commerce sales worldwide were expected to surpass USD 4 trillion (an increase of 18% on the previous period) (Cramer-Flood, 2020). According to the United Nations Conference on Trade and Development (2021), the share of online retail grew by 7.5% in the United Kingdom (UK) between 2019 and 2020. Forecasts show that e-commerce will continue to rise in the UK. By 2025, it is projected that online shopping will account for half of the sales in the food, beverage, and household goods industries (Fisher, 2021).

As the figures above indicate, the growing use of online shopping appears an almost unstoppable force. Notwithstanding the extra boost provided by COVID-19 pandemic-related conditions, a large body of literature has identified multiple factors which have driven consumer take-up (Venkatesh et al., 2022). Consumer motivations for using online shopping include perceived convenience (Duarte et al., 2018), efficiency, and cost-savings, an ability to compare products, and an enjoyment of browsing and shopping (Venkatesh et al., 2022). Personal traits such as value-consciousness and impulse-buying tendencies also correlate with increased use of online shopping channels (Venkatesh et al., 2022).

A consequence of this growth is the parallel increase in the amount of packaging used for shipping these goods (Chua, 2021). For example, it is expected that global use of plastic packaging for e-commerce will grow to reach an estimated weight of 4.5 billion pounds by 2025 (Tiseo, 2021). With this projected growth trajectory of e-commerce, and the existing approach to how purchases are packaged, the negative environmental impact of e-commerce packaging can only increase. The environmental problems associated with packaging from e-commerce sales are two-fold: the resources used to produce the packaging materials (primarily paper/cardboard and plastic) and the disposal of used packaging at various stages of the e-commerce sales process. For example, it is estimated that some 3 billion trees are pulped annually to support the creation of 241 million tons of cardboard for paper packaging (Pack4Good, n.d.). Cutting down trees to create packing causes deforestation and negatively impacts biodiversity (International Union for Conservation of Nature, 2022), as does the disposal of packaging waste.

According to a World Bank report, global waste will grow by 70% in 2050 unless urgent action is taken (Kaza, et., 2018). In England rates of recycling are not particularly high, with the recycling rate for ‘waste from households’ recorded at just 45.5% in 2019 (Department for Environment, Food & Rural Affairs, 2021). Where material is not recycled, it tends to end up in one of the most common systems of waste disposal, landfills, which have been shown to cause significant environmental damage. As materials in landfills decompose, they produce leachate (a highly toxic liquid) and greenhouse gases, such as methane, which cause

groundwater and air pollution and contribute significantly to the existential threat of climate change (El-Fadel et al., 1997). If waste does not end up in landfill, then it is often incinerated, with 10.8 million tonnes of waste being sent from England to be incinerated in 2017/18 (Department for Environment, Food & Rural Affairs, 2018). This contributes to the estimated 40% of global waste which is burned, posing large-scale risks to both our atmosphere and the people who live near the burning sites (United Nations Environment Programme, 2021).

Having identified the key environmental issues associated with the proliferation of e-commerce packaging, this paper aims to identify effective and practical solutions to reduce the amount of e-commerce packaging that ends up being incinerated or sent to landfills. Importantly the project accepts, on the weight of the evidence outlined above (and the market power of key e-commerce firms and current consumer demand), that the growth trajectory of e-commerce sales is somewhat predetermined. The project does not seek to reduce the number of e-commerce transactions themselves, but rather to identify ways in which to systematically reduce the amount of packaging used throughout the e-commerce transaction life-cycle, and to increase the effective recycling of that which remains.

The scope of this project is further focused specifically on large city centres (such as London) in the United Kingdom. Such a narrow focus is necessary given the significant heterogeneity that exists across the world in terms of cultural and social norms, economic conditions, urban planning, and legal and regulatory contexts (including surrounding waste disposal) – all of which create very different environments in which to examine possible solutions to the problem identified above. Furthermore, the project focuses specifically on larger e-retailers as they hold greater responsibility for packaging waste growth given their sizable market share. Given the scope of the project, it is acknowledged that the analysis and proposed solutions will likely differ (and need to be adapted) to different contexts around the world. However, a focus on large city centres in the UK and large e-commerce firms does provide opportunities for deeper analysis (given the amount of data available for review) and larger impact overall, as even small changes to the current operation of very large e-commerce firms (and to consumer behaviour in large cities) have the potential to generate substantial positive impacts.

Introduction

The project background above outlines the rising dominance of e-commerce in everyday life and the parallel increase in e-commerce packaging in circulation, along with the significant environmental impact of this packaging when it is not effectively recycled. Given this contextual background, and within the outlined project scope, this paper aims to identify effective and practical solutions to reduce the amount of e-commerce packaging that ends up being incinerated or sent to landfills. In the following sections, the paper outlines our theoretical approach, relying on the Circular Economy Model and Installation Theory, and subsequently produces analysis on key 'stages' of the e-commerce packaging life-cycle. Based on this analysis, the project develops viable solutions for current e-commerce packaging that acknowledge business imperatives and customer needs, and which, if successfully implemented, should significantly reduce the amount of packaging within the e-commerce life-cycle, and increase the effective recycling of that which remains. We conclude with an analysis of identified limitations which present opportunities for future exploration.

Theoretical Models of Analysis

Circular Economy Model

The Circular Economy (CE) Model is centred on the idea of extending the value of resources through slowing, closing, and narrowing resource loops (Bocken et al., 2016). A linear process becomes circular through designing life-long durable products, leveraging waste as a resource, and using fewer materials per product. CE has increasingly been receiving attention on a global level as a critical step to achieving a more sustainable society (Reike et al., 2018). This support has been evidenced through the urgent recommendations to close materials loops from global actors including the Organization for Economic Co-operation and Development, the World Economic Forum, and the United Nations Environment Program (Reike et al., 2018). Through its objective of breaking the 'take-make-consume and dispose' pattern of growth (European Environment Agency, 2016), it enables economic growth without the use of virgin resources, decoupling economic growth from resource extraction (United Nations Environmental Programme, 2011).

There are also relevant examples of its practical application. In 2018, the Single Use Plastic Project was launched, a coalition of 35 European outdoors retailers with the objective of significantly reducing the growing amount of plastic waste in the distribution of their goods (Single Use Plastic Project, 2022). Through significant research and assessment over a four-year period, it was concluded that it was a systems problem rather than a materials problem. To test this hypothesis, the project created a circular designed research trial which found great success, "consumer feedback showed elevated net promoter scores (NPS), an elevated

perception of order condition/value, [no impact to return rates, and a staggering amount of plastic saved from landfills.]" (Single Use Plastic Project, 2022, p.14). While this was conducted by independent retailers within their own fulfilment centres, there is great promise of innovations that can be adopted industry-wide to reduce packaging waste.

Both the literature of circular models and evidence of a successful application within the packaging sector demonstrates the CE models viability for analysing solution areas within the packaging sector. This analysis will be further enhanced using Installation Theory, wherein behaviour change is required to enable circularity.

Installation Theory

"Installations are local, societal settings where humans are expected to behave in a predictable way...[they] consist of a set of components that simultaneously support and control individual behaviour." (Lahlou, 2018, p. 404). Within these local, specific settings, Installation Theory guides us to analyse the three interconnected elements or layers: the physical affordances, the psychological or embodied aspects (e.g. the embodied competencies of the subjects in the setting) and the social regulation of the setting (Lahlou, 2018). Installation theory tells us that from this analysis, we find that, in each installation, these three layers act simultaneously to produce the observed behaviour of the subjects, but also provide the key to determining where we might effectively intervene to change behaviour (and thus relevant outcomes) (Lahlou, 2018).

In the context of this project, the application of the CE model assists in identifying key installations for analysis, leading to suggestions for practical interventions which reduce packaging waste in systematic and sustainable ways. Several well-established social-psychological theories have contributed to the development of Installation Theory (for example, Activity Theory and Distributed Cognition), and these are drawn on in various ways below to deepen our analysis of identified installations (Lahlou, 2018), specifically in relation to the Consumer Recycling section of this report.

Analysis and Solutions

E-Commerce Packaging System Overview – Application of the CE Model

The CE model was applied to the currently linear e-commerce packaging system. As shown below in Figure 1, ten key steps were identified, showing where certain behaviours are facilitated or constricted, impacting the ability to achieve and maintain circularity. By understanding the current e-commerce packaging system in its entirety, the best opportunities to slow, close and narrow the overall system, enabling circularity, became

identifiable. The analysis in this section allows us to identify and analyse key leverage points for intervention, and underpins the solutions described in later sections. The development of lasting solutions was rooted in thorough analysis, where the aforementioned theoretical models were applied towards our identified problem.

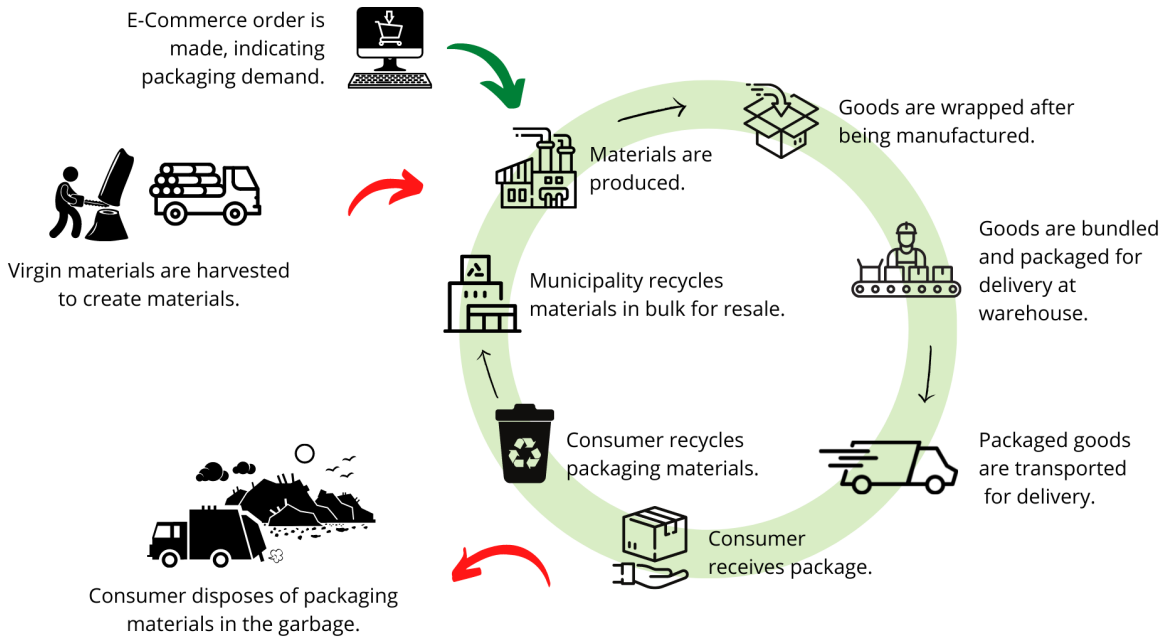

Figure 1. Application of the CE Model to the E-Commerce Packaging System.

There are two steps which serve as the simplest determinants of circularity: packaging materials developed and consumer disposal. If packaging materials were solely sourced from recycled materials and consumers exclusively recycled all packaging materials, the process would successfully shift from linear to circular. However, the complexities of human psychology, cost of doing business, materials available, recycling infrastructure, among other complex factors, explain why only relatively low amounts of materials end up being reused and recycled (BBC News, 2021).

Fortunately, further analysis into each of these key steps demonstrates that circularly can be enabled by stakeholders in various steps of the e-commerce packaging lifecycle. While each step holds promise for playing a role in achieving circularity, it is apparent that not all action is effective or cost-efficient. For example, whilst decomposition technology has advanced considerably, it is still expensive and energy intensive to create, with certification reliant on successful trials in laboratory environments (Shah et al., 2008). Though many delivery companies are key stakeholders in e-commerce, their bandwidth for enabling further sustained change remains low. Furthermore, an environmental intention-action gap on the part of consumers poses a significant barrier to the success of companies employing a more financially demanding eco-packaging option at checkout (Shaw et al., 2015). Consequently,

the key themes of packaging materials, warehouse packaging, and consumer recycling are identified from our application of the CE model as the most appropriate areas where meaningful interventions can be employed.

Table 1 below presents an overview of the e-commerce packaging system steps of analysis and subsequent proposed solutions aimed at enabling greater circularity and thus less extraction of virgin materials and waste of reusable materials.

Table 1. Solution Overview

Themes of Analysis		**Solutions**
	*Packaging Materials*	1. Banning single-use plastics to prioritise the use of cardboard packaging
		2. Reducing primary packaging for e-commerce orders by leveraging forecasting technologies
	*Packaging in the Warehouse*	3. Fulfilling E-commerce orders with a single layer of packaging
	*Consumer Recycling*	4. Distributing 'move-in packs' to all new residents across London boroughs
		5. Increasing the ability to recycle at delivery lockers

Theme #1 - Packaging Materials

Analysis

When a product is brought to the market, a key factor regarding the chosen packaging is where and how the product is sold. If the product is sold in a retail setting, it may require less packaging than an online setting, as the item is packaged by the cashier. Furthermore, the amount and type of packaging used is dependent on whether the product is sold under a business's independent e-commerce shop or retail location or through a third-party distributor.

Once determining the setting in which the product is sold, businesses then consider a wide range of variables that dictate the type and quantity of packaging materials used. This includes fragility of the product, cost of the materials, accessibility of the materials, unboxing experience, and product size. Moreover, the trade-offs associated with the variables must be considered, for example, some products like an Instant Pot (a multifunction cooking

appliance) will cause much more environmental impact if they arrive damaged and unusable compared to utilising more packaging to prevent damage (Chua, 2021). In addition, the 'unboxing experience' can significantly influence the design and use of packaging; for example, Louis Vuitton has created various packaging ranges aligned with their approach of creating iterative fashion seasons, creating a visual signature for the brand (Louis Vuitton, 2021).

However, selling products through a third-party retailer will likely have the biggest influence on packaging. Amazon, who yielded USD 468.78 billion of revenue in 2021, is the world's largest online marketplace (Coppola, 2021a). The benefit for producers to sell on Amazon is the access to 300+ million world-wide customers and order fulfilment services (inventory storage, delivery, returns, and customer service). To successfully use Fulfilment by Amazon, sellers must follow strict guidelines on product packaging. This includes no loose items, perforated boxes passing a 3-foot drop test on all sides/corners and polybags not protruding 3-inches past the enclosed product (Amazon, n.d.-a). If a seller does not comply, they will receive financial repercussions or have their product removed from the marketplace (Amazon, n.d.-b).

By analysing the decision making and justification that goes into product packaging material, we have developed two feasible solutions.

SOLUTION 1. Banning single-use plastics to prioritise the use of cardboard packaging.

The three most common types of product packaging include cardboard, polybags, or blister packs, as shown below.

Figure 2. Common Packaging Materials.

Cardboard is lightweight and durable, making it optimal for shipping. Due to its composition from softwoods trees, it is very biodegradable but energy intensive to produce (Daggar, 2021). Both polybags and blister packs can protect products from moisture damage, but due to their crude oil by-product origins, they take upwards of 400 years to degrade (ATL-Dunbar, 2019). This is why plastics are often found in natural areas when garbage has accumulated; they take a *very long* time to degrade. Governments globally are responding by implementing regulations that target packaging as a whole, and single-use plastics in particular, for their severe environmental impact (Berg et al., 2020). Moreover, some corporate giants like

Unilever are taking proactive action in response by applying the *"less plastic, better plastic, no plastic"* framework across their business (Unilever PLC, 2022).

Considering this, and the fact that the overall rate of recycling in the UK for cardboard is 80% while just 54% for plastic (Botham, 2021), this project recommends all packaging use paper-based materials, such as cardboard, wherever possible. We recommend that this be achieved via the implementation, by the UK Government, of a ban on single-use plastics.

In April 2022, the UK Government introduced the Plastic Packaging Tax, which applies to plastic packaging that does not include at least 30% recycled content (UK Government, 2021). This provides incentives for materials manufacturers to use recycled plastics with the aim of growing demand for these materials. However, a study carried out by the New Economics Foundation for the Rethink Plastic Alliance concluded that while plastic taxes would increase recycling rates, they do not address the overall increasing levels of consumption that plastics, recycled or otherwise, would continue to respond to (Rethink Plastic Alliance, 2018). As such, we recommend that the UK Government go further than the current plastics tax and follow the Government of India's lead by banning all single-use plastics, aside from those exempt to respect perishability and maintain cleanliness (food quality preservation, Band-Aids, etc.).

A limitation that must be considered is the moisture sensitivity of various products, such as medicines and electronics. Currently, both require plastic packaging to maintain the integrity of the product. However, Amazon India has successfully eliminated single-use plastics from their Fulfilment Centres, suggesting that innovations for plastic-free moisture-blocking packaging is attainable if prioritised (Amazon India, 2020).

SOLUTION 2. Reducing primary packaging for e-commerce orders by leveraging forecasting technologies.

When goods are produced at a manufacturing facility, they are individually wrapped in packaging to protect the item on its journey to the chosen sales site (retail or e-commerce, whether administered independently or by a third-party). When the product shows up at the retail site, the individual product packaging (primary packaging) will be removed and disposed of before the product is sold. For e-commerce, the product maintains this layer of primary packaging, followed by the secondary packaging in which it is shipped in.

However, this process creates an unnecessary amount of packaging. With the growing collection of data points and subsequent sales forecasting capabilities, most businesses can gauge how much product will be sold through each sales path through analysis of past years' performance. We therefore recommend that when a product line is made at the manufacturing facility, it is bulk wrapped with respect to the forecasted sales intended within each sales channel, as shown below in Figure 3.

Figure 3. Bulk Packaging Solution.

The Single Use Plastic Project (2022) conducted a study with some 30 outdoor retail companies. In the experiment, e-commerce orders were fulfilled without the use of primary packaging. Results showed that customers reported no indication that the product was damaged, dirty, or wrinkled and expressed an improvement in the overall experience by having less waste in the ordering process (Single Use Plastic Project, 2022).

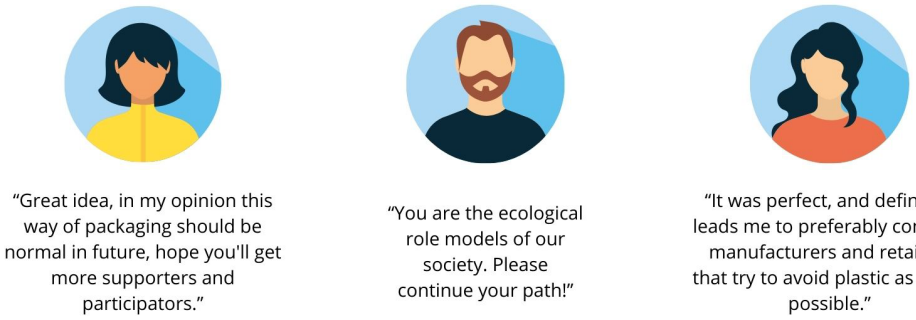

Figure 4. Feedback collected from The Single Use Plastic Project research study.

A limitation that must be considered is the viability for this solution with a third-party e-commerce marketplace, like Amazon. Considering they have 350 million products (Runyon, 2022), which all vary in popularity and sales speed, having loose items in warehouses could be problematic for maintaining inventory organization and product cleanliness.

Theme #2 - Packaging in the Warehouse

Analysis

While we briefly touched on the process of selling through an online marketplace like Amazon, it requires further analysis. E-commerce will make up almost a quarter of all retail purchases by 2025 (Coppola, 2022) and this continuing growth will only exacerbate the negative environmental impact, unless significant changes are made. E-commerce itself is dominated worldwide by third-party online marketplaces (Coppola, 2021b), such as Amazon, Alibaba, JD.com etc. The third-party nature of these marketplaces means that at least two layers of packaging are involved in the delivery of an item purchased online; primary packaging by the producing company and secondary packaging from the online-service-provider (e.g., Amazon).

Primary packaging may be in bulk or individual, depending on the type of product and size of the purchase by the marketplace. Though the primary layer of packaging has various purposes that apply to brick-and-mortar shopping, some of these do not extend to e-commerce. Many aspects of product packaging are designed to attract the attention of consumers and influence their purchasing behaviour through brand marketing, product differentiation, and transmission of product information (Poturak, 2014). However, in an e-commerce context, the product is generally purchased before the packaging is seen and information is communicated via the purchase site, so these traditional functions of product packaging are not likely playing any significant role.

Secondary packaging by the online marketplace has multiple purposes, such as providing additional protection, optimizing multi-product purchases, enabling effective transport and storage, and encoding and sorting products. Therefore, this layer of packaging can currently only be minimised, not removed. Amazon has been conducting research on how to minimise secondary packaging and make it paper-based where possible (Quigg, 2019), while also collaborating with suppliers to create the “frustration free packaging” program, which combines primary and secondary packaging as much as possible (Wright, 2021).

Considerations of hygiene, cleanliness and safety still apply to certain products, which necessitate their being shipped in primary packaging. For these, the minimisation of primary packaging is desirable, instead of its removal. However, there are items where these considerations do not necessitate primary packaging. For such items, the aforementioned study by the Single Use Plastic Project (2022) indicated that consumers did not report damage or contamination of delivered items when primary packaging was removed, and consumer responses to the remover of primary packaging were positive overall.

SOLUTION 3. Removal of primary packaging where feasible.

Building upon the limitations identified in Solution 2, we propose that online marketplaces encourage their suppliers to limit or remove primary packaging for applicable products (except where product fragility, perishability, etc., make this impractical). In this first instance, this could be achieved by incentivising suppliers to bulk wrap items for a discounted service fee when using a service like that of Fulfilment by Amazon. However, where this is not possible, large online marketplaces should consider (with supplier agreement) removing primary packaging in the fulfilment facilities at the point of preparing an order for shipment. The discarded primary packaging could then be resold back to suppliers or material suppliers, generating a new revenue stream for online marketplaces, as shown in the following Figure 5. While this would increase time taken to package each order (removing the primary packaging the product was originally sent in), therefore reducing efficiency, we believe this investment would prove worthwhile regarding transport costs, consumer attitudes, and the environment.

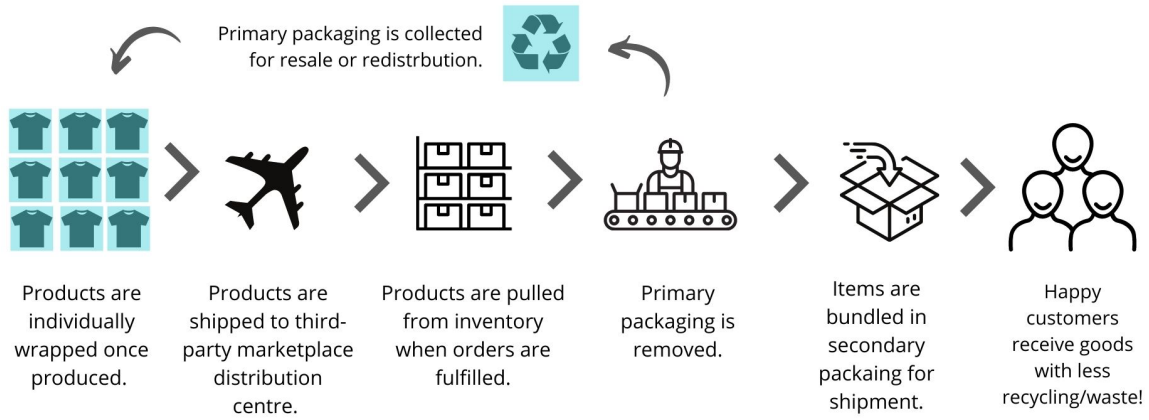

Figure 5. Removal of Primary Packaging Solution for E-Commerce Marketplace.

This would benefit the consumer as they receive less packaging waste to dispose of, which may reduce the potential for cognitive dissonance regarding the amount of packaging materials delivered and ability to effectively dispose of them. Studies have shown an increasing consumer interest in sustainable product packaging and preferences for environmentally friendly packaging (Rokka & Uusitalo, 2008). Consumer concerns for sustainable packaging have increased steeply, and most UK consumers would even pay more for sustainable packaging (Eriksson et al., 2021).

If consumer preferences for sustainable packaging are changing, Amazon's core value of "customer obsession" (Amazon, n.d.-c) should incentivise them to provide this service for their consumers. In fact, 87% of Amazon customers believe that the company must improve their packaging use (Coppola, 2021c). This reduction in packaging could appeal to the growing number of environmentally concerned customers, which would align with Amazon's

consumer-oriented approach. In addition, transport costs would also be reduced because the delivered items would be lighter and smaller without the layer of primary packaging. This means that delivery vehicles use less fuel/energy and fewer overall vehicles may be required. Finally, given the relatively low household recycling rate of 45.5% in England (Department for Environment, Food & Rural affairs, 2021), the removal and systematic recycling of primary packaging at the fulfilment facility will generate further environmental benefits and bolster the circularity of the ecommerce packaging life cycle. Therefore, unrecycled packaging waste could be significantly reduced, as the burden of recycling decisions on the consumer is mitigated.

Online-marketplaces, like Amazon, have research departments dedicated to improving packaging, making it lighter, smaller, more durable etc. (Quigg, 2019). The removal of primary packaging provides an additional resource to reduce weight and size, which, in turn, reduces transport costs and increases efficiency. A key limitation that should be considered is the applicability of this idea dependent on product fragility. We suggest future research be conducted towards discovering which products primary packaging can be removed, without increasing the risk of damage or contamination.

Theme #3 - Consumer Recycling

Analysis

Whilst the previous sections identified solutions which should reduce the amount of packaging used earlier in the process, it is inevitable that some will still be reaching consumers on delivery. In this scenario, we have identified two installations in which there is some ‘low hanging fruit’ which can be targeted to try and reduce the amount of packaging ending up in landfills: the consumer on receipt of an e-commerce delivery at home and the consumer picking up a package at designated e-commerce delivery lockers around London.

Stepping through the first process identifies five prototypical steps a consumer follows once a package has been delivered at home (see Figure 6 below). This process is analysed at each of the three ‘layers’ of installation theory – physical affordances, embodied competences, and the social regulation surrounding the setting, to identify what may be guiding, facilitating, or constraining the behaviour of the consumer.

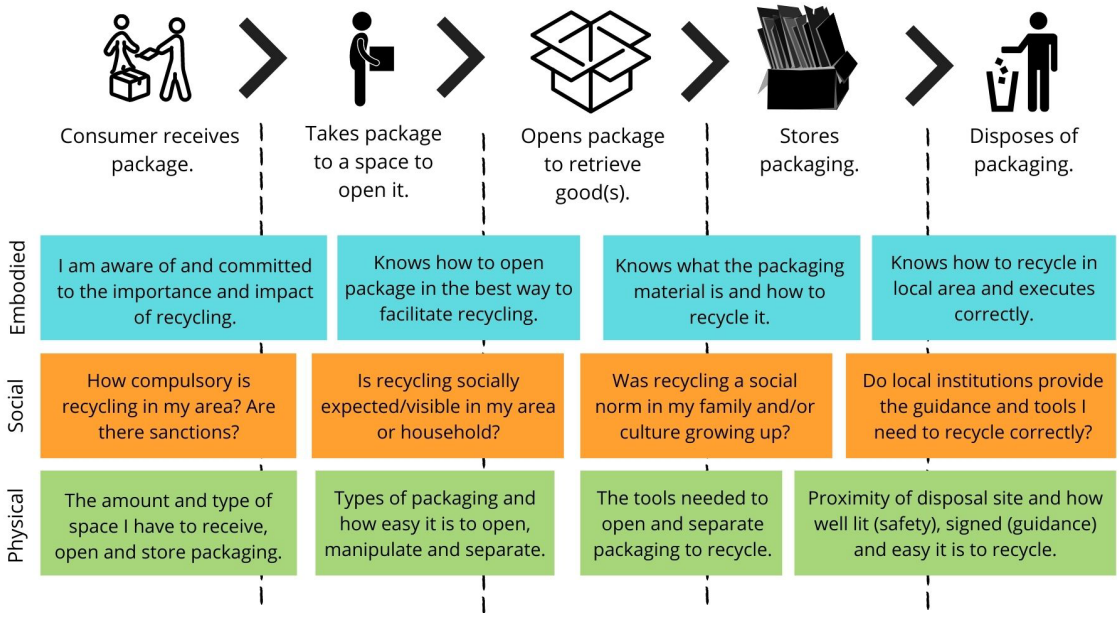

Figure 6. Application of Installation Theory to Receiving Packaging at home.

A key issue facing any intervention to improve the rate and correct execution of recycling is the significant heterogeneity of cultural backgrounds, socio-economic statuses, household make-up, and living spaces of London e-commerce consumers. Furthermore, different borough recycling policies and facilities will have an impact on which elements of the identified Installation Theory layers may have any effect at any point in time.

However, many London households are also transitioning from e-commerce delivery at home to delivery at designated delivery locker sites. The global market for smart parcel lockers is projected to grow from USD 718.0 million in 2021 to USD 1,630.2 million in 2028, a compound annual growth rate of 12.4 % from 2021 to 2028 (Fortune Business Insights, 2022). Due to this increase, intervening at the point of pick-up from smart parcel lockers is another vital point at which we can increase recycling and reduce environmental impact. Again, applying Installation Theory to this scenario assisted us in identifying all the elements that needed to be considered to try and maximise the success of our second solution in this section, as illustrated in Figure 7 below.

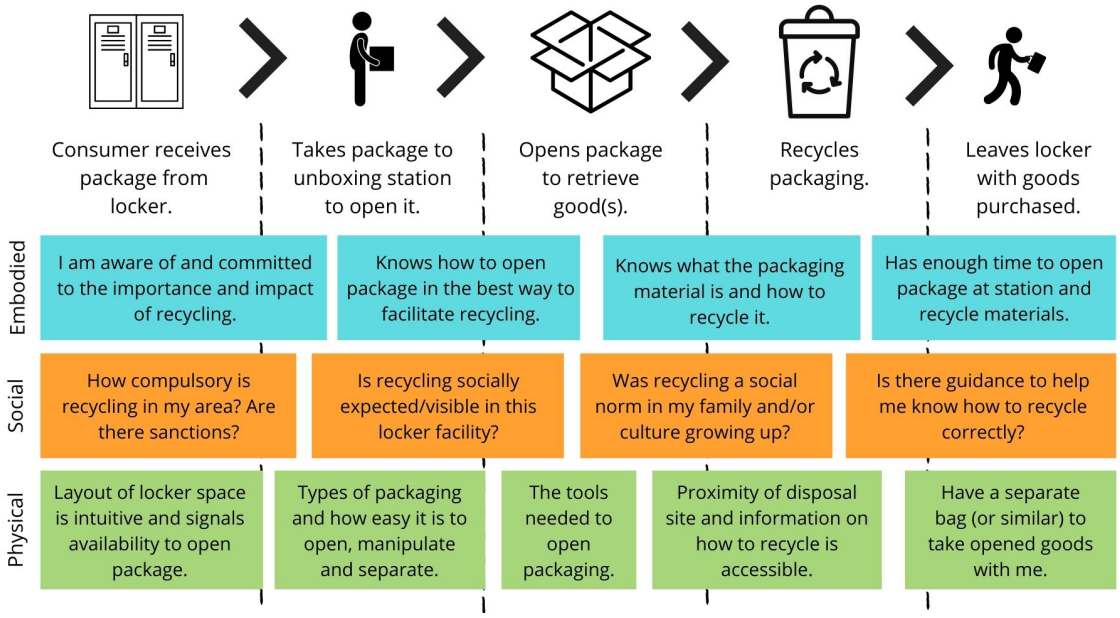

Figure 7. Application of Installation Theory to the proposed solution for Delivery Lockers.

Shift Sustainability produced a consumer research study with Londoners for ReLondon to identify current barriers to recycling and how they could be motivated to improve their recycling habits (Kedros, 2020). Among other things, the Kedros (2020) report identified:

- a lack of clarity about how to recycle correctly, and about what happens after recycled goods have been collected;
- a lack of awareness about the link between waste disposal and climate change; and
- a feeling of anonymity in a large city like London, and a sense that there is no clear visibility of, or reward/punishment for, correct recycling behaviours.

Based on the analysis above we have identified two consumer-focused solutions which are described below.

SOLUTION 4. Distributing 'move-in packs' to all new residents across London boroughs

All new tenants and residents register with their local borough for council tax purposes. In this proposed solution, on registration, boroughs will send **personalised 'move-in packs'** (via mail and email) focused on encouraging new tenants to join their neighbours in recycling efforts.

Figure 8. Illustrative example of Move-In Packs.

These packs will provide any borough-specific items required for recycling (e.g., separate recycling bags), set early expectations around recycling in the borough, and outline the new resident's role in supporting this. They will also include clear information and behaviourally informed calls to action on:

- specific and address-dependent recycling instructions and collection times; and
- information on the end-to-end recycling process in the borough along with any recent positive recycling statistics, and also include a fridge magnet or bin sticker with key recycling reminders.

Follow-up communication will be sent at various intervals to maintain a sense of dialogue and combat the sense of anonymity experienced by some Londoners. To achieve this, follow-up communications will be personalised to the consumer's street or building and note, for example whether (and how) recycling rates have improved, key areas for improvement (for example, stripping boxes of plastic tape), and updates on council recycling initiatives.

Consumers and each of the 32 London borough councils are the primary stakeholders in this solution, although there is an opportunity for support from other levels of government (for example, the Greater London Authority) to help coordinate a consistent approach and iterative learning in this space. It could also be beneficial to seek input from third-party organisations such as ReLondon (referenced above) who have conducted relevant research on this topic and who have resources and advice which could improve the effectiveness of the packs over time.

This is a low-cost and efficient solution – councils use existing processes to obtain contact information and can automate many aspects of the packs. The packs also seek to directly address some of the current key barriers impeding the recycling efforts of Londoners (as

identified further above). However, there are known limitations to disclosure or communication-based interventions in general (see, e.g., Ben-Shahar & Schneider, 2016), for example if the pack is missed in the mail or is not read then its effectiveness is automatically limited. Furthermore, the move-in packs will only address some of the identified issues which demotivate recycling and will not be a sufficient 'trigger' for all new residents across London. However, as the intervention is low-cost and easy to execute, implementation is still worthwhile to seek additional recycling 'wins' at the margin in the CE model we outlined for the ecommerce packaging process.

SOLUTION 5. Increasing the ability to recycle at delivery lockers

E-commerce delivery lockers enable consumers to have their packages delivered to a convenient and secure location for collection, in circumstances where home delivery may not be ideal or is not preferred. This proposed solution seeks to increase the recycling of packaging by:

- installing highly visible recycling bins and unwrapping counters or 'stations' near the lockers, which will be equipped with tethered (and safe) plastic tools to enable packages to be opened;
- sticking arrows on the floor which guide consumers through the unwrapping and recycling points; and
- introducing signage.

Figure 9. Sample of Unboxing station at Delivery Lockers.

Today most customers simply pick up their package and wait until they are home to dispose of the packaging. Solution 5 provides customers an easy and convenient alternative to recycling packaging at home. Drawing on nudge theory (Thaler & Sunstein, 2008), sticking arrows on the ground leading a pathway to the bins aims to create additional awareness of the opportunity to recycle. Changing choice architecture in this way draws on the success of

other trials, such as that of designated smoking areas in Copenhagen Airport, where they had a problem with noncompliant smokers. According to the results of the randomised controlled trials conducted, the arrows were found to successfully lead smokers to the designated area, resulting in fewer noncompliant smokers (iNudgeyou, 2016). Furthermore, the sign with the slogan “Lets save our environment together by unpacking and recycling here” aims to engage consumers' consciences and urge them to think about the environment by using both logos and pathos (Higgins & Walker, 2012).

The primary stakeholders in this solution are locker owners/operators (often large e-commerce retailers or courier companies), consumers, and the relevant London boroughs who would be responsible for emptying the recycling bins as part of their usual recycling routes.

The following three main benefits of this solution include that:

1. it will make disposal of packaging more convenient as consumers would not need to dispose of the packing when they get home;
2. the effectiveness of borough recycling is increased as using the bins at the lockers will prevent contamination from other household waste; and
3. customers would not need extensive knowledge of local recycling requirements or collection times, which is different in every London borough.

There are three limitations that must be identified. Firstly, not all packages will lend themselves to being immediately unwrapped, including fragile goods or personal packages with taboo items. Secondly, the customer may need the packaging to carry the package home for easier transport of goods. Finally, some London boroughs may not have the adequate resources to implement solution 5.

Limitations

Limitations have been addressed throughout the exploration of each solution thus far. As discussed, product fragility and perishability impact the type of packaging that can be used. Therefore, we recognise that even though cardboard is the best and most environmentally friendly material, it will not be appropriate for all e-commerce packaging. Regarding the second and third solutions, success hinges on the collaborative efforts of manufacturers, suppliers, and e-commerce marketplaces. While we have clearly outlined the business advantages, they are only attainable with voluntary stakeholder cooperation. Limitations in the fourth and fifth solutions highlight tactics that can encourage but not force compliance with recycling; the customer must make the ultimate choice to recycle, however the solutions proposed aim to simplify decision-making.

Additionally, the scope of the project is focused on London, and therefore we have not accounted for recycling in more suburban/rural areas in the UK. As acknowledged earlier, all solutions would have to be adapted to account for different socio-cultural, economic, and legal contexts. We argue that although the project does not take its point of departure in these conditions, the solutions put forward would still make a substantial initial impact on a greater scale due to the population density in larger cities.

The scope of the project has not included an in-depth analysis of the transport aspect in relation to e-commerce which would be important to investigate further. Lastly, solutions put forward do not consider a comprehensive assessment of the economic feasibility of the solutions, which would require information and analysis outside the scope of this project. Future research should include more in-depth analyses of the feasibility of the outlined ideas.

Conclusion

Through comprehensive analysis of the growing e-commerce packaging problem, including the application of CE Model and Installation Theory, a wide range of opportunities for solutions were identified, all with the aim of reducing the amount of ecommerce packaging that ends up being incinerated or being sent to landfill. However, with practicality at the centre of analysis, we chose to pursue the solutions deemed the most realistic and with higher impact factors given the complexity of stakeholders and systems associated with the problem at hand, and consideration of the varying advantages and disadvantages for relevant stakeholder groups.

Through this project, we have demonstrated the ways in which recycled packaging can be enabled outside of the usually targeted suspects: consumers. By employing the CE Model of slowing, closing, and narrowing resource use (Bocken et al., 2016), new innovative paths to support recycling were unearthed. While these identified solutions show great promise, they

must be considered within their boundaries, as demonstrated in the previous limitations section. Humanities entry into the Anthropocene is a growing concern and while the presented solutions will not solve the problem in its entirety, we believe that it will positively contribute to building the climate friendly future many of us desire.

References

Amazon. (n.d.-a). *Packaging and prep requirements – Amazon Seller Central*. Seller Central - Amazon. Retrieved May 2022, from https://sellercentral.amazon.co.uk/gp/help/external/G200141500?language=en_GB

Amazon. (n.d.-b). *Unplanned services – Amazon Seller Central*. Sellar Central - Amazon. Retrieved 2022, from https://sellercentral.amazon.co.uk/gp/help/external/201000230?language=en_GB&ref=efph_201000230_cont_201074400

Amazon (n.d.-c). *Who we are.* Aboutamazon. https://www.aboutamazon.com/about-us

Amazon India. (2020, June 29). *Amazon India successfully eliminates 100% single-use plastic in packaging across its Fulfilment Centers*. About Amazon India. Retrieved 9 May 2022, from https://www.aboutamazon.in/news/sustainability/amazon-india-successfully-eliminates-100-single-use-plastic-in-packaging-across-its-fulfilment-centers

ATL-Dunbar. (2019, February 1). *Which Packaging is more Environmentally Friendly, Polythene or Cardboard?* ATL Dunbar. https://www.atl-dunbar.co.uk/which-packaging-is-more-environmentally-friendly-polythene-or-cardboard/

BBC News. (2021, October 25). *Where does recycling and rubbish from the UK go?* https://www.bbc.co.uk/news/science-environment-49827945#:%7E:text=How%20much%20gets%20recycled%3F,waste%20from%20households%20by%202020.

Ben-Shahar, O., & Schneider, C. (2016). *More than you wanted to know: the failure of mandated disclosure*. Princeton University Press.

Berg, P., Feber, D., Granskog, A., Nordigården, D., & Ponkshe, S. (2020, January 31). *The drive toward sustainability in packaging—beyond the quick wins*. McKinsey & Company. https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/the-drive-toward-sustainability-in-packaging-beyond-the-quick-wins

Bocken, N. M. P., de Pauw, I., Bakker, C., & van der Grinten, B., (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, *33*(5), 308–320. https://doi.org/10.1080/21681015.2016.1172124

Botham, D. (2021, December 10). *UK Recycling Statistics 2021*. Recycling Bins. https://www.recyclingbins.co.uk/blog/uk-recycling-statistics-2021/

Chua, J. M. (2021). Online shopping has boomed in the pandemic. But what about all the packaging?. *Vox*. Retrieved 16 January 2022, from https://www.vox.com/the-goods/22214017/online-shopping-pandemic-packaging-ecommerce-waste-plastic

Coppola, D. (2021a, October 7). *Amazon global retail e-commerce sales 2017–2021*. https://www.statista.com/statistics/1103390/amazon-retail-ecommerce-sales-global/

Coppola, D. (2021b, November 10). *Global e-commerce market share of leading e-retailers 2020*. Statista. https://www.statista.com/statistics/664814/global-e-commerce-market-share/

Coppola, D. (2021c, August 3). *Amazon customers' opinion on sustainability in the UK, U.S. and Canada 2020.* Statista. https://www.statista.com/statistics/1243917/amazon-customers-opinion-on-sustainability/

Coppola, D. (2022, February 3). *E-commerce as share of total retail sales worldwide 2015-2025*. Statista. https://www.statista.com/statistics/534123/e-commerce-share-of-retail-sales-worldwide/

Cramer-Flood, E. (2020). Global Ecommerce 2020. EMarketer. Available at: https://www.emarketer.com/content/global-ecommerce-2020

Crutzen, P. J., & Stoermer, E. F. (2000). The "Anthropocene." *Global Change Newsletter*, *41*, 17–18.

http://www.igbp.net/download/18.316f18321323470177580001401/1376383088452/NL41.pdf

Daggar, J., (2021). How is cardboard made? Everything you could need to know…. GWP Group. Retrieved 17 January 2022, from https://www.gwp.co.uk/guides/how-is-cardboard-made/.

Department for Environment, Food & Rural affairs. (2018, December 11). *Statistics on waste managed by local authorities in England in 2017/18*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918862/Stats_Notice_2017_2018_3_Dec_accessible.pdf

Department for Environment, Food & Rural affairs (2021, July 15). *UK statistics on waste.* Government Statistical Service. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1002246/UK_stats_on_waste_statistical_notice_July2021_accessible_FINAL.pdf

Duarte, P., Costa e Silva, S., & Ferreira, M. B. (2018). How convenient is it? Delivering online shopping convenience to enhance customer satisfaction and encourage e-WOM. *Journal of Retailing and Consumer Services*, *44*, 161–169. https://doi.org/10.1016/j.jretconser.2018.06.007

El-Fadel, M., Findikakis, A. N., & Leckie, J. O. (1997). Environmental Impacts of Solid Waste Landfilling. *Journal of Environmental Management*, *50*(1), 1–25. https://doi.org/10.1006/jema.1995.0131

Eriksson, D., Feber, D., Granskog, A., Lingqvist, O. & Nordigården, D. (2021, January 23). *Global consumers' attitudes toward sustainable packaging.* McKinsey & Company. https://packaging360.in/casestudies/global-consumers-attitudes-toward-sustainable-packaging/

European Environment Agency., (2016, February). *Circular economy in Europe: Developing the knowledge base*. European Union. https://op.europa.eu/en/publication-detail/-/publication/0cc8128f-d6d3-11e5-8fea-01aa75ed71a1/language-en

Fisher, B. (2021). UK Ecommerce Forecast 2021. Insider Intelligence. Retrieved 28 November 2021, from https://www.emarketer.com/content/uk-ecommerce-forecast-2021.

Fortune Business Insights. (2022). Smart Parcel Locker Market Size, Share, Growth | Report [2028]. Fortunebusinessinsights.com. Retrieved 6 May 2022, from https://www.fortunebusinessinsights.com/smart-parcel-locker-market-104718.

Higgins. C., & Walker, R., (2012). Ethos, logos, pathos: Strategies of persuasion in social/environmental reports. Accounting Forum, Volume 36, Issue 3, 194-208, ISSN 0155-9982, https://doi.org/10.1016/j.accfor.2012.02.003.

International Union for Conservation of Nature. (2022). Forests and climate change. IUCN. Retrieved 16 January 2022, from https://www.iucn.org/resources/issues-briefs/forests-and-climate-change.

iNudgeyou. (2016). Nudging Smoke in airports – A case study in nudging as a method (pp. 1-7). Retrieved from https://inudgeyou.com/wp-content/uploads/2017/08/OP-ENG-Nudging_Smoke_in_Airports.pdf

Kaza, S., Yao, L. C., Bhada-Tata, P., Van Woerden, F., (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development. Washington, DC: World Bank. World Bank. https://openknowledge.worldbank.org/handle/10986/30317

Kedros, J. (2020). *Motivating young Londoners to recycle*. London Waste and Recycling Board. https://relondon.gov.uk/wp-content/uploads/2021/03/Motivation-to-recycle-insights-report-Oct-2020.pdf

Lahlou, S. (2018). *Installation Theory: The Societal Construction and Regulation of Behaviour*. Cambridge University Press.

Louis Vuitton. (2021, July). *Louis Vuitton Reveals a New Range of Packaging*. LV Now. Retrieved May 2022, from https://eu.louisvuitton.com/eng-e1/articles/louis-vuitton-reveals-a-new-range-of-packaging

Pack4Good. (n.d.). Canopy Planet. Retrieved 28 November 2021, from https://canopyplanet.org/campaigns/pack4good/.

Poturak, M. (2014). Influence of product packaging on purchase decisions. *European Journal of Social and Human Sciences*, (3), 144-150.

Quigg, D. (2019). *The big ideas and tiny details behind Amazon's new recyclable mailer.* Aboutamazon. https://www.aboutamazon.com/news/sustainability/the-big-ideas-and-tiny-details-behind-amazons-new-recyclable-mailer

Reike, D., Vermeulen, W. J., & Witjes, S., (2018). The circular economy: New or Refurbished as CE 3.0? — Exploring Controversies in the Conceptualization of the Circular Economy through a Focus on History and Resource Value Retention Options. *Resources, Conservation and Recycling*, *135*, 246–264. https://doi.org/10.1016/j.resconrec.2017.08.027

Rethink Plastic Alliance. (2018, September). *The Price is Right. . . or is it? Rethinking Plastic*. Plastic Solutions Fund. http://zerowasteeurope.eu/wp-content/uploads/2018/09/PlasticsTax_FINAL.pdf

Rheude, J. (2021, April 20). 7 Statistics that tell the story of eCommerce in 2021. Onlinesalesguidetip. https://www.onlinesalesguidetip.com/7-statistics-that-tell-the-story-of-ecommerce-in-2021/

Rokka, J., & Uusitalo, L. (2008). Preference for green packaging in consumer product choices–do consumers care?. *International Journal of Consumer Studies*, *32*(5), 516-525. https://doi.org/10.1111/j.1470-6431.2008.00710.x

Runyon, R. (2022, May 4). *Your One-Stop Guide To Amazon SKU Numbers*. Sunken Stone. https://www.sunkenstone.com/blog/amazon-sku/

Shah, A. A., Hasan, F., Hameed, A., & Ahmed, S. (2008). Biological degradation of plastics: A comprehensive review. *Biotechnology Advances*, *26*(3), 246–265. https://doi.org/10.1016/j.biotechadv.2007.12.005

Shaw, D., McMaster, R., & Newholm, T. (2015). Care and Commitment in Ethical Consumption: An Exploration of the 'Attitude–Behaviour Gap'. *Journal of Business Ethics*, *136*(2), 251–265. https://doi.org/10.1007/s10551-014-2442-y

Single Use Plastic Project., (2022, January). *Single Use Plastic Project Report* (No. 1). European Outdoors Group. https://assets.website-files.com/5ed628f96456314726a814ee/621f6559ce079e30df7c5976_single%20use%20plastic%20report_web.pdf

Thaler, R. H., & Sunstein, C. R., (2008). Nudge: Improving decisions about health, wealth, and happiness. Yale University Press.

Tiseo, I. (2021). E-commerce plastic packaging use worldwide | Statista. Statista. Retrieved 16 January 2022, from https://www.statista.com/statistics/1271093/annual-e-commerce-plastic-packaging-use-globally/.

UK Government. (2021, July 8). *Introduction of Plastic Packaging Tax from April 2022*. GOV.UK. Retrieved 9 May 2022, from https://www.gov.uk/government/publications/introduction-of-plastic-packaging-tax-from-april-2022/introduction-of-plastic-packaging-tax-2021

Unilever PLC. (2022, March 23). *Rethinking plastic packaging*. Unilever. https://www.unilever.com/planet-and-society/waste-free-world/rethinking-plastic-packaging/

United Nations (2021, May 3). Global e-commerce jumps to $26.7 trillion, fuelled by COVID-19. UN News: Global perspective Human stories. https://news.un.org/en/story/2021/05/1091182

United Nations Environment Programme. (2021). Waste not: the heavy toll of our trash. UNEP. Retrieved 30 November 2021, from https://www.unep.org/news-and-stories/story/waste-not-heavy-toll-our-trash.

United Nations Environmental Programme. (2011). *Decoupling Natural Resource Use and Environmental Impacts from Economic Growth*. International Resources Panel. http://www.gci.org.uk/Documents/Decoupling_Report_English.pdf

Venkatesh, V., Speier-Pero, C., & Schuetz, S. (2022). Why do people shop online? A comprehensive framework of consumers' online shopping intentions and behaviours. *Information Technology & People*. https://doi.org/10.1108/itp-12-2020-0867

Wright, J. (2021, October 5). *What is Amazon frustration free packaging?.* SellerLabs. https://www.sellerlabs.com/blog/what-is-frustration-free-packaging/