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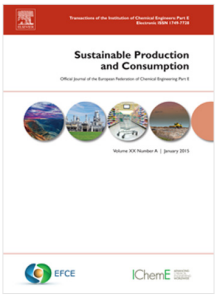

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Promoting reuse behaviour: Challenges and strategies for repeat purchase, low-involvement products

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Abstract

Reusable products offer reduced environmental impact compared to recycling, but producers mostly focus on strategies such as light-weighting, recyclability and eco-labelling. A reasonable number of innovative reusable products and business models exist for repeat purchase, low-involvement products, but they are largely restricted to niche health-food stores. Therefore, this research primarily attempts to understand consumer attitudes and behaviour towards reuse of household care products (e.g. air fresheners, domestic cleaning products). Focus groups with UK consumers are utilised to examine reusable/refillable spray products and the data are triangulated with global archival data on various refill business models, reusable products and recycling initiatives. The study offers useful guidelines for both producers and policy makers to encourage reusable products. First, we recommend that eco-innovations have a familiar design congruent with well-known brands, to reduce uncertainties for consumers. Second, if the innovation has an unfamiliar design, to mitigate, producers should offer new functional benefits. Third, and most important, producers must place greater emphasis on aesthetic aspects that could evoke product attachment, thus encouraging reuse. Fourth, if reusable products are to become mainstream, 'well-known brands' have to promote the transition from one-off sales to a service model built on durable products. Finally, a successful outcome is dependent on government interventions in designing new life cycle policy instruments, in particular de-marketing the current recycling norm and emphasising reusing over recycling.

Key words: Consumer behaviour; Environmental sustainability; Eco-innovation; Repeat purchase products; Low-Involvement products; Life cycle analysis.

1. Introduction

Product innovation managers and researchers are increasingly challenged to develop a better understanding of consumer attitudes and behaviour towards environmentally friendly products. Producers are increasingly providing new eco-friendly products and/or adding eco-friendly features and messages to existing products. Despite these efforts by producers, consumers are still reluctant to buy eco-friendly products in the case of repeat purchase, low-involvement (REPLIN from here on) products, as they are generally perceived to be less effective and therefore less value for money (Newman, et al., 2014). Consumers may also be skeptical about environmental claims, or cynical about producer efforts. Moreover, when status motives are absent, particularly relevant for REPLIN products, consumers would rather choose effectiveness over green credentials (Luchs, et al., 2010).

In the recent past, alarm bells have been ringing over aquatic pollution caused by plastics (Cookson & Hook, 2019) and also illegal dumping by developed countries in other parts of the world (Hook & Reed, 2018). This demands urgent action from governments and large businesses. It makes little sense to use a material that lasts for hundreds of years just for a few days or weeks (Fearnley-Whittingstall, 2019). Packaging should therefore be repurposed for durability and reuse. Since 2017 'Coca Cola' has been trialling its refill stations at a few public universities in the US and UK through its BYOB (Bring Your Own Bottle) scheme and aims to roll-them out to more locations in the future (Moye, 2019). The 'Refill campaign' in UK that encourages the public to refill water bottles is also gaining momentum (Smithers, 2018). Their mobile application contains locations of more than 15,000 refill stations across the UK (refill.org.uk, 2018). There has also been a rise in zero-waste stores where consumers can buy unpackaged fresh fruit and vegetables and bring their own durable containers to refill their groceries (W-Thomas, 2019). Recently a large UK retailer 'Waitrose' has also been trialling grocery refill stations (Jahshan, 2019). Household cleaning products company 'Ecover' provides refill stations across Western Europe, and in the UK there are more than 600 in small health-food stores (Mesure, 2011).

Beyond the smaller zero-waste and health food-stores, refilling water bottles, and a handful of trials by large brands and retailers, reusing and refilling has its challenges in becoming mainstream. Consumer usage habits are difficult to break. They like to have a product that works, and except for the highly environmentally conscious or aware consumers, do not want to put in additional effort to make it work. For example, consider opening a concentrate refill pack for a kitchen cleaner, adding it to a reusable bottle, diluting with water and finally screwing in the spray cap, consumers may feel this is too much effort for REPLIN products.

Despite the growth in the zero-waste movement, refilling in a store may feel too idiosyncratic as it has not become mainstream with large retailers. Consumers may be in a rush or forget to take their reusable bottle or pouch. Also, the experience of refilling household care products in a supermarket is not the same as refilling a drinking water bottle or refilling groceries; consumers may spill cleaning chemicals during the filling process. A major UK supermarket chain, 'Asda', had to abandon trial stations for refilling fabric conditioners in plastic pouches. This was because sales did not meet expected projections (Lewis, 2017). Though a good sample of customers refilled it twice, only a limited number re-filled it more than twice, despite the pouch being re-usable up to 10 times (Lee, 2010).

Perhaps, there is not much product innovation compellingly attractive to mainstream society, such that reusable REPLIN products are just a regular norm of people's purchases. Recycling has become a deeply entrenched norm and disposal habit, making it challenging to adopt other pro-environmental behaviours such as reduce or reuse (Thomas & Sharp, 2013). For example, recycling rates of plastic packaging in the UK have almost doubled in the last decade, from 24.2% in 2011 to 46.2% in 2017 (DEFRA, 2019; Eurostat, 2019). "Recycling is the green thing to do", dispelling the guilt generated by high-consumption lifestyles (George, 2018). Consumers may regard the ability to recycle as a 'get

out of jail free card' that makes consumption more acceptable, leading to even more consumption (Catlin & Wang, 2013). On the other hand, perhaps, producers are resisting reusable products, because, the production and supply infrastructure has to change.

Consumer demand drives the products businesses sell, and if eco-awareness is claimed to be growing among consumers (EDIE, 2018; NIELSEN, 2018), then how can producers provide more resource efficient reusable products. Therefore, the primary aims of this research are to provide a better understanding of consumers' attitudes and behaviour towards reuse, and offer high-level suggestions for practice and policy in the case of REPLIN products. The primary product focus in this study are household care sprays with applications in air care and surface care. Additionally, consumer perceptions on other products such as refill pouches for coffee granules aid our analysis.

The remainder of this article is organised as follows. In section 2, we critically review the literature and formulate the research questions. In section 3, we justify our methodology. Section 4 incorporates findings and analysis and section 5 offers conclusions.

2. Critical review and Research questions

Individual behaviour accounts for a remarkable proportion of environmental issues (DeSombre, 2018; Stern, 2000; Vlek & Steg, 2007). Each one of us produce an environmental impact when we drive our cars, consume food, burn gas and engage in a myriad of other activities. Although each activity contributes minute amounts of environmental problems, when aggregated across millions of individuals, collectively they have an enormous impact. For example, 27% of electricity and 30% of natural gas consumption globally is by the residential sector (IEA, 2019).

Environmental policies that seek to control behaviour of individuals are normally unpopular, for example many commuters are largely against congestion charges for drivers within cities (Salmon,

2011). The effort it takes to change behaviour varies according to behavioural costs which are not limited to financial costs (De Groot & Schuitema, 2012). Behavioural costs include the perceived convenience and effort of the specific behaviour addressed in a policy. Congestion charge targets 'high-cost' behaviour because it impacts on the comfort level and lifestyle of drivers. Hence policies that target 'low-cost' behaviour (i.e. take little effort to change), for example charging consumers for plastic carrier bags, are more acceptable. Consumers easily adapt to the bag charge because they rapidly find new routines, such as keeping shopping bags in the boot of their car or keeping a foldable reusable bag in their back-packs or handbags (Poortinga et al., 2016; Giorgi & Hughes, 2014).

Efforts to change individual behaviour are also thwarted because many individual behaviours are not consciously considered decisions (DeSombre, 2018). Many behaviours with environmental implications - such as food consumption, choice of transportation, energy and resource use, shopping, and disposal of products—are strongly habitual (Kurz, et al., 2015). Whereas some sustainable behaviours (e.g., installing an energy efficient light bulb) require only a one-time action, many other behaviours (e.g., switching off lights when not needed) involve repeated actions that require new habit formation (White et al., 2019). While policies have been enacted to phase out inefficient light bulbs (Collinson, 2018), it is difficult to get someone to turn off the lights when not needed. In a similar vein, though consumers may be initially incentivised to buy a reusable/refillable household care product, it will be challenging to get them back to the store for refilling beyond a few times.

Habit change is a critical component of sustainable behaviour change (Verplanken & Roy, 2015). Habit formation requires repetition, therefore interventions that break repetition, such as discontinuity and penalties, can break unsustainable habits (Kurz, et al., 2015). Actions that encourage repetition, such as utilizing prompts, incentives, and feedback, can strengthen sustainable

habits (White, et al., 2019). For example, reuse can be encouraged for REPLIN products by using deposit schemes to ensure they are returned (Cole, 2016). Consumers can also be incentivised through discounts after a certain number of refills.

The fact that individual contributions are so small compared to the environmental impact from industries makes it hard to convince any one individual that changing their habitual behaviour will make a difference (Babcock, 2009). Changing individual habitual behaviours is particularly challenging when "messages about conservation behaviours compete with an overwhelming number of advertisements for consumptive actions that promise economic viability, status, and pleasure." (Monroe, 2003).

The answer to effective policies for behaviour change may therefore lie in norms, including both social norms and personal norms. Social norms are informal obligations that are enforced through social sanctions or rewards. Individual behaviour is not only driven by personal preferences and identity, but also through observed behaviour of others or through the existence of norms (Farrow, et al., 2017). Binder et al. (2019) suggest that when peer behaviours are more varied, individuals are less green because green behaviour is less visible and less uniform and hence not as binding or pressure-inducing. High polarization of peer behaviour, on the other hand, seems to increase the visibility or salience of existing norms and exerts more pressure on the individual to act in accordance with green norms. Effective policies induce both short-term changes in behaviour and longer-term changes in social norms. For example, though in many places recycling programs began with much grip under the pressure of increased cost of garbage collection and landfilling, today recycling is second nature for many people who have come to view it as a normative behaviour (Kinzig, et al., 2013). This has led to increased recycling even under reduced enforcement.

Personal norms are informal obligations that are enforced through an internalized sense of duty to act, as well as guilt or related emotions for a failure to act. In medium-high cost contexts such as buying organic food, sustainable behaviour is guided by personal norms that cannot probably be created directly by outside agents, and should be seen as an indirect effect of the individuals ''self-persuasion'' (Thogersen, 2009). The Value-Belief-Norm (VBN) theory (Stern, 2000), strongly emphasizes the role of individual characteristics. It suggests that people's engagement and level of involvement in environmentally relevant behaviour is based on three value orientations: egoistic (i.e. self-centred), biospheric (i.e. environmental), and social-altruistic (i.e. concern for the welfare of others including animals). According to the VBN theory, a new belief that a value is threatened and that the individual can act to reduce the threat tends to activate norms and induce action. Gilg, et al., (2005) conclude from an extensive survey of everyday environmental actions, including reuse behaviour, that highly environmentally conscious individuals were less concerned with material wealth and personal influence. They hold values that place nature in an equal position with humans, and believe that nature has critical limits which must not be crossed by human development. Therefore, those who are more likely to engage in sustainable consumption would have more biospheric and altruistic values.

It may be challenging for consumers to develop or maintain biospheric and altruistic values and behaviour when consuming REPLIN products. Consumers may choose non-eco or less eco brands when their ideal aspirational eco-friendly brands are not available on the supermarket shelf. Besides, when involvement is low, habits will drive consumers to pick a product that they know does the job. They may believe that they will be less satisfied if they alter their behaviour by buying a more expensive eco-friendly product. Any benefits will be generalized benefits to the collective, not typically perceived as producing any substantial, immediate benefit to the individual (Carlson, 2001). For example, even though reusing a household cleaning spray produces environmental benefits such as reduced landfill use, fewer emissions in transporting products, fewer emissions in producing new

products, lower use of virgin natural resources etc., it remains the case that consumers will see no reason to change unless the alternative behaviour is economical, convenient and there is an immediate benefit. Consumers may also rationalise that buying a reusable cleaning product is meaningless unless reuse behaviour is mainstream and many others also participate. Thus, when many individuals cause a harm that is external to them, the utility maximizing consumer will see no reason to change their behaviour (Babcock, 2009).

To the extent that pro-environmental actions are perceived as new and/or unusual, consumers' predisposition to buy new and different products and brands (i.e. innate consumer innovativeness) would affect the likelihood of engaging in pro-environmental behaviour. Therefore, besides environmental motivations, consumers who seek novelty in their shopping trip, are perhaps more likely to purchase innovative green products (Choi & Johnson, 2019). According to Bhate and Lawler (1997), although innovative consumers may be market initiators, they may not be highly involved, and may just be exercising their innate need to try novel or new products. They may also engage in impulse buying, rather than making a focused effort to change their attitudes towards environment and behaviour. Therefore, in the early stages, innovators are more inclined to buy environmentally friendly products. The more environmentally conscious consumers may be late adopters; for them to adopt a new eco-product and eventually change their behaviour, is dependent on provision of detailed information by producers. However, Englis and Phillips (2003) argue that consumers who most strongly subscribe to the attitude that nature is a delicately balanced system that should be protected, may also be the most open to and accepting of new innovations; these consumers are most likely to translate their pro-environmental attitudes into action.

Consumers may resist new products because of functional and psychological barriers (Ram & Sheth, 1989). Reusable or refillable products are largely restricted to niche zero-waste shops, perhaps because they pose a functional barrier in terms of usage and convenience. Education may be

required for consumers to change behaviour, which they are not always delighted about and willing to do. Even straightforward solutions, e.g. reusable coffee cups, do not seem to have become as popular as reusable carrier bags. This is because, reusable cups need washing, furthermore some consumers do not want to have a used coffee cup with a little amount of liquid in their bag for the rest of the day (Hughes, 2017).

Psychological barriers are the consequence of improper communication about eco-products. These barriers cause even environmentally conscious consumers to perceive the purchase process of eco-products as stressful, expensive and time-consuming (Barbarossa & Pastore, 2015). Informational strategies are especially effective when environmentally friendly behaviour is relatively convenient, and not very costly in terms of money, time, effort and/or social disapproval (Steg & Vlek, 2009). When consumers are loyal to a traditional non-green brand, or when they dedicate little time for shopping, they are generally reluctant to conduct extensive information searches and elaborate cognitive processing for REPLIN products (Barbarossa & Pastore, 2015). In such cases, even environmentally conscious consumers might not be willing to incur the extra monetary and non-monetary costs of seeking and evaluating the information required to assess the credentials of an alternative eco-product or brand.

Presenting inflated green claims has become very difficult today; it is assumed that consumers are more knowledgeable about green issues, with the Internet providing them easy access to information on the validity of an environmental claim. Providing complete and accurate information to the consumer should therefore serve to encourage long-term customer relationships (Underwood & Ozanne, 1998). This assumes that consumers behave rationally as a result of cognitive deliberation. Therefore, behaviour change is based on the ability to deliver sufficient information so that consumers can make informed choices based on the available options. But, consumers can find it challenging to process information, and 'trade-off' between price, product effectiveness and

environmental claims and often purchase is based on emotional response rather than a result of conscious deliberation. Humans are constrained by habits, routines and cues, thus imposing cognitive limitations on our ability to take thoughtful action (Jackson, 2005).

If environmentally-minded businesses want to attract new customers in addition to the highly environmentally-aware, attaching aesthetic quality could be persuasive (Todd, 2004). Aesthetics can be understood as appreciation of beauty (Goldman, 2001). While beauty is subjective, design is unquestionably linked to the beautification of objects. When we form positive connections with objects we consider beautiful, we are more likely to become emotionally attached with them. While function would trump form for REPLIN products, there is room for style and beauty. Luchs, et al., (2012) argue that when consumers are presented with a trade-off between functional performance and sustainability, they may presume that the performance-advantaged product also has an aesthetic design advantage. Hence, superior aesthetics can provide a disproportionate positive effect in choosing eco-friendly products over performance-advantaged products. In essence, behaviour may not be mediated by either attitude or intention; therefore it should be possible to change behaviour without necessarily changing attitudes first.

Consumers generally find products that are attractive more functional than they do unsightly ones, and therefore are more inclined to use them (Hosey, 2012). They prefer using things that look better, even if the products are inherently difficult to use. If a product is more likely to be used, consumers will more likely continue to use it. If a product is functional, beautiful, and valuable, all at once, consumers will not want to throw it, but make optimal use of it. Aesthetics and functionality must co-exist, and the key to successful eco-design is its ability to adapt to consumer needs. A product that provides aesthetic nourishment to the consumer will possess qualities that will enable the recipient to feel continuous pleasure by watching it, touching it, and using it—and therefore be inclined to take care of it and repair it, if necessary (Harper, 2018). Walker (2006) suggests that if

designers create market demand by designing products that gratify consumers' social need's (love, belonging, social acceptance, status etc.), the product will most likely have a very short shelf life. Durable and sustainable products on the other hand meet and satisfy spiritual needs (search for meaning, aesthetic sensibilities, personal growth, altruism etc.), rather than solely functional and socially fleeting desires. In the words of Chapman (2015) "Such objects are designed for empathy and are created in an artful way, engendering powerful emotional attachments, rich evolving narratives, intense user experience and a sustained element of uncertainty and fiction". Such products speak to what Walker (2006) describes as our "highest potential" and, in doing so, the very root causes that spur our unsustainable practices are overcome. Approaches such as recycling or using bio-based materials merely address the symptom of our wasteful practices, whereas durable and aesthetically pleasing products can address the root cause.

Fletcher and Goggin (2001) categorise eco-design into three broad strategies : *product focus* - making existing products more resource efficient, e.g. making packaging reusable; *results focus* - producing the same outcome in different ways, e.g. filling a cleaning product at a refilling station, buying a large refill can or buying a refill concentrate, all lead to less waste; and *needs focus* - questioning the need fulfilled by the object, service, or system, and how it is satisfied, e.g. 'feel good' needs when one believes that their plant based surface cleaner does not pollute aquatic streams, or the needs could be selfish such as money saved in reusing packaging. Therefore, achieving optimal environmental gains through design is also dependent upon consumers and on understanding the way in which they respond to and interact with their material surroundings. Yet, the dominant approaches to eco-design tends to focus on resource efficiency and pollution (Vallet, et al., 2013; McAloone & Pigosso, 2017), rather than consumer intentions, choices and actions. In contrast, consumer focus in eco-design considers ways of satisfying fundamental human needs (Walker, 2006). Implicit within this is a requirement to deal with issues underlying consumer actions, to

understand behaviour in many contexts, and to connect with people's aspirations and expectations (Moreno-Beguerisse, 2013).

Though, a durable and aesthetic design proposal can optimise a product from a longevity perspective, designers will still need to choose among alternatives with the least environmental burden over their life cycle. Life Cycle Assessment (LCA) methodology is the main technique for systematically assessing the environmental burdens associated with a product throughout its entire life cycle, from raw materials extraction and acquisition, to manufacturing, transportation and distribution, to use and maintenance, and all the way to disposal and waste management (Guinee, et al., 2010). LCA complements design for longevity and tracks the overall environmental profile of the product as it develops, thereby helping decision makers compare all major environmental impacts when choosing between alternative courses of action. LCA use is growing, but the process is a complex undertaking and expert dependent due to the extensive amount of data required (Cooper & Fava, 2008; McManus & Taylor, 2015).

LCA is a valuable tool in early technology development and design stages (Kaebemick, et al., 2003). Choices made early in the process have a significant effect on the overall environmental impact of the final product, particularly because changes are significantly less likely to occur later in the development process due to technological lock-in (Hetherington, 2014). An important limitation of LCA in early product design is that a full quantitative analysis is not feasible because exact information about size, material composition, and construction may not be available. Also, product details are not fixed and concept changes are very rapid. Therefore, there has been a growing interest in developing rapid methods, such as streamlined LCA (Graedel, 1998). Streamlining generally refers to any procedure taken to reduce the scope, cost, and effort required to conduct the LCA by limiting the amount of data needed for the assessment (Pelton & Smith, 2015).

Anecdotal evidence, case studies and popular press frequently report initiatives taken by several companies to develop and market new products and designs that explicitly address environmental issues. It is far from certain whether these products have changed consumer attitudes and behaviour. To date, there has been sparing research on consumer attitudes towards reuse for REPLIN products. The most comprehensive research has been done by Lofthouse et al. (2009, 2017) who offers useful insights into the advantages and disadvantages of refillable packaging systems from the perspectives of the consumer and industry. Their research offers guidelines from a utilitarian perspective (cost, quality, convenience, space etc.). It lacks in critical argument from a life cycle perspective and does not offer insights on how consumers assess reusing against recycling which is now a normative behaviour. Further, their research does not offer any insights on consumers' trade-off decision making process in a low-involvement situation. Vaughan et al. (2007) offer some critical perspectives on reuse in the case of milk bottles. They suggest that the absence of any information on the "classic" design of a glass milk bottle offers a desired world of permanency and aesthetics, and this is maintained by the practice of reuse. This has parallels to the spiritual needs presented by Walker (2006). They also argue that a reusable glass bottle becomes a priceless object, losing its commodity status and binding the dairy, milkman and the consumer for a longer period of time. It therefore becomes a site of resistance to the bargaining power of the supermarkets from the dairy's point of view. Another instance where reuse has been researched is spontaneous reuse or 'upcycling' of used packaging within the household (Fisher & Shipton, 2009).

Moderate amount of research exists on marginal consumption of 'pre-loved', 'pre-owned', 'reclaimed' or 'second-hand' products (Cole, et al., 2017; Curran & Williams, 2010; Gregson, et al., 2013), or voluntary 'take-back' or 'trade-in' initiatives by manufacturers and retailers (Yla-Mella, et al., 2015). These studies focus on 'exchange' of more durable products such as clothing, furniture, electronic appliances and cars. While these studies are important, they do not offer suggestions to minimise unsustainable practices for REPLIN products.

Reuse occupies a prominent position near the top of the "waste hierarchy" that ranks waste management options according to what is best for the environment (DEFRA, 2011). The waste hierarchy gives top priority to reducing waste in the first place. When waste is created, it gives priority to preparing it for re-use, then recycling, then recovery, and last of all disposal (e.g. landfill or incineration. Chapman (2015) asserts that during the recent years, this golden principle has been pretty much thrown out of the window; recycling has now taken the number one spot, and its relegated counterparts, reduce and reuse are now seldom discussed. Therefore, the primary aims of this research are to provide a better understanding of consumers' attitudes and behaviour towards reuse, and offer high-level suggestions for practice and policy in the case of REPLIN products. In order to meet the research aims, the following research objectives and corresponding research questions have been derived.

Table 1: Research Objectives and Questions

	Research Objective	**Research Question**
1	To understand the 'enablers' and 'disablers' of pro-environmental behaviour for REPLIN products.	How do consumers decide between functional, aesthetic and eco-attributes for REPLIN products?
2	To evaluate the level of awareness of the 'waste-hierarchy' concept among consumers.	How relevant are higher level environmental practices such as reuse in the case of REPLIN products?
3	To analyse whether resource-efficient product innovations and their market availability has an impact on consumer attitudes.	How commercially successful are reusable REPLIN products and what are the implications for eco-design?

3. Methodology

As the purpose of this study is to build a broad understanding of production and consumption of reusable products, using qualitative rather than quantitative research methods is appropriate. Qualitative methods simulate participant's experience of the real world, avoiding pre-judgments and presenting people on their own terms. They offer a more fluid, evolving and dynamic approach, compared to more rigid and structured quantitative research methods (Corbin & Strauss, 2008). Quantitative methods might explain what decisions participants make, whereas qualitative research methods explore the reasons behind the decision. Another virtue of qualitative research is that, it allows using many alternative sources of data, providing 'thick descriptions' (Geertz, 1973) of the thoughts, decisions, and actions of consumers and producers. Geertz states that the aim of 'thick' descriptions is to draw "large conclusions from small, but very densely textured facts". It goes beyond the merely 'factual', so that it is both analytical and theoretical in its description (Daymon & Holloway, 2001)

This research is based on primary research consisting of nine focus groups with UK consumers and global archival data on reuse business models, reusable products and recycling initiatives. For archival data, we primarily rely on mass media and information on corporate websites. Interviews in mass media are accepted as credible as it is presumed that they cannot be released without the consent of interviewees. The focus group data was triangulated against the archival data to identify common themes for discussion. Thematic analysis provides a highly flexible approach that can be modified for the needs of many studies, providing a rich and detailed, yet complex account of data (Braun & Clarke, 2006). To support our research objectives, we have identified three themes: (1.) Effect of consumer 'familiarity' (design and brand) (2.) Significance of 'aesthetic' attributes in comparison to utilitarian needs, and (3.) Consumer attitudes on 'Reuse vs Recycle'. By using complementary data from focus groups and a variety of archival data, the comprehensiveness of our study is enhanced, providing a qualitatively derived richness and a more complete understanding of

the themes under study. Also, the validity of qualitative research is enhanced, when two or more methods that have offsetting biases and limitations are used to assess a given phenomenon, and the results converge or corroborate (Greene, et al., 1989). In this study qualitative evidence is used to 'explore' various thoughts and actions involved in eco-consumption and production; the purpose is not to build a generalised theory.

3.1 Focus Group Discussions

Focus groups allow for "the explicit use of group interaction to produce data and insights that would be less accessible without the interaction found in a group" (Morgan, 1990). Focus groups generally work best for topics concerned with convictions and beliefs of others, and group interaction may tap into the motivation and subliminal areas of the human psyche. Focus groups are an excellent method for establishing the why behind participant opinions (Morgan, 1990).

If moderated properly, focus groups allow for participant focus over researcher emphasis. Unconstrained free flowing discussion through group interaction creates multiple perspectives within the group. Thus, focus groups capture the 'symbolic interactionist' perspective often lost in one to one interviewing (Threlfall, 1999)

Participants at a UK University were invited to complete an online screening questionnaire to identify suitability to participate in the focus groups. Screening criteria was based on participants' pro-environmental and innovativeness claims, - specifically for aerosol spray products (see appendix A). Gender and occupational group was also considered to ensure a mixed demographic. We assume that highly environmental friendly consumers hold more biospheric values and would be more aware of consequences of their activities (Stern, 2000). Furthermore, adoption of eco-friendly products may also correlate with innovativeness (Bhate & Lawler, 1997). We therefore placed participants into three categories: (a.) fairly pro-

environmental – some participants answered 'No' to screening question 1 on their interest in eco-friendly sprays, many answered 'Sometimes', none answered 'Yes'. With regards to screening question 2, all the participants said that eco-purchase was of secondary importance to product and price. (b.) highly pro-environmental – Participants either answered 'Yes' or 'sometimes' to screening question 1, none said 'No'. Participants either said an eco-purchase was very important or they try their best to buy and (c.) interested in trying new innovations – in response to screening question 3, all participants here said they were always interested in trying new products irrespective of environmental claims. Verifying the antecedents or factors for pro-environmental behaviour was not our goal however; the objective was to have moderate respondent homogeneity in terms of issue focus rather than in terms of socio-demographics. It was hoped that moderate levels of issue homogeneity can improve the quality of member interaction and encourage self-disclosure while allowing sufficient variation among members to stimulate insightful discussion. Each category had three groups. There was no overlap of participants between the nine total groups. The focus groups had 6-10 participants, and the discussion time varied from 60 to 90 minutes. The final composition of the focus groups is shown in appendix B.

Throughout the discussions, moderators used a discussion guide (Appendix C), which was mainly to structure the topics to cover (defining green, discussing different drivers of green purchasing for REPLIN products and preference for reusable vs recyclable spray products), rather than 'forcing' respondents to discuss the factors which had emerged from literature. Therefore, the structure of discussions was kept fluid, and participants were able to direct the conversation along their own lines. In keeping with the mainly exploratory goals of the research, little direction was pre-specified for each group. Participants were first taken through an icebreaking exercise where they generated different definitions of green, after which they generated examples of different REPLIN green products that they had purchased in the recent past. For each focus group, the examples generated

by participants in early stages of discussions tended to fall into three different REPLIN categories: food, personal care, and household care, although a very small minority gave examples outside of REPLIN products. The moderator then used the examples in the three REPLIN categories to drive the group discussion, eventually showing the four spray products to the participants. The overall design allowed a good amount of consistency in terms of discussion around REPLIN products, in particular the aerosol products. Table 2 provides details of the four spray products. It was hoped that various combinations of product features (e.g. trigger vs button, gas vs no-gas, and environmental credentials (e.g. reuse vs recycle), would reveal cognitive basis for consumers' trade-off decision-making process.

Table 2: The four aerosol products used in the focus groups

Product	Traditional (Trl) 	No-Gas 1 (NG1)	Compressed Air (CAir) 	No-Gas 2 (NG2) 
Trade Name	N/A	Flairosol	Airopack	Minimist
Characteristics	Trigger press; Liquefied Petroleum Gas (LPG) mixed with content produces mist.	Trigger press	Button press; Compressed air in the bottom chamber and content in upper chamber.	Twist and button press; Spray time depends on amount of twist (max 180° for 7 second spray)
Materials (see Appendix D for more details)	Plastic dispenser, Aluminium container	All plastic	All plastic	All plastic
Manufacturer / Owner	N/A	AFA Dispensing	Airopack	Alternative Packaging Solutions
Patent	N/A	EP 2766127 A2	US 9951759 B2	US 2004/0238572 A1

Commercialisation Status	Popular	Recently commercial (less than 10 years)	Recently commercial (less than 10 years)	Not yet commercial
Applications	Febreze™ (P&G) and Airwick™ (Reckitt & Benckiser) air freshener's	Febreze ONE™ air freshener (P&G) - not available in the market at the time of the focus group research.	'Method™' air freshener; available at some retailers in the UK at the time of focus group research.	N/A

Trl is a conventional, widely available and recognizable aerosol spray with a trigger format. A flammable fossil fuel gas, i.e. Liquefied Petroleum Gas (LPG) mixed with the product propels Trl. A continuous spray can be produced with the trigger pulled and held. CAir and NG1 are recently commercial. CAir has a transparent container. It is activated by a button and the contents are propelled by compressed air in a separate piston chamber at the bottom. CAir can also provide a continuous spray when the button is pressed and held. NG1 is not propelled by any gas, and is activated by a trigger. A continuous spray with NG1 requires repeated trigger action. NG2 is not yet commercial, and similar to NG1, it is not propelled by any gas. It uses a 'twist and button press' mechanism to activate. A full twist can only provide a continuous mist for maximum seven seconds. If using for less than seven seconds, no twist is required for further activity until the full seven second spray capacity is used, after which, the user will have to twist again.

A dummy air-freshener brand 'FLOAT', was applied to the four spray products (see Figure 1). The textual communication was consistent in minimum details across products (see Table 3). We avoided price, because for reusable products this would depend on the refill business model. Moreover, price could impede the discussion around product features and eco-credentials. The colour scheme for text was similar for all the sprays. A neutral background design of white cotton flowers and light blue sky signified an air-freshener for Trl, NG1 and NG2. Because, CAir is 'transparent', this was maintained using a transparent label, so participants are able to visualise the compressed air

chamber and contents. The top chamber of CAir was filled with water to maintain neutrality and a symbolic 'air-flow' image on the label highlighted the visible pneumatic mechanism. We acknowledge that a consistent visual strategy is challenging to achieve because the sprays are different technically and in their basic design. We however believe that this approach provides a more realistic context, and could therefore provide useful high-level response on functionality, form, novelty and reuse. Moreover, the triangulation with secondary data would mitigate any inherent biases. We also acknowledge that some respondents did recognize Trial in relation to 'Febreze™' brand, but we believe that the differences in the various products features and their eco-credentials would engage consumers in a more involved comparison with minimal bias.

a. Traditional (Trl)

b. No-Gas 1 (NG1)

c. Compressed Air (CAir) (Transparent film)

d. No-Gas 2 (NG2)

Figure 1: Branding and labelling on the four aerosol bottles

Table 3: Messaging on the aerosol products

Product	Content and Warning Message	Functionality Message	Packaging Message
Traditional (Trl)	Pressurised Gas. Leak proof. Highly flammable (5% by mass flammable), keep away from fire and do not puncture.	Keep trigger pressed for a continuous mist.	Container RECYCLABLE. Check local authority.
No-Gas 1 (NG1)	No Gas. No Chemical propellant or harmful gases. Just 100% product.	Repeat trigger for a continuous mist.	The cap is designed to be REUSABLE. Bottle RECYCLABLE.
Compressed Air (CAir)	Powered by Air. No Chemical propellant or harmful gases mixed with product. Just 100% product. 1% by mass flammable. Caution: May burst if heated.	Keep button pressed for a continuous mist.	Bottle RECYCLABLE.
No-Gas 2 (NG2)	No gas. No chemical propellant or harmful gases. Just 100% product.	Activate with a twist and keep button pressed for a continuous mist of 7s.	The cap is designed to be REUSABLE. Bottle RECYCLABLE.

Trl type aerosol cans are recyclable, and indeed in the UK, 97% of local councils collect aerosol cans (Heskins, 2017), however, we have used the message "check local authority". Recycling aerosol cans requires separate consumer education. Trl type cans cannot be recycled when there are partial contents inside the can; therefore, they do not normally carry any eco-label. Many cans may carry a label that only says that the producer has made a financial contribution towards the recovery and recycling of packaging (see Figure 2). The label does not necessarily mean that the packaging is recyclable, will be recycled, or has been recycled.

Figure 2: Aerosol can disposal. (a.) Recycling label for a traditional aerosol can, (b.) Leaflet from a UK council emphasising that aerosols must be empty before recycling.

3.2 Secondary Archival Data

Primary interviews, and less frequently, observational data, have been used by social science researchers as the main sources for interpreting and analysing focal research themes. Although interviews and observations are rich materials with which to build an understanding of eco production and consumption there are significant opportunities for making greater use of secondary archival data for this purpose. Because there is a disjunction between what people say and what they do (Hoshino, Rahman, 2015), we cannot rely only on interviews to provide insights into attitudes and behaviours of consumers. Interviews have become the conventional rather than the appropriate methodological choice (Alvesson, 2003). On the other hand, from analysing the activities of businesses and the thinking of their managers from publicly available sources, we may be able to infer how they shape consumer attitudes and behaviour. A particular concern about secondary data is that the researcher is unable to exercise any control over their generation (Harris, 2001). However,

lower cost and time are advantages because greater amount of materials such as periodicals, corporate annual reports, consumer reviews, product complaints etc. have been made widely accessible owing to the internet. Furthermore, according to Lee (2017), the unobtrusive access that secondary data can present may help overcome problems of recall of past behaviour and discussions of sensitive matters that are problematic in the interview. Lee further says: "Simplicity and accessibility are also advantages of unobtrusive measures; they rarely require great technical or technological sophistication and are widely adaptable to many kinds of research situations". The 'open-source' approach to using publicly available secondary data can encourage careful reporting and justification of analysis, and allows researchers to test alternative explanations. Moreover, as alluded previously, secondary data can also be used to provide "triangulation", increasing the credibility of research findings using primary data (Cowton, 1998).

Table 4: Sources of archival data. All URLs were last accessed on 17 June 2019

Subject	**Organisation and/or product**	**Sources**
Reuse / Refill business models	'Terracycle's' 'LOOP' programme	Mass media: Business Wire (2019); Holder (2019); LOOP US LLC(2019) Business website: https://loopstore.com/
	'Ecover' refill stations	Mass media: Bridgman (2013); Mesure (2011) Business website: https://www.ecover.com/store-locator/
	'Common good' refill stations	Mass media: Baker (2013); Badore (2014) Business website: https://www.commongoodandco.com/apps/store-locator
Recycling of laminate refills	'Terracycle's' Tassimo & L'OR recycling programme	Business website: https://www.terracycle.co.uk/en-GB/brigades/tassimo-lor

	'Enval'	Mass media: Corbin (2016); Williams (2018) Business website: http://www.enval.com/
Metal recycling	'Metal matters' Initiative	Project website: https://metalmatters.org.uk/ Leaflet from a local council in UK, Calderdale: https://www.calderdale.gov.uk/v2/sites/default/files/BC0001_BCME_Trans_Lflt_1_AW_Calderdale_v4a.pdf
Products (Innovative designs)	'Method™' products (aesthetic design)	Mass media: Deighton (2016); Herrera (2012) Business website: http://methodproducts.co.uk/
	'Arm & Hammer' Essentials (refill cartridge)	Mass media: Packaging Digest (2008); Green Biz (2008)
	'JAWS' / 'iQ REFill' (refill cartridge)	Mass media: Oppenheim (2011); WRAP Resource Efficient Database: A trigger spray bottle with concentrated cartridge refill system (http://reid.wrap.org.uk/item.php?id=13) Business website: https://jawscleans.com/
	'MyReplenish' / 'MyCleanpath' (refill pod)	Mass media: Bardelline (2010); Packaging Digest (2012); WRAP Resource Efficient Database: A trigger spray bottle with concentrated pod refill system (http://reid.wrap.org.uk/printitem.php?printmode=1&id=3) Business website: http://www.myreplenish.com/ https://www.mycleanpath.com/

3.3 Narrative Analysis

We use narrative analysis, reporting findings or excerpts from transcripts alongside the researcher's own interpretation. Presenting original data from our research will help establish the 'audit trail' and strengthen credibility of our analysis, and help the readers make their own judgement on the researcher's interpretation. Quotes from participants aid in the understanding of specific points of interpretation and demonstrate the prevalence of the themes (Nowell, et al., 2017). Embedding extracts of raw data within the analytic narrative supports illustrating the complex story of the data, going beyond a description of the data and convincing the reader of the validity and merit of the analysis (Braun & Clarke, 2006).

3.4 Life Cycle Analysis

Analysis in the following section 4 starts with Life Cycle Analysis (LCA) of the packaging for the four aerosol spray products (excluding any contents). Carrying out a full LCA is time and cost-intensive task; for managers who have to make decisions considering both consumer and industry perspectives, it would add little value. We therefore carry out a highly streamlined LCA. There is no consensus as yet on a suitable metric for eco-impact that is able to guide design in the early stages (Ashby, 2012). However, there is a degree of international agreement and commitment to progressively reduce the carbon footprint, interpreted as meaning carbon dioxide (CO_2) emissions, or carbon dioxide equivalent (CO_2 eq), a value that also includes global warming potential of the other gaseous emissions. A highly streamlined approach which only measures CO_2 emissions and equivalent energy requirements should more appropriately be called an eco-audit (Ashby, 2012). It identifies the phase of life – material, manufacture, transportation, use and disposal – that carries the highest demand for energy or the greatest CO_2 burden. We use this approach alongside qualitative judgements of other environmental and social impacts. Data for bill of materials, process type, transport requirements, and associated energies and CO_2 intensities are given in appendix D.

4. Findings and Discussion

4.1 Recycle or Reuse: Life Cycle Analysis (LCA)

Results of LCA for the four aerosol sprays that can accommodate 200 ml of liquid content are shown in Figure 3. These results were not shared with participants before or anytime during the focus group research.

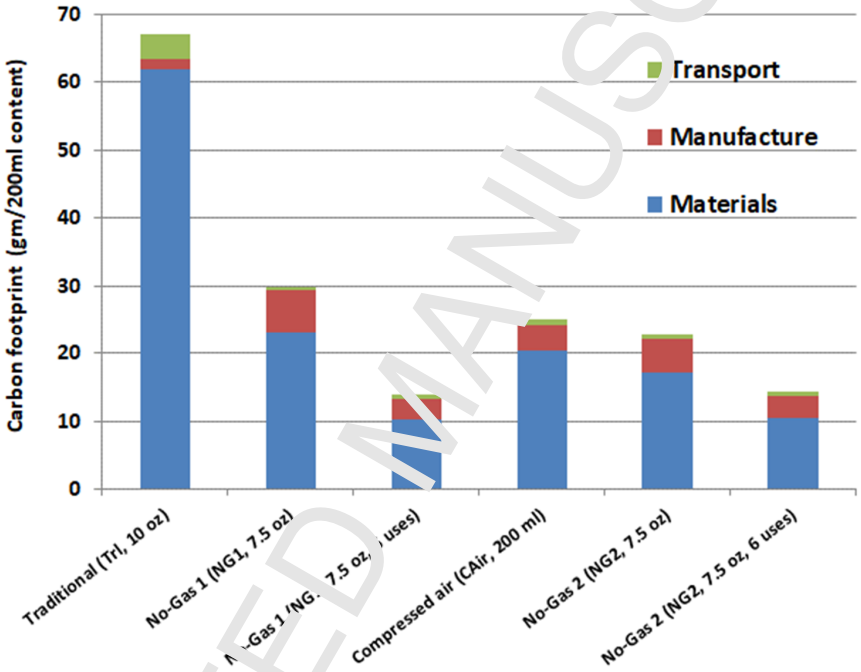

Figure 3: Life Cycle Analysis of the four aerosol sprays

Liquefied Petroleum Gas (LPG) that propels Trl is lost during usage, but we have not included the energy that is consequently lost. For Trl, the user does not get 100% product, because the propellant is mixed with the actual product. Also, we assume an initial headspace of 34%, this is generally considered as safe to contain LPG in its gaseous state, thus providing a liquid product content of about 200 ml.

The 'embodied' energy recovered from recycling is not included in our results. This is because, all the packaging materials for the four products are fully recyclable at the end of life, although current recycling fractions vary between materials. Figure 3 shows impact of six refills in the case of NG1 and NG2. We assume that for each reuse, only the bulkier spray cap is reused, whereas the lighter bottle is new (not reused). The results indicate that NG1, CAir and NG2 have a lower CO_2 burden compared to Trl. When a single use is assumed, CO_2 burden for CAir (~25 gm) is lower compared to NG1 (~29.87 gm), but marginally higher than NG2 (~22.76 gm). Assuming a reuse of six times for NG1 and NG2, significantly lowers their CO_2 burden. Indeed, for six uses, CO_2 burden for NG1 (~13.89 gm) is comparable to NG2 (~14.24 gm).

The processing energies for NG1, NG2 and CAir are higher than that of Trl. We assume that NG1, NG2 and CAir can be locally filled; therefore, the energy to transport them is lower compared to Trl that is centrally filled. Moreover, for NG1 and NG2, reusing the cap for more than six times and refilling the bottle, can lead to further reductions in processing energy per unit product.

While the streamlined LCA results demonstrate that reuse is preferable to recycling, it is important to be mindful of some caveats. We applied streamlined LCA to find a balance between comprehensiveness and usability. If the methodology is too complicated, it may not be utilised to inform eco-design in the crucial early stages of product development, and before it is too late to change the design direction. The realisation of any eco benefits is also dependent on consumer acceptability. Therefore, other important environmental and resource impacts are not included, such as biodiversity, acidification, toxicity, water usage etc. However, certain judgements can be made about resource use and eco-toxicity. The reusable formats do not contain any propellants, therefore the user would benefit from additional product in a given packaging volume. Moreover, recyclers can only accept LPG based aerosol cans, provided that they are completely empty. Therefore, Trl type products that are not fully empty would end up in a landfill, and pose an eco-

toxicity threat. CAir is not reusable, but it does not contain any harmful propellants. Further, the container is transparent, therefore before disposal consumers can identify whether the bottle is empty.

Besides, the social dimension of sustainability is not covered in the present version of the methodology, despite the fact that it is more important for packaging today than ever before. Propellant-free formats can be considered as safe to use for primary users and other secondary customers such as fillers and recyclers, because there is no hazard of explosion. A full social life cycle analysis is however beyond the scope of this research.

4.2 Product Innovation: Familiar Design or familiar Brand

For REPLIN products, the major goal for consumers is not to make an "optimal" choice, but rather to make a satisfactory choice while minimizing cognitive effort (Hoyer, 1984). They therefore 'satisfice' by settling for 'good enough' rather than 'best' (Simon, 1955), and tend to optimize time and effort as opposed to deliberating on the consequences of their actions. Hence, product heuristics that suggest "easy" or "simple" are important for REPLIN products. If usage does not depart significantly from familiar use, it may provide a barrier to encouragement for consumer choice.

> *"The thing I like about [NG1] though is we're so programmed in knowing that that's an aerosol, if you put anything out that was too different on the market people wouldn't recognise it" (FG9, Innovative)*

> *"I prefer [NG1] to [NG2] because [NG2], it says directions, it says you have to activate with a twist, whereas for [NG1], it's just a no brainer, I would just buy a product that works" (FG5, Highly eco aware)*

Habitual users engage in a behaviour automatically, and do not make ongoing evaluations of that behaviour unless some circumstance triggers the need for conscious thought. Therefore, focusing on habits is essential for behavioural change, as un-sustainable behaviours are locked in habitual behaviours (Jackson, 2005). Habitual and routine behaviour contributes to the awareness–intention–behaviour gap between environmental values and everyday interaction with products (Bhamra, et al., 2011). To the extent that many consumers are less aware about consequences of their action on the environment, a familiar design may be more effective. Moreover, even for REPLIN products, consumers can develop habits and preferences through habitual purchase and involvement with a brand.

> *"All my deodorants that I have ever used, have been twist and spray. I know the majority of X [a well-known brand] deodorants are designed like that, so I personally would not have an issue with it." (FG2, Fairly eco aware)*

> *"If I was already committed to a brand and they implemented something like that, then I might be more inclined. If [a well-known brand] deodorants had a reusable thing, then I might just buy like a canister or whatever that you put into the old can." (FG1, Highly eco aware)*

A major barrier to the purchasing of eco-friendly products is concern over the expected performance of the product. Consumers generally trust the performance of well-known brands; therefore, eco-friendly products could be successfull under well-known brands, provided they perform or exceed consumer expectations. Early majority consumers are likely to trust the effectiveness of well-known brands more than the effectiveness of environmentally friendly products. Well-known brands could therefore help reusable products become mainstream, diffusing them beyond zero-waste shops and committed ethical consumers.

Recently, 'Procter & Gamble' (P&G) commenced selling its 'Febreze™' branded air-fresheners in format NG1. 'Febreze™' air fresheners are popularly sold in format Trl. P&G differentiates the line in the NG1 format as 'Febreze ONE™' in the US (P&G, 2017). P&G also sells 'Febreze ONE™' through a new online business model 'LOOP' which started operations in May 2019 (LOOP US LLC, 2019). 'LOOP' has been created by 'Terracycle' which was originally formed to recycle typically hard-to-recycle waste. The 'LOOP' platform aims to create a market for reusable/refillable or 100% recyclable products (Business Wire, 2019). According to Tom Szaky, the CEO of 'Terracycle', *"Through 'LOOP', consumers can now responsibly consume products in specially-designed durable, reusable or fully recyclable packaging made from materials like alloys, glass and engineered plastics. When a consumer returns the packaging, it is refilled, or the content is reused or recycled through groundbreaking technology"* (Holder, 2019). Although, mainly a few niche brands such as 'Ecover' and 'Method™' have attempted to influence consumer choice towards green products, it is to be seen how well-known brands can shape consumption patterns through new business models such as 'LOOP'. A statement on 'LOOP's' website reads *"Shop for trusted brands now redesigned to be smarter and waste free."*

Whether brands can become a major driver of sustainability is debateable. They could be criticised for brainwashing consumers into artificial wants, over production and consumption, and resultant negative effects on individual society and environment (Lehner & Halliday, 2014). The World Wildlife Fund (WWF) has also critiqued potential brands and their advertising, because of the negative impact they offer by 'covering' unsustainable behaviour (Alexander, et al., 2011). They argue that brands through their advertising shape consumer culture, to produce ever-higher consumption levels. Despite these arguments, in order to bridge the gap between claimed ethical concern and actual consumer behaviour, and for sustainable living to become mainstream, perhaps more marketing is required. Well-known brands could particularly be the main driver of such efforts; they have the power to move from a production to a service economy. Chapman (2015) says that

corporations have to shift their business strategy "away from the temporal world of one of sales into a new reflexive domain of relationship management". 'LOOP' proposes such a service business model, but success will depend on consumers desire to keep their products for a greater length of time. Empathy with the products will lead to empathy with the brands.

4.3 Product Innovation: Functionality or Aesthetics

Often, not enough environmental gains can be realised solely through technological improvements of existing products (Zwan & Bhamra, 2003). For example, light-weighting will not reduce our wasteful consumption habits, it only delays or maybe increases accumulation of waste. Light-weighting often shrinks down packaging into items that are unrecyclable, difficult to capture, and designed without end-of-life solutions (Szaky, 2017). For most consumers, environment plays a secondary role to cost, convenience and functionality. Therefore, in pursuing packaging redesign towards more durable longer lasting products, it may be important for a newly designed package to provide 'new' benefits to the end-user.

> *"I think it is more child friendly [twist and button press in NG2]. I think the fact that it only allows you a certain amount of time to spray, up to maximum is a good idea as well." (FG6, Fairly eco-aware)*

Luttropp (2006) suggests that reducing environmental impacts while increasing the level of the product's functional performance is a win-win situation that eliminates unnecessary functions. Furthermore, Luttropp is critical of a 'green fix' strategy (using new materials while keeping the same functions) that result in short term gains, labelling them as 'low-hanging fruits' that will anyhow be achieved. Luttropp is also critical of a 'linear down' strategy where environmental impact is reduced by eliminating certain functions, e.g. a surface cleaner product that uses a concentrated refill cartridge and smells nice, but does

not clean well. For REPLIN products, most consumers would want the product to at least meet its basic functions. Avoiding transporting water, by using concentrated cartridges or pods, may be considered an additional eco-benefit that is nice to have, but not at the sacrifice of the products basic functions. Moreover, if consumers perceive a new function as providing higher level of environmental benefits, they would consume more of the product (Paparoidamis & Tran, 2019). For example, consumers may spray more of the surface cleaner product to achieve the desired cleaning performance, thus cancelling any efficiency gains that may be achieved by transporting less water. This is similar to the 'Rebound' effect in energy economics which states that technological progress in energy efficiency leads to increased energy consumption (Berhout, et al., 2000)

The greater novelty associated with a new product and new functions may appeal to the ''novelty-seeking'' trait or behaviour of highly innovative individuals, however, consumers may have a threshold level of functional performance expectation from REPLIN products.

> *"I think the products we are talking about, like aerosols, they are quite basic anyway. I mean I am quite into technology and any innovation in terms of technology I am really interested. But, an aerosol, I think it's only got so far it can actually go." (FG3, Innovative)*

The success of 'Method™' suggests aesthetic design may be more relevant than functional innovations in a low-involvement category. 'Method™' produces eco-friendly household and personal care products. Their website informs that 113 of the 114 listed ingredients are biodegradable, and their bottles are made from 100% recycled materials. Notably, according to Clare Burke, head of marketing at 'Method™' UK, their success in a low involvement household care category is primarily due to aesthetic 'desirability' (e.g. bright colours and idiosyncratic designs),

allowing consumers to display products out of a cupboard stacked with clinical cleaning products (Deighton, 2016). 'Method™'s' eco-credentials are not the primary determinant of consumers purchasing intention. 'Method™' uses CAir for its air freshener range whose distinctive design can be attractive.

> *"If I was going to pick something that was different to the product I normally buy, I'd probably be most likely to give that one a go because it does look the most different [CAir], I keep that on display. I wouldn't mind that being out in my house whereas the other three I'd instantly want to put them in to a cupboard." (FG1, Fairly eco aware)*

'Method™'s' products appear to oppose social conventions by challenging the place of household care products in the home. At the same time, they could form a counterpoint to predominant trends in household care products through their peculiar design. These aesthetic strategies can deliberately encourage the consumer to show their 'disapproval' of the standard (Harper, 2018). 'LOOP' has seemingly adopted this strategy, a statement on its US online store reads *"In partnership with leading industrial designers, enjoy products you're proud to display on your countertop"*.

Adam Lowry, cofounder of 'Method™' says, *"I fundamentally believe that if you build something and ask people to buy it for the sole reason it is green, you will ultimately fail"* (Herrera, 2012). His cofounder Eric Ryan further adds, *"What has worked really well for the brand is, people have come in because of the more joyful, fun side (of our products) and then discover that this is actually good for you"*. Further, according to Clare Burke, *"when consumers realise the products are environmentally friendly, they convert into repeat customers and brand ambassadors. When people read the back of their products, our sustainability voice comes through. I guess it is all the softer touch points: social media, website and communications"* (Deighton, 2016). Therefore, a holistic understanding of

sustainable consumption decisions has to move beyond rational cost-benefit calculations. Attempts to influence behaviour through education and awareness raising may have little success in delivering sustained changes in consumer behaviour beyond recycling. This is because, environment is not a central or well-established part of most people's day-to-day conceptual frameworks (Austin, et al., 2011). Moreover, consumers' classification systems are highly personal and contextually specific.

> *"I buy XX [a green household care brand] floor cleaner, because I just think it doesn't matter how good your floor cleaner is, but I buy YY [A major national brand washing up liquid], because it is better and lasts longer." (FG1, Fairly eco aware)*

> *"I think food, it's higher up for me [Eco-friendliness], things like toiletries is much lower down, it's the effectiveness of the product is much higher up" (FG4, Fairly eco aware)*

Strategies where consumers are framed as using information to optimize their behaviour can be critiqued for not taking account of cognitive processing limitations (Brynjarsdottir, et al., 2012). Therefore, strategies that encourage stewardship and innovation in product aesthetics may overcome some of the limitations of previous strategies for REPLIN products; they do not require consumers to be committed to the environment or evaluate the amount of sacrifice towards desired performance benefits.

4.4 Recycle or Reuse: Consumer attitudes and Producer efforts

Barr, et al. (2001) argue that consumers who re-use are influenced by knowledge of environmental issues and a concern about the consequences of waste; therefore, their behaviours are value-based. Although consumers who recycle are concerned about environmental issues, the main influence on their recycling behaviour is the logistics of recycling, i.e. the convenience of local authority kerbside

schemes and knowledge about recycling. Tonglet, et al. (2004) found that, neither buying to reduce waste (e.g. long-life bulbs), nor repair/re-use to reduce waste (e.g. rechargeable batteries) were significantly correlated with recycling intentions or attitudes. Therefore, the more aware consumers are about the consequences of waste and impact on limited natural resources, they may choose a reusable product. However, consumers may think recycling is better than reusing.

> *"I find the whole concept of refillable chemical stuff a bit old fashioned now. I think innovation has moved on, and recycling ability has moved on. They should be able to create, integrate products that are wholly recyclable." (FGs, Innovative)*

> *"I think everything needs to be recyclable these days and reusable is just a choice that we might want to make. If something wasn't recyclable, whether it was reusable or not, I would not buy that I." (FGs, Innovative)*

The biggest factors deterring customers from refills are "inconvenience, mess and cost" (Bridgman, 2013; Lofthouse, et al., 2009). Furthermore, according to Sacha Dunn, the founder of 'Common good': *"It's very hard to change people's behaviour"* (Baker, 2013). The big challenges for retailers are distribution (Badore, 2014), and the need for a different retail format and point-of-sale proposition that mainstream retailers can find particularly difficult to implement (Sherwin, 2018). According to 'Ecover', it is "unfeasible" to offer something similar to niche health-food stores in supermarkets (Mesure, 2011) - *"You need to clean up after customers, plus we do not have the volume to invest in big refills"*.

The concept of refills itself is not new, as in the past beverage companies and milk dairies packaged their products in glass, arguably the easiest type of packaging to refill and reuse. However, several innovative solutions and designs have appeared on the market for household care products. These

employ a reusable bottle and concentrated refill pods or cartridges. The user simply has to add water at home. The argument for such solutions is that most household care spray products contain 80-90% water, and refill cartridges avoid the transportation cost and associated emissions. Consumers may initially choose such reusable products, if it functions to satisfy their novelty seeking nature or appeals to their environmental conscience.

An innovative refillable solution that has received much attention is the 'Mr Cleanpath' range of household care products made using the 'Replenish Refill Smart System' (Bardelline, 2010; Packaging Digest, 2012); here a concentrated recyclable refill pod is attached to the bottom of a bottle. Another reusable spray product is 'JAWS' (Just Add Water System), also called 'iQ REFill' (Reduced Environment Footprint) (Oppenheim, 2011). The user just has to add water to the spray bottle and insert a recyclable cartridge into the bottles opening. One of the first products using a concentrate system was from a well-known brand, 'Arm & Hammer's' Essentials range (Green Biz, 2008; Packaging Digest, 2008). The bottle contains a small piece of plastic in the inner lip of the bottle that cuts open the refill as it is twisted into the bottle. In Table 5, we offer a comparative analysis of the various products. The mainstream diffusion of these products beyond early innovative or environmentally conscious consumers is questionable. 'Arm & Hammer' has withdrawn its product, and the others are moving away from supermarkets and experimenting with new online business models.

Table 5: Innovative reusable sprays using a concentrated refill pod or cartridge

	Arm & Hammer (Essentials)	**Replenish Refill smart**	**JAWS / iQ Refill**
			
Sustainability Savings	Refills use 93 percent less plastic and 80% less packaging compared to new bottles.	Refill pods cut plastic waste by 90%; freight reduced by 16 to 20 times over standard single-use bottles.	Refill cartridges reduce plastic by 80% compared to conventional spray bottles
Reusability	Spray trigger lasts for about 10,000 pulls, and it takes about 1,000 pulls to use up a full bottle, though the trigger may last longer than seven refills.	The Replenish bottle has a lifespan of at least three years—as many as 40 pods can be applied before a foam ring between the pod and bottle begins to wear out, which could then be replaced. Each pod makes 6 bottles.	The bottle can be reused over and over. The sprayer can be reused up to 10 refills.
Patent	N/A	US 7850043 B2, US 2008/0035668 A1 Available for licensing	US 2009/0159614 A1, US 2007/0205218 A1
Commercial Status	Withdrawn	Initially retailed at Walmart, but not available anymore. Customised bottles and refills available on mycleanpath.com website. Limited range on Amazon.	Launched originally as iQ clean in Canada but does not exist now. 'JAWS' is stocked in about 1500 Kroger retail stores in US. However, the business model is moving online with refills only sold online on jawscleans.com and Amazon.

Whilst it is generally believed that the increased use of refills would lead to sustainability benefits for the household care sector, many barriers need to be overcome before reusable products become mainstream. First, reusable packaging will need to be increased in quality and durability, such as weight and gauge and they need to be leak proof, to allow them to withstand 'repeated' use. Second, the success of business models such as 'LOOP' will depend upon consumers' willingness to return. The involvement of major producers and retailers with 'LOOP' suggests that they believe there can be positive benefits for consumers to adopt reusable/refillable products. However, the challenge is in setting an accurate deposit rate. A higher deposit rate would be counterproductive for many REPLIN products. The deposit rates on 'LOOP' vary depending on the product and some are shown in Table 6 for their US store.

Table 6: Deposit rates for some products on 'LOOP's' US store

Product	**Price range ($)**	**One time Deposit ($)**
Burlap & Barrel 1.5 oz spice glass jars with metal caps.	$7-$10	$1.25. Forfeited in 2 years if not returned.
Hagen Daaz 14 fl oz frozen ice cream (stainless steel double walled container)	$6.49	$5.00. Forfeited in 6 months.
Clorox disinfecting wipes (60 nos.) in a steel canister	$5.49	$10.00. Forfeited in 6 months.
Soapply 8 fl oz liquid hand wash in reusable recycled glass bottles and recyclable plastic pumps.	$23.75	$1.25. Forfeited in 12 months.
FEBERZE ONE 10.1 fl oz fabric spray/air freshener	$5.00	$2.00. Forfeited in 12 months.
Ren skincare products 300 ml in reusable recycled glass bottles and recyclable plastic pumps. Glass bottles can be reused up to 100 times.	$20.70 (hand wash) - $ 59.40 (body lotion)	$5.00. Forfeited in 9 months.
Pantene 12.6 fl oz conditioner and shampoo pump spray in aluminium bottles	$5.50	$2.00. Forfeited in 12 months.

Presumably more durable steel products have a higher deposit rate compared to other products and also relative to the product cost, and have a shorter forfeiture period. For such products, consumers are more likely to find other spontaneous storage solutions in their kitchen, thus preserving the useful life of the product. The deposit rates are relatively low for liquid personal care products and the 'Febreze ONE™' air freshener. In these cases, in order for producers to realize the potential profits associated with cleaning and reusing bottles, as well as the potential sustainability benefits from reduced waste management costs and energy consumption, the bottle must be returned after customer use. Otherwise, producers would prefer to avoid the additional capital investment to produce 'durable' and higher 'quality' refillable bottles and additional equipment for cleaning. The migration to refillable bottles is unlikely to be successful under conditions in which consumer return costs are high relative to disposal expenses of recycling (Grimes-Casey, et al., 2007). Therefore, such extended product responsibility policies without understanding the incentives and behaviour of consumers are unlikely to be effective.

Early adopters may evaluate new products, brands or even business models favourably, because it appeals to their 'venturesome ness' or environmental conscience. For other consumers, if the perceived trade-offs are high, they may be reluctant to adopt an innovation that they perceive as eco-friendly. This is perhaps true even for straightforward solutions such as coffee refills.

> *"I have noticed that especially with coffee, because you get less in refill packets, we just tend to buy the glass jars and then we recycle the glass jars." (FG7, Fairly eco aware)*

The above statement is in line with prior studies (Luchs et al., 2012; Olson, 2013) that emphasize the negative effects of perceived trade-offs in consumers' decisions to buy eco-friendly products.

Moreover, consumers may also believe that producers are not being sincere in their environmental pursuit, because one can always recycle glass jars, whereas the refill package may not be recyclable.

> *"With the coffee, they have started doing like little zip lock bags and you pop them into your glass jar when you get home. But, I don't believe the bag itself is recyclable" (FG6, Highly eco aware)*

Laminated plastic packaging that is used in coffee refill pouches is not a targeted material for recycling in the UK, because it is not financially viable (Slater & Christchton, 2011; Williams, 2018). However, transporting a heavier glass jar may not be as eco-friendly as a 97% lighter refill, and reshaping glass jars is very energy intensive. Even if glass were to be 100% recycled, the energy lost in its conversion will still exceed the energy lost in the processing of other materials that are not 100 % recycled (Ashby, 2012). Consumers may not want to take the cognitive stress to trade-off by considering all the different eco-attributes of a product. They may end up making a trade-off with economic value as the main deciding factor, and any feelings of guilt are neutralised if they are able to satisfactorily recycle.

'Terracycle' has partnered with FMCG (Fast Moving Consumer Goods) brands, 'Tassimo', 'L'OR' and 'Kenco', to recycle or upcycle hard to recycle packaging into useful items. The critical question though is, whether many consumers are aware of such extended producer responsibility efforts, and whether these are effectively communicated to consumers. The programme is run by a network of volunteers who have set up dedicated collection points at public locations across the country. The volunteers coordinate the collection and send the waste to 'Terracycle' for recycling, raising money for charity in the process. Despite such voluntary consumer efforts, 'Enval' has been highly critical of FMCG brands for not doing enough to recover hard to recycle laminated packaging (Williams, 2018).

'Enval's' 'pyrolysis' technology has been cited as a key potential intervention in treating plastic-aluminium laminates (Corbin, 2016).

When consumers are able to rationalise their decision for not choosing a product marketed as eco-friendly, e.g. skepticism around the recyclability of laminated packaging, it may lead them to use neutralization techniques to reduce any feelings of guilt (Atkinson & Kim, 2015), e.g. recycling glass coffee jars, instead of buying lighter eco-refill packs. Recycling glass jars may still offer consumers a positive image of being an environmentally responsible consumer. Recycling also offers a sense of consumer control by placing the sustainability outcome in the hands of the consumer.

> *"RESPONDENT A: I think it is good to be in control of what you do, not dictated to by anything else or anybody else.*
>
> *RESPONDENT B: I think that's why I go for recycle over reuse, because, the environmental impact, you can be involved in that, but also you are still in control of what you're buying. "(FG5, Highly eco aware)*

There are two key implications for producers here. First, the choice among recycling or reusing depends critically on the goals of the consumer. The option that is selected will depend on the extent to which the consumer's goals are about minimizing the cognitive effort required for making a choice, maximizing the accuracy of the decision, minimizing the experience of negative emotion during decision making, maximizing the ease of justifying the decision, or some combination of such goals (Bettman, et al., 1998). All these goals are satisfied when local councils actively promote recycling, for example, in relation to Aluminium aerosol cans, 97% of councils in the UK now accept empty cans.

Second, choice among options depends on the complexity of usage. Options that are superior on their eco friendliness may be more preferred as the usage becomes more complex. Hence, for

REPLIN products, particularly everyday use products, consumers may not value reusing more than recycling. This creates an important ethical dilemma. We find confronted by the very real need to ensure that environmental gains achieved through better recycling are not offset by a 'rebound' effect in the form of increased demand for recyclable products. If a product is recyclable, consumers will buy more and thus nullify the purported positive impact of recycling and perhaps, cause more environmental damage (Catlin & Wang, 2013). Reusable products help us consume less packaging and hence reduce consumption. However, despite the widespread commitment to sustainability among policy makers, it is difficult to make reduction in consumption appealing to consumers. Many current social marketing campaigns do not attempt to change consumer behaviour to reuse or reduce. For example, the 'Aluminium packaging recycling organisation' (Alupro), which is industry funded and not-for-profit, works with many local councils in UK to encourage metal recycling. Their 'Metal matters' communications programme educates householders about metal packaging recycling, including Trl type aerosols. A leaflet from Calderdale council reads: "*put two extra cans in your white [recycling] sack and you will save enough energy to run a computer for up to 12 hours …. Just pop your metals into your white sack every week, it is that easy".*

Promoting reusing and reducing is not a simple task, nor one that can be easily practiced by interested consumers. It will need more sophisticated social marketing (or de-marketing) strategies and policy interventions. Therefore, extended producer responsibilities around reuse may not be enough for changing consumer behaviour. A successful transition into reusable / refillable products is highly unlikely without government intervention.

5 Conclusions

From Life Cycle Analysis of the four aerosol products, it is evident that reusable products have a lower CO_2 burden, potentially low eco-toxicity impact, and safer for users and producers. However our research using focus groups and archival data reveals particular challenges for consumer adoption of reusable products. The following table provides our key findings, and offers useful guidelines for practice and policy.

Table 7: Key Findings

	Research Question	Key Findings
1	How do consumers decide between functional, aesthetic and eco-attributes for REPLIN products?	In the case of REPLIN products, consumers tend to make a satisfactory choice by minimising cognitive effort, rather than make an optimal choice. Therefore, a familiar design may be more suitable for new eco-innovations. If the design is unfamiliar, the innovation has to offer new benefits, particularly when consumers have a threshold level of expectation from functional REPLIN products. An aesthetic design may invoke positive consumer response compared to an innovation that only offers functional improvements or new benefits. Aesthetic strategies lend permanence to objects, encouraging consumers to display them on their home countertops and reusing them, thus framing an antithesis to wasteful consumption. Well-known brands can alleviate some of the uncertainties associated with new products that have unfamiliar design or redesigned for reuse.
2	How relevant are higher level	Consumers may perceive recycling as more environmentally friendly compared to reusing, perhaps because recycling norm

	environmental practices such as reuse in the case of REPLIN products?	has become widespread. Conceivably, governments current policy instruments supported by industry may also give a perception that recycling technology has become considerably sophisticated. Moreover, recycling gives consumers a sense of control in their eco behaviour, and help them rationalise their intentions to not purchase reusable / refillable products. Though refilling may be cost ineffective, inconvenient and messy, consumers in addition may also be uncertain about the environmental gains in buying refills if they cannot be captured in recycling. Therefore the choice of recycling requires less cognitive effort and easy for the consumer to justify. Reuse may be more appreciated as the usage becomes more complex and involved, but for less complex REPLIN products, consumers may not value reusable products more than 'fully' recyclable products.
3	How commercially successful are reusable REPLIN products and what are the implications for eco-design?	Though eco friendly brands such as 'Ecover' and 'Common Good' have been operating refill stations in niche health-food stores, there is uncertainty about their success in mainstream retailers. Refill stations would require a different retail format and a new point of sale proposition. Only recently have well-known mainstream brand owners decided to trial a new online business model with 'Terracycle' through its 'LOOP' programme. However, producers may not commit to large-scale changes in extended responsibility. Any significant capital investment for producing more 'durable' reusable products, and in auxiliary cleaning equipment, will depend on consumer willingness to return. This is

		particularly a concern as the initial consumer deposit is low for REPLIN products. On the other hand, some innovative designs incorporating refill pods and cartridges have appeared in the market. Their success with mainstream consumers is questionable. One well-known brand 'Arm & Hammer' has withdrawn their product, and other less known brands such as 'MyCleanpath' and 'JAWS' are moving away from supermarkets and experimenting with new online business models. While aesthetics and durability are important factors for REPLIN products, new business models are therefore required for making reuse the normative choice.

By telling consumers what to do, producers cannot accomplish an increased uptake of more eco-friendly products. There are several reasons to avoid this approach: consumers find it challenging to give up habits, they may not trust producers about their environmental claims, they may believe eco-friendly products to be less effective, and they are likely to resist innovations. Uptake can be challenging, not only because of consumer attitudes and behaviour, but also because of logistical challenges and availability. Therefore, for reuse to become more widespread, more concerted effort is required between governments and businesses to design new environmental policy instruments. For REPLIN products, despite extended producer responsibilities to support consumers in creating value for themselves through reuse, a cooperative outcome between producers and consumers is unlikely without government intervention. Reusing must take priority over recycling, thus requiring more sophisticated de-marketing strategies. This will subsequently support more innovation in reusable designs and business models, enabling enhanced resource efficiency and effectiveness, and overall societal well-being.

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Appendix A: Screening Questions for Focus Groups

Environmental claims

SQ1. When purchasing sprays, is it important to you that the product you buy is environmental friendly?

- Yes
- No
- Sometimes
- Don't know

SQ2. How important is it to you that the product you buy is environmentally friendly? (This question is not asked if answer is No or Don't Know to SQ1)

- Very important: I always buy environmentally friendly products
- Somewhat important: I do my best to buy environmentally friendly products when I can
- First and foremost I am interested in the product - if it is environmentally friendly that is a bonus
- I am not sure if I have a strong preference for environmentally friendly products
- I like to buy environmentally friendly products when the price is reasonable

Innovativeness claim

SQ3. Generally speaking, do you consider yourself as someone who likes to try new types of products?

- Yes - I am always interested in trying new and innovative products
- No - I prefer to stick to what I know
- Sometimes - I am sometimes swayed to try a new and innovative product depending what category I am buying
- Don't know

Appendix B: Composition of Focus Groups

Table 8: Fairly Environmentally Aware groups

Group No.	2	4	7
Discussion time (min)	73	75	62
Gender			
Male	4		1
Female		7	8
Profession			
Student in full time HE education/Junior managerial/ clerical/ administrative	2	1	
Semi and unskilled manual worker			1
Intermediate managerial/professional/administrative	7	5	8
Higher managerial/professional/ administrative		1	
SQ1			
No (respondents don't answer further screening questions)	2	3	3
Don't know (respondents don't answer further screening questions)	1	1	
Sometimes	6	3	6
SQ2			
First and foremost I am interested in the product - if it is environmentally friendly that is a bonus	4	3	5
I like to buy environmentally friendly products when the price is reasonable	2		1

Table 9: Highly Environmentally Aware groups

Group No.	1	5	6
Discussion time (min)	90	76	85
Gender			
Male	2	4	3
Female	8	3	5
Profession			
Student in full time HE education/Junior managerial/ clerical/ administrative	2	2	1
Skilled manual worker	1	1	
Intermediate managerial/professional/administrative	7	4	6
Higher managerial/professional/ administrative			1
SQ1			
Sometimes	7	2	2
Yes	3	5	6
SQ2			
Somewhat important: I do my best to buy environmentally friendly products when I can	10	6	7
Very important: I always buy environmentally friendly products		1	1

Table 10: Innovative groups

Group No.	3	8	9
Discussion time (min)	80	79	78
Gender			
Male	[illegible]	3	2
Female	2	4	5
Profession			
Student in full time HE education/Junior managerial/ clerical/ administrative	2		2
State pensioner/unemployed/casual workers	1		
Intermediate managerial/professional/administrative	3	6	4
Higher managerial/professional/ administrative		1	1
SQ1			
No	1		1
Don't know		1	
Sometimes	4	5	5
Yes	1	1	1
SQ2			
First and foremost I am interested in the product - if it is environmentally friendly that is a bonus	2	2	1

I like to buy environmentally friendly products when the price is reasonable	2		
Somewhat important: I do my best to buy environmentally friendly products when I can	2	5	6

Appendix C: Focus group discussion guide

Table 11: General version of focus group discussion guide.

Section / Questions	Notes	Objectives
1. Opening (10 min) Facilitator introduces themselves; explains what the research is about, length (finishing time) and incentives; seeks consent for recording. Go around the round table and ask names and profession.	Explain that the research is aiming to understand green buying behaviour, so as to help product innovators design more eco-friendly products. Explain that the discussion will last for approximately one hour and be split broadly into three discussions (1.) what is meant by green; (2.) factors respondents consider when making a purchase, and (3.) their thoughts on four aerosol spray products. Explain there is no bad idea, participants should feel free to express any idea.	Explain rules of FG. Participants Get to know each other. Help the facilitator identify participants.

2. Ice-breaker (10 min) What does the term 'green' mean to you?		Understanding participants' awareness of green issues.
3. Green Purchase (1[illegible] min) Can you think of an eco-friendly non-durable product that you have purchased in the past? What key factors did you consider when selecting the item, not just green factors? If you did not purchase an eco-friendly product in the past, what were your reasons?	Explain what Nondurable goods means (consumables such as toiletries, soft drinks, food, clothes).	To understand the place of green criteria in the attitude / behaviour / decision of consumers.
4. Product preference (30 min) Show the four aerosol spray products to the participants and ask them to read the labels.	Ask if they understand the Gas, No-Gas difference. Probe into interest in reusable / refillable products. Also for the 'innovative' focus groups, probe into their interest in new innovations in non-durables.	Understanding consumers' interest in reusable/refillable products. Understanding their predisposition to innovation.

What attributes and characteristics (functional, environmental) attract you and why? Which product would you prefer and you may take into account any other factors that you normally consider? Just be straightforward and unbiased about your preference.		

Appendix D: Details of streamlined LCA calculations

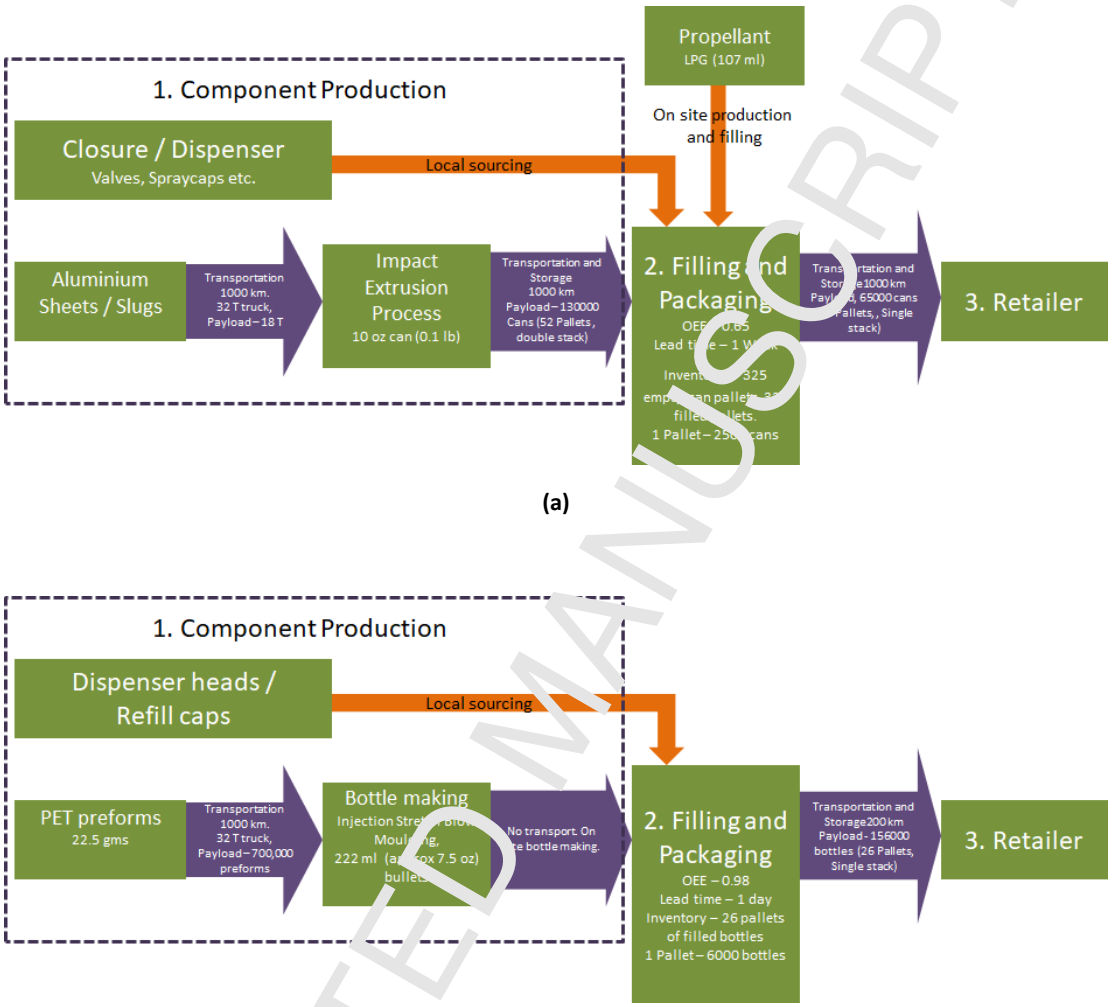

Figure 4: Example production process flows (a) Traditional (Trl) aerosol can and (b) No-Gas 1 (NG1, Flairosol)

Table 12: Bill of Materials and Conversion Process

Product	Part and Material	Weight (g)	Conversion Process
Trl	Can – Aluminium	46.7	Deformation
	Valve - Aluminium	3.78	Casting
	Actuator cap – Poly Propylene (PP)	4.5	Moulding
NG1	Bottle – Poly Ethylene Terephthalate (PET)	22.5	Moulding
	Dispenser cap - PP	66	Moulding
CAir	Bottle - PET	20.6	Moulding
	Valve - Aluminium	3.78	Casting
	Pressure Vessel – PET	9.1	Moulding
	Lower Pressure Vessel – Polycarbonate (PC)	11	Moulding
	Actuator Cap - PP	4.5	Moulding
	Piston head – High Density Polyethylene (HDPE)	6.6	Moulding
NG2	Bottle – PET	28.23	Moulding
	Dispenser Cap – PP	15.64	Moulding
	Dispenser Cap	30.36	Moulding

Table 13: Average Embodied and Processing energy (MJ/kg) and CO2 footprint (kg/kg)

Material	Embodied energy from primary production	CO2 footprint, primary production	Conversion Process	Processing energy	CO2 footprint, conversion process
Aluminium	220	12	Deformation	2.65	0.21
			Casting	2.65	0.155
PP	97	2.7	Moulding	8.6	0.68
PET	84	2.33	Moulding	9.83	0.79
PC	118	5.65	Moulding	10.7	0.856
HDPE	81	2.1	Moulding	6.45	0.515

Table 14: Transportation mode assumptions

Mode	Energy (MJ/tonne-km)	CO2 (kg/tonne-km)
32T Diesel truck	0.46	0.033

Table 15: Payload and Distance assumptions

Product	Activity	Distance (km)	Payload based on a 32T 53' truck
Trl	Aluminium sheets to Can Manufacturer	1000	8 tonne
	Transportation to Filler	1000	130,000 cans
	Filler to Retailer	1000 (longer distance than NG1, CAir and NG2 because aerosol filling by brand owners is highly centralised)	65,000 10oz cans
NG1	Transporting preforms for blow moulding and filling (assuming both operations happen at same facility)	1000	500,000 preforms of 30g each
	Filler to Retailer	200 (assumed shorter distance as more decentralised smaller facilities)	156,000 bottles
CAir	Transporting preforms for blow moulding and filling	1000	800,000 preforms of 20.6g each
	Filler to Retailer	200 (decentralised)	65,000 bottles
NG2	Transporting preforms for blow moulding and filling	1000	400,000 preforms of 37.64 g each
	Filler to Retailer	200 (decentralised)	156,000 bottles

Highlights

- Aesthetic design invokes product attachment, thus encouraging reuse.
- Brands can alleviate uncertainties associated with products redesigned for reuse.
- Because recycling norm is widespread, consumers may perceive it as more sustainable than reuse.
- Large scale success of refill business models depends on consumer willingness to return.
- Without government intervention, it would be challenging to transition from recycling to reuse.