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Towards a shared design research agenda for reusable packaging systems

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Abstract: Reusable packaging systems (RPS) are increasingly explored as an alternative to single-use packaging. Current research lacks focus and direction. This article defines a research agenda based on the findings of a 1-day workshop with participants actively involved in UKRI and EU funded projects for reusable packaging[1].

Findings identify 21 Consumer and Industry factors for future research, and highlight the need for design to improve consumer interaction and experience, to develop inclusive design solutions, and to help resolve issues related to hygiene and contamination. Additionally, the role of design as an enabler to increase transparency between stakeholders across the value chain was highlighted.

1. Introduction

In Europe, nearly 80 million tonnes of packaging is placed on the market annually (Eurostat, 2019). 80% of packaging waste is recovered, however, only 40% is recycled (ibid). Recently, there has been an interest in developing reusable packaging systems (RPS) to address the environmental and economic impacts of single-use packaging wastage and the loss of value within the system. Reusable packaging is "*packaging which has been conceived, designed and marketed to carry out multiple trips in its lifetime by being refilled or reused for the same purpose for which it was conceived*" (EU Directive 94/62).

Plastics are a valuable commodity, with their energy efficiency and material usage outweighing "green" alternatives such as aluminium and glass (Helmche et al., 2022). RPS can help mitigate the usage of single-use plastics (SUP), by keeping the plastic components in the system for longer through the return, refill, or repurposing of existing containers (Greenwood et al., 2021). However, RPS create complex socio-economic and environmental trade-offs (Meyhoff Fry et al., 2010; Stefanini et al., 2020), with the viability of reuse systems dependant on various factors, such as cycle rates, profitability, and consumer acceptance (Long et al., 2022; Vezzoli et al., 2015).

With pressure from policy makers, some UK retailers have been trialling different types of RPS for a range of products including food, beauty, and homecare products (Tesco, 2022). However, there is limited understanding about how to scale-up and mainstream RPS. Scale-up has been hindered by barriers such as user adoption, supply chain reconfiguration, and perceived economic costs. Design, we propose, could play an important role in the successful implementation and scale-up of RPS.

[1] Perpetual Plastic for Food to Go (PPFTG) (NE/V01076X/1), Many Happy Returns - Enabling reusable packaging systems NE/V010638/1, A Systems Analysis Approach to Reduce Plastic Waste in Indonesian Societies (PISCES) (NE/V006428/1), 101059923 - Buddie-Pack - horizon-CL6-2021-Circbio-01

2. Methodology

Workshop participants - the authors of this paper – include nine academics and professionals actively involved in UKRI and EU-funded projects focused on reusable packaging[1]. Two main objectives were identified for the workshop: 1) to explore the key challenges for scaling up RPS; and 2) to collaboratively identify and prioritise key design research questions. These formed the basis of the research agenda defined within this paper.

For the first activity, eight categories based on the findings from a round table discussion held as part of an All-Party Parliamentary Sustainable Resource Group Inquiry were presented (Table 1). Insights gathered were discussed, with initial coding established to confirm category placement.

Category	Example Definition
(i) Collaboration	Defining standardised practices through stakeholder collaboration to mainstream RPS.
(ii) Environmental impact	Calculating required cycle rates for reusable containers to be environmentally beneficial (break-even).
(iii) Labelling	Communicating with the consumer to increase engagement.
(iv) Consumer behaviours	Understanding consumer motivations for changing behaviours, and how motivations can be morphed into actions.
(v) Accessibility	Exploring how social equity can be embedded within RPS, how RPS can be desirable, available, and affordable for various demographics.
(vi) Logistics and supply chains	Current linear supply chains are optimised to reduce costs, reverse supply chains may increase costs deterring uptake.
(vii) Hygiene	Touchpoint cleanliness can impact a consumer perception of RPS.
(viii) Policy	The role of policies, legislation, and tax incentives for industry uptake.

Table 1. Categories Identified within the All-parliamentary Resources Group (Corsini & Ceschin, 2022).

For the second activity, participants identified gaps in current research, mapping these to generate research questions. Questions were prioritised by each individual and then discussed within the group to justify their placement.

Figure 1. Workshop participants at Brunel University London (June 2023) – discussion activity.

The session was recorded and transcribed, with additional questions raised during the session added to the dataset. Participants verified findings and themes discussed until a consensus was met. Themes were divided between those relating to consumer and industry perspectives. For consistency, workshop themes were analysed and systematically reviewed against reuse factors and sub-factors presented by Bradley & Corsini (2023).

3. Findings

In part one, participants identified themes relating to their current knowledge and future research (Figure 2, Figure 3). From this, themes have been translated to be consistent with the factors identified by Bradley & Corsini (2023) (Table 2). Highlights include:

- Lack of research to determine consumer demographics, and how this can influence the effective uptake of RPS.
- Consumer motivation is crucial for the adoption of RPS, but how this is achieved is still to be explored.
- Reuse needs to consider hygienic practices, with consumers concerned with content quality and the industry is concerned about liability issues.
- Standardisation will help to mainstream RPS, but establishing consistent standards and packaging is difficult to achieve without

government driven legislation and policy change.
- Multi-disciplinary stakeholders should be included within future RPS design.

	Factor (Bradley & Corsini (2023))	Workshop Theme
Economic	Material, infrastructure, and operational costs	Industry Investment
	Labour	Training
	Customer retention	Incentives
	Logistics	Supply chain

Table 2. Future research areas: Example mapping Industry Workshop Themes for future research to Bradley & Corsini (2023) – refer to Appendix A for all consumer and industry codes (Tables 1a &1b).

In part two of the workshop, research questions were identified, with codes expanded based on the research question category. This led to 10 consumer factors and 17 industry factors (Figure 4, Figure 5).

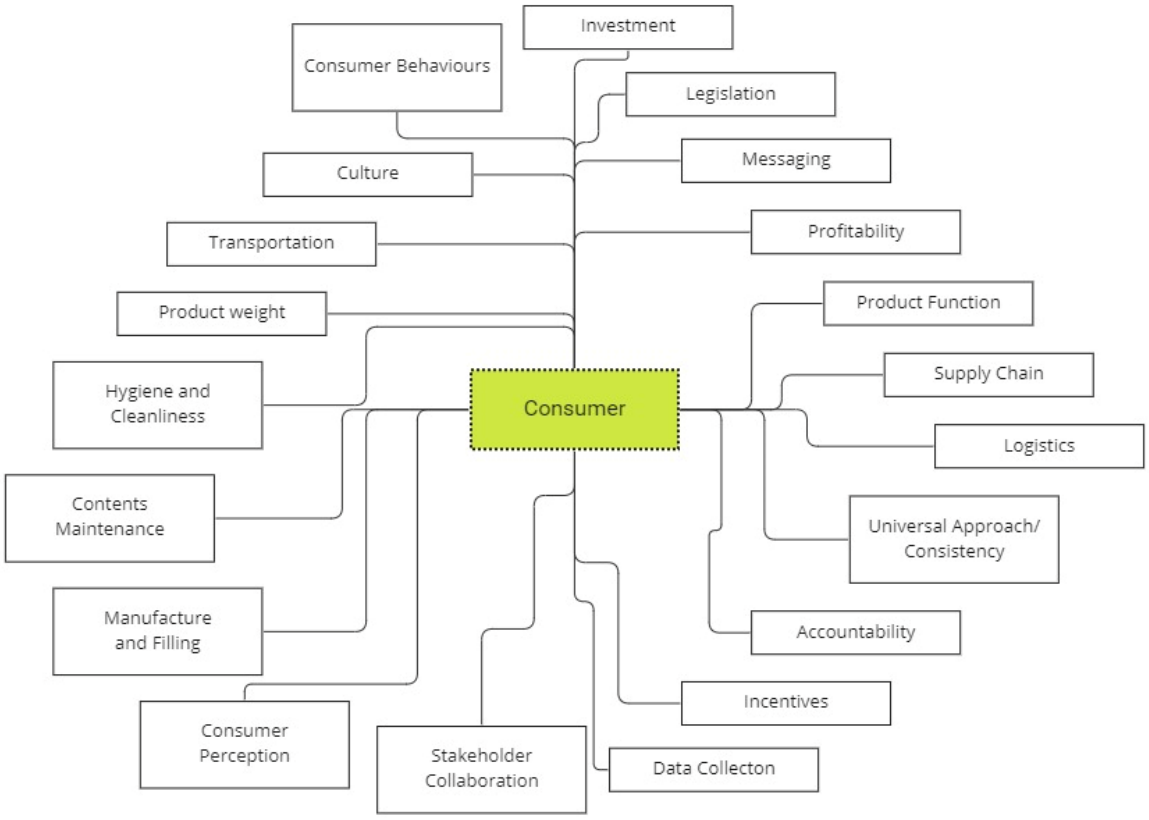

Figure 2. Consumer themes identified within the workshop

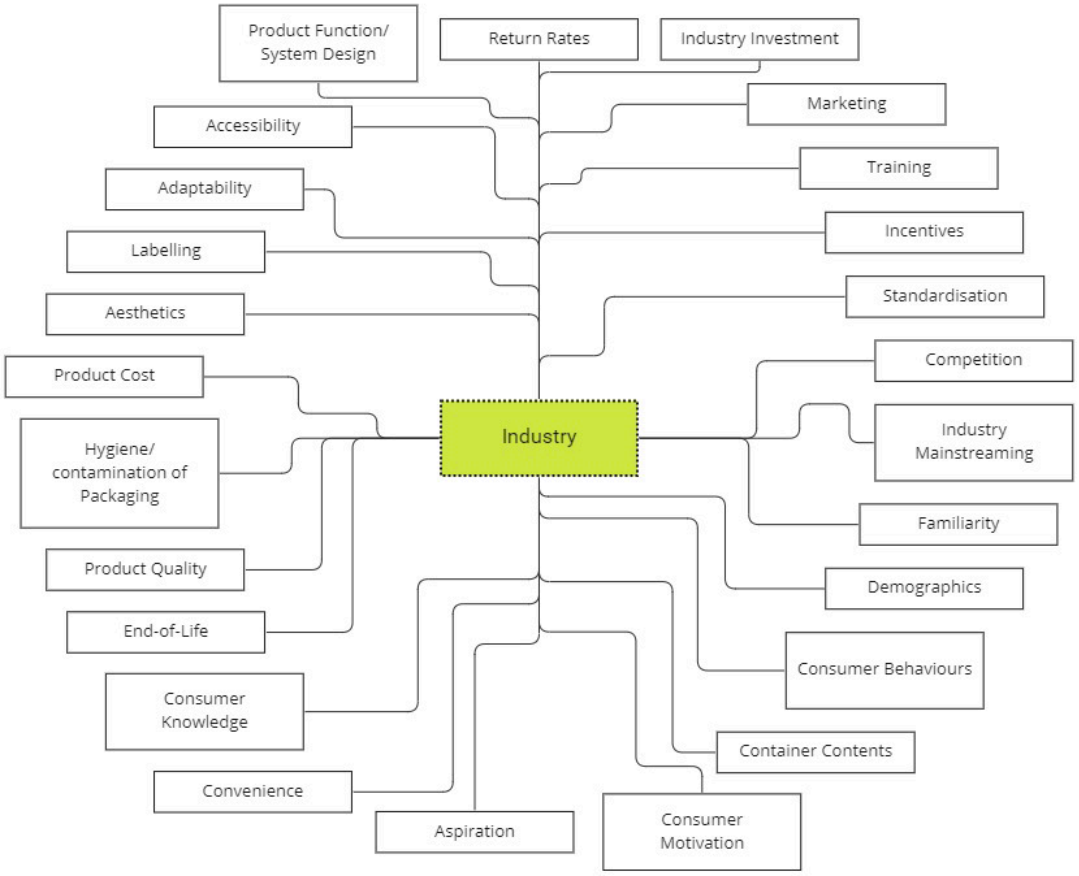

Figure 3: Industry themes identified within the workshop.

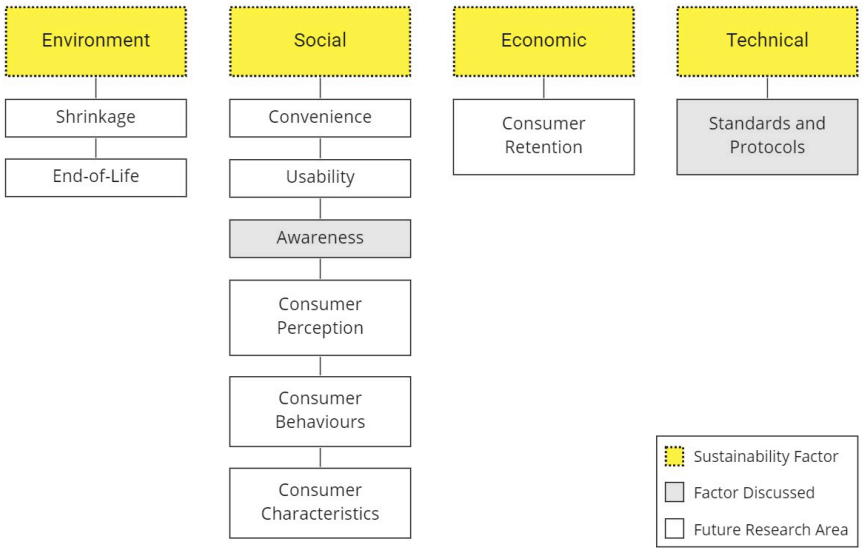

Figure 4. Mapped Consumer factors for future research.

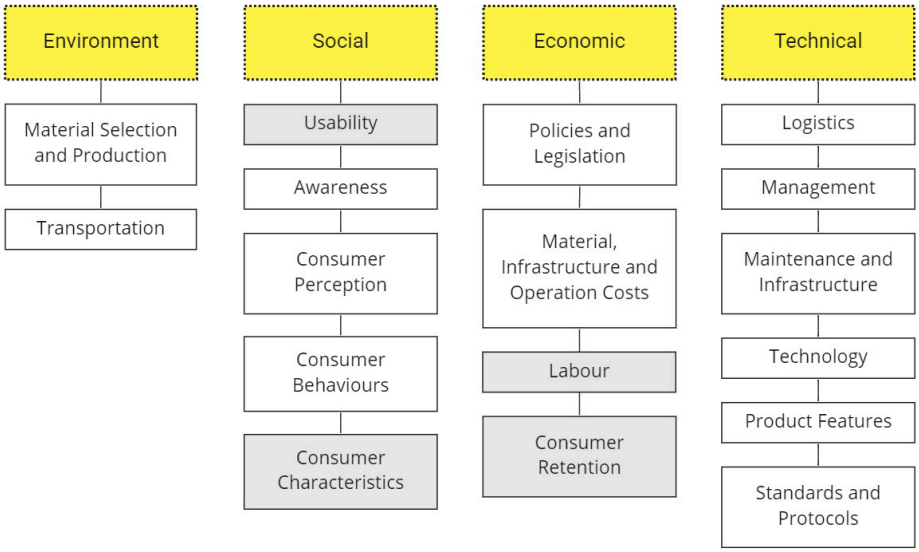

Figure 5. Mapped Industry factors for future research.

4. Research Agenda

See Appendix B, Table 2a & 2b for all research questions identified.

4.1 Consumer Perspective

Within this section, 8 factors for future research from a consumer perspective are discussed (Figure 4).

4.1.1 Environmental Factors

4.1.1.1 Shrinkage. Shrinkage is the reduction of container quantity throughout the value chain, typically through container loss, damage, and misuse. For reuse to outperform SUP, minimum cycle rates are required. Return rates are dependent on the service provided and product category. Due to poor return rates providers can be quick to abandon reuse schemes without refining practices. Consumer convenience, behaviour change, and return incentives should be explored to ensure shrinkage is minimised and cycle rates are optimised.

Example research questions
• How can the design of RPS prevent misuse, and clarify the products intended use?
• How can the RPS be designed to include the alternative product uses to remove the possibility of shrinkage through misuse?

Table 3. Design Research questions related to Shrinkage.

4.1.1.2 End-of-Life (EOL). Consumers can be confused by mixed messaging and limited knowledge of disposal practices (Clark et al. 2022). This coupled with inconsistent recycling infrastructure, dampens the consumers' willingness to engage in sustainable disposal practices. Whilst reuse is seen as a valid aid to reduce the reliance on recycling, consumer behaviour changes and education on the intended disposal route is required to ensure reusables remain in the closed loop. At EOL, reusables should be re-entered into the closed loop, maximising circularity, and lowering overall contribution. Design research should define how to maximise returns and maintain system circularity.

Example research questions
• How can reusable packaging be designed for the last use and End-of-Life?

Table 4. Design Research questions related to End-of-Life.

4.1.2 Social Factors

4.1.2.1 Convenience. Reuse systems are currently designed to be blended within current user habits to make consumers more open to reusable solutions through familiar practices. Systems should be readily available and widely accessible to meet consumer needs. Systems currently trialled, have adopted curb-side and at-home delivery models, as well as local shop pickups. Assigning drop-off locations can allow for consumers to return packaging with ease. It is suggested that poor convenience can increase single-use dependency.

Example research questions
• How can RPS be designed to streamline consumer interactions, maximising convenience? • How will alternative packaging systems impact user uptake? • How can RPS incorporate diversity and inclusion?

Table 5. Design Research questions related to Convenience.

4.1.2.2 *Usability*. System usability focuses on the adaptability of the product (i.e. Coca-Cola multi-spray bottles) as well as product functionality. It is highlighted that packaging cannot be designed for the act of repurposing or the emotional attachment consumers may feel towards a product. However, you can integrate practices within the design phase to encourage alternative product purposes (Wilson et al. 2022). RPS research should determine the appropriate product features, functionality and use to ensure optimal uptake and cycle rate. Providing product value should increase consumer uptake.

Example research questions
• How can user motivations be influenced through the design of RPS? • How can RPS be designed to improve the users return experience? • How can the intended product use be communicated to consumers effectively? • How can RPS design encourage consumer engagement?

Table 6. Design Research questions related to Usability.

4.1.2.3 Consumer Perception. The product aesthetics, quality, and cost can influence a consumer's decision to engage with RPS. Additionally, integrating historical design influences may increase user uptake by presenting the perception of reliability and durability. Meanwhile consumers can associate RPS with inferior cleanliness/ contamination hindering product uptake. Packaging contents affect consumer perception with consumers more likely to reuse packaging for fruit and vegetables, dry goods, and household goods than meat and alcohol (Shipton and Fisher, 2016). Both packaging product hygiene and the hygiene of the refill station should be considered when designing RPS.

The effect price has on perception is yet to be justified. However, it is theorised that reducing the price-gap between single-use and reusables can be perceived as better value-for-money, but may increase disposal rates due to the resultant perception of lower value. Designing the user experience to be enjoyable may increase RPS by establishing status. RPS can be designed to exude luxury, integrating human-led services to present exclusivity, and increasing product longevity through maintenance/ servicing.

Example research questions
• How can design change the social perception of single-use product consumption? • How does design influence consumer reuse/ behaviours? • How can reusable packaging be designed to be aspirational? • How can the effective design of a product service system influence the consumer uptake? • How can RPS be designed to be enjoyable? • How can design challenge consumers hygiene and contamination concerns? • How can RPS be designed to evoke transparency on cleaning practices?

Table 7. Design Research questions related to Consumer Perception.

4.1.2.4 Consumer Behaviours. Understanding consumer behaviours is required to streamline and integrate RPS without negative implications. Short-term reuse trials have not accurately examined long-term reuse habits. Aligning system functionality with familiar practices and motivations can improve engagement and behaviour (Clark, 2020), however, consumers should be held accountable for failing to fulfil tasks or meet cycle-rates. To tackle this issue and to define optimal RPS, participants suggest the inclusion of psychology or sociology researchers within the system design to study attitudes, habits and behaviours of prolonged system interaction.

Example research questions
• How can the design of RPS increase consumer engagement? • How can design be informed by theories of behaviours? • How can design ensure instore refill systems are convenient for all users? • How can design research help to define the unintended consequences of reusable packaging within the different product categories?

Table 8. Design Research questions related to Consumer Behaviours.

4.1.2.5 Consumer Characteristics. Personalisation and technical attributes can increase consumer demand, whilst pro-environmental behaviours appear to be effective at encouraging consumers to engage. Personalisation increases the emotional attachment, desirability, and individuality of the product (e.g., Tate Modern and Chilly water bottle collaboration). Whilst this technique has been explored to change consumer behaviours, research is lacking to solidify the assumption. Varying cultures can also aid and hinder reuse integration. Cultural differences can change industry behaviour, whilst country density may also affect uptake (e.g., America may have more landfill space, therefore will not prioritise reuse strategies due to the limited visible plastic pollution). Current systems are targeted towards middle-class early adopters, as RPS demographics (e.g., sex, age, education, societal influences) are poorly explored. Defining the target audience assists marketing and sales, whilst understanding the cultural barriers streamlines the integration and increases acceptance rates of RPS.

Example research questions
• How can design research help to identify the target audience for RPS? • How can design research help to specify geographic trends in relation to RPS uptake? • How can design research help to define the challenges of RPS uptake for consumers from varied demographics? • How can RPS be designed to take into consideration the various demographic barriers to reuse uptake? • How can RPS respect cultural beliefs to increase uptake? • How can RPS be designed to facilitate inclusivity and diversity? • How can packaging be designed to include consumers with visual impairments?

Table 9. Design Research questions related to Consumer Characteristics.

4.1.3 Economic Factors

4.1.3.1 Consumer Retention. Maintaining consumer engagement is critical to RPS success. There is limited research on the impact of incentives, however some argue that they can increase consumer uptake, but may also lower product value and result in increased disposal habits. 'Starter packs' are a good example. Consumers may find the reduced price for a refill and product better value than refills-only due to the lower costs, resulting in a greater consumption and lower cycle rate. Loyalty points may be effective, reducing the retailer's investment costs whilst also providing an immediate tangible reward to increase user return. Research should aim to identify drivers for reuse uptake, and how consumer engagement can be maintained.

Example research questions
• How can return points be designed for convenience? i.e interactions and location

Table 10. Design Research questions related to Consumer Retention.

4.2 Industry Perspective

Within this section, we discuss 13 factors for future research from an industry perspective (Figure 5).

4.2.1 Environmental Factors

4.2.1.1 Material Selection and Production. Packaging design attributes can help to reduce the environmental impact of RPS during the production and transportation phase of reusable packaging. Light weighting products can result in lower carbon contributions and energy consumption. Material selection and product features should be incorporated within the design of RPS.

Example research questions
• How can the design of packaging reduce the environmental impact of increased product/material weight?

Table 11. Design Research questions related to Material Selection and Production.

4.2.1.2 Transportation. During transportation and use, stakeholders want to ensure the contents of the packaging are secure, and the quality and safety is maintained. Damage during transportation ultimately impacts product longevity, cycle rates, and profit. Additionally, the distance travelled can determine system viability when compared to single-use alternatives. RPS research should aim to determine cost-effective asset management.

Example research questions
• How can RPS be designed to evoke trust during product transit?

Table 12. Design Research questions related to Transportation.

4.2.2 Social Factors

4.2.2.1 Awareness. Inconsistent recycling infrastructure has shown to encourage poor disposal practices. OPRL aims to standardise messaging through introducing binary labelling (OPRL,2021). Simple messaging should be incorporated within RPS to reduce product misuse and loss. Intuitive system messaging may be achieved through the inclusion of educators (e.g., teachers and storytellers) within the system design. The marketing of reusables should be evident within stores to promote consumer system awareness. System benefits should be reiterated to consumers, based on their values.

Example research questions
• How can design help to separate packaging from marketing?

Table 13. Design Research questions related to Awareness.

4.2.2.2 Consumer Perception. RPS can have the perception of lower content quality or poor taste due to the associated contamination and alternative materials used. For example, reusable coffee cups can alter the coffee taste when suds remain after cleaning. To change consumer perception, visibility of cleaning practices can evoke comfort when using reusables (e.g., dishwasher to clean pint glasses at public houses). Consumers should interact with reusables on a regular basis to disassociate container cleanliness and contamination. Design research should identify how RPS can evoke and maintain hygiene.

Example research questions
• How can design change industry perception of packaging as a product to a system? • How can design improve the instore reuse retail experience? • How can reusable products be designed to integrate within the entire service chain? • How can design aid the conveyance of reliability and cleanliness?

Table 14. Design Research questions related to Consumer Perception.

4.2.2.3 Consumer Behaviours. It can be argued that by limiting the consumers choice, consumers are forced to change their behaviour. However, brand loyalty may present difficulties in changing consumer preference. For this to be successful, all competitors should agree to a standard practice (e.g., a ban on single-use bags).

Example research questions
• How can the design of a system make reuse the default option? • How can design research help to identify the product categories that are most suitable for reuse? • How can design research help to define the unintended consequences of reusable packaging within the different product categories?

Table 15. Design Research questions related to Consumer Behaviours.

4.2.3 Economic Factors

4.2.3.1 Policies and Legislation. Consumer motivations are not enough to change industry practices, with companies able to avoid accountability through generalising commitments. Tax, policy, and legislation can enforce targets and penalties to hold companies accountable for negative practices (e.g., Extended Producer Responsibility). The evolving nature of legislation presents the risk of re-classifying packaging as products. Resultant tax implications may lead to limited industry adoption. For RPS management to be streamlined, standardisation of international regulations is required, and further funding opportunities provided.

Example research questions
• Who is responsible for standardising RP? • How can a shared standard be achieved that facilitates reuse?

Table 16. Design Research questions related to Policies and Legislation.

4.2.3.1 Material, Infrastructure, and Operational Costs. Associated system costs can deter producer, retailer, and consumer investment. Businesses pivoting to new structures may experience impacted sales and fail to meet management targets during the early stages of adoption. Unless support for reusables is established at a management level, companies may revert to linear systems to reduce the risk of low economic return (Clark et al. 2020). Reassurance of the value RPS can provide, as well as validate profitability needs to be given to the company. Defining responsibility within the system is also fundamental, especially when considering the repair, manufacture, and management of assets to meet cycle rates.

Example research questions
• How can RPS be designed to ensure profitability? • How can RPS be designed to reduce the risk of investment?

Table 17. Design Research questions related to Material Infrastructure and Operational Costs.

4.2.4 Technical Factors

4.2.4.1 Logistics. Shifting from linear to circular systems can be difficult for industries who have optimised their supply chain processes. Industries want to be innovative, but at the same time are hesitant to take new practices to market. Some wait for leading industries to first take the risk and implement new strategies to reduce the economic risk. Companies need to share data collected for mainstreaming of RPS to be achievable, but currently, there is no economic incentive for industries to do so. This may be due to the limited relationships between current stakeholders, and the competitive nature of emerging markets. System design should include multi-disciplinary stakeholders, not least, business designers, system architects, manufactures and engineers.

Example research questions
• How can design research help to define the steps of transitioning from single-use to RPS? • How can design research help to define the new actors within RPS supply chains? • How can RPS be optimised to streamline the flow of reusable packaging/ containers? • How can design research help to define a standardised criterion for reusable packaging across industries? • How can the design of primary reuse systems be influenced by secondary/ tertiary packaging systems? • How can RPS design be universal for multiple FMCG product categories? • How would design build a better infrastructure where all stakeholders are making good business? • What does it mean for companies to have standardised packaging that is interchanged in an open system?

Table 18. Design Research questions related to Logistics.

4.2.4.2 Management. Defining the interlinking relationships and system architecture is vital to creating an optimised system. To achieve a universal design, multi-disciplinary stakeholders should be included in the research, design and development phases. These can include: retailers, manufacturers, packaging technologists, engineers, customers, business designers, psychologists, sociologists etc.

Example research questions
• How can design research aid the upskilling of packaging designers transitioning to reuse? • How can design research utilise stakeholder communication and connections to collect data and convince businesses to adopt refined business models? • How can design research influence and initiate collaboration between stakeholders? i.e consumers, retailers and producers • How can RPS be designed to foster collaboration across the value chain? • How can RPS design motivate other stakeholders to collaborate within the management and design of the system? • How can the design of RPS help to identify the responsible stakeholders and their associated roles/ responsibilities?

Table 19. Design Research questions related to Management.

4.2.4.3 Maintenance and Infrastructure. Product cycle rates depend on product type, refurbish and refill rates. Determining the potential liability is necessary to optimise container flow and reduce shrinkage. Retailers are focused on sales rather than asset management and hygiene. Third-party logistics can provide cleaning, repair, and asset management to out-source liability to qualified stakeholders. Further research is required to determine effective contents management within the supply chain to maintain product quality and hygiene.

Example research questions
• How can design research help to define liability within the system? • How can design research identify the challenges providers, retailers, and suppliers of RPS face?

Table 20. Design Research questions related to Maintenance and Infrastructure.

4.2.4.4 Technology. Insights based on data collection can incentivize industries to invest in RPS. Tracking and monitoring consumer usage could be deemed invasive, leading to reduced consumer uptake. Data should be ethically and transparently collected with justification provided to enhance consumer acceptance.

Example research questions
• How can design research establish effective data collection practices throughout the consumer journey? • How can design research assist the collection of consumer data to incentivise circular business models?

Table 21. Design Research questions related to Technology.

4.2.4.5 Product Features. Industries are currently emphasizing the importance of packaging itself, however, the product contents should be the Unique Selling Point (USP). However, standardisation of packaging design may result in difficulty differentiating brands as actual product feature USP may be negligible (Fleet & Ankudinova, 2023). Refill trials and research are needed to identify how brand identity can be portrayed through standardised packaging.

Example research questions
• How can design assist the brand unique selling point vs standardisation challenge?

Table 22. Design Research questions related to Product Features.

4.2.4.6 Standards and Protocols. Standardisation of hygiene practices should reduce contamination and reassure consumers (Fleet & Ankudinova, 2023; Nahar et al., 2023). To ensure consistency, reuse schemes need to be defined at a local and international level to accommodate for migrating communities. Mixed messaging and inconsistent practices can cause scepticism with consumers wanting to do the “right” thing, with poor disposal/return practices leading to increased supply chain issues.

Example research questions
• How can RPS be designed to ensure packaging hygiene and cleanliness is maintained? • How can design research aid the definition of effective green products?

Table 23. Design Research questions related to Standards and Protocols.

5. Conclusions

This study has defined a research agenda informed by two main objectives: (i) to explore the key challenges for scaling RPS, as well as current knowledge and limitations, and (ii) to collaboratively identify key design research questions. This paper concludes how further research is required within 8 consumer focused areas, and 13 industry areas. Some salient foci for future research include: (i) Stakeholder Collaboration, (ii) Data Collection, (iii) Consumer Behaviours, and (iv) Consumer Experience. Demographics should be measured to understand who the intended consumer should be, and how systems should be designed to include cultural aspects, beliefs, knowledge, and attitudes. To achieve RPS success, consumer attitudes, knowledge and behaviours need to be better understood and utilised within the design of RPS. Exploring these areas through future research can help to mainstream future reuse systems.

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Appendix A.

	Bradley & Corsini (2023) Factor	Workshop Theme
Environment	Shrinkage	Return Rates
Social	Convenience	Convenience
		Accessibility
	Usability	Adaptability
		Product Function / System Design
	Awareness	Labelling
		Marketing
	Consumer perception	Aesthetics
		Consumer Interaction / Experience
		Product Cost
		Product Quality
		Hygiene / Contamination of Packaging
		Aspiration
	Customer behaviours	Consumer Knowledge
		Familiarity
		Consumer Behaviours
		Container Contents
	Consumer characteristics	Consumer Motivation
		Demographics
Economic	Consumer Retention	Incentives
Technical	Standards and Protocols	Hygiene / Contamination of Packaging

Table 1a – Mapping all identified consumer workshop factors to Bradley & Corsini (2023) factors.

	Bradley & Corsini (2023) Factor	Workshop Theme
Social	Usability	Product Functionality
	Awareness	Messaging
	Consumer perception	Functionality of System
		Consumer Perception
	Customer behaviours	Consumer Behaviours
		Behaviour Change
	Consumer characteristics	Culture
Economic	Policies and Legislation	Legislation
		Incentives
	Material, infrastructure, and operational costs	Profitability
		Investment
Technical	Logistics	Supply Chain
		Logistics
		Universal Approach / Consistency
		Accountability
	Management	Data Collection
		Stakeholders
		Collaboration of Stakeholders
		Manufacture and Filling

	Maintenance and infrastructure	Contents Maintenance
	Standards and protocol	Hygiene and Cleanliness

Table 1b – Mapping all identified workshop industry factors to Bradley & Corsini (2023) factors.

Appendix B.

	Factor (Bradley & Corsini, 2023)	**Question**
Environment	Shrinkage	• How can the design of RPS prevent misuse, and clarify the products intended use? • How can the RPS be designed to include the alternative product uses to remove the possibility of shrinkage through misuse?
	End-of-life	• How can reusable packaging be designed for the last use and End-of-Life?
Social	Convenience	• How can RPS be designed to streamline consumer interactions, maximising convenience? • How will alternative packaging systems impact user uptake? • How can RPS incorporate diversity and inclusion?
	Usability	• How can user motivations be influenced through the design of RPS? • How can RPS be designed to improve the users return experience? • How can the intended product use be communicated to consumers effectively? • How can RPS design encourage consumer engagement?
	Consumer perception	• How can design change the social perception of single-use product consumption? • How does design influence consumer reuse/ behaviours? • How can reusable packaging be designed to be aspirational? • How can the effective design of a product service system influence the consumer uptake? • How can a RPS be designed to be enjoyable? • How can design challenge consumers hygiene and contamination concerns?
	Consumer behaviours	• How can the design of RPS increase consumer engagement? • How can design be informed by theories of behaviours? • How can design ensure instore refill systems are convenient for all users? • How can design research help to define the unintended consequences of reusable packaging within the different product categories?
	Consumer characteristics	• How can design research help to identify the target audience for RPS? • How can design research help to specify geographic trends in relation to RPS uptake? • How can design research help to define the challenges of RPS uptake for consumers from varied demographics? • How can RPS be designed to take into consideration the various demographic barriers to reuse uptake? • How can RPS respect cultural beliefs to increase uptake? • How can RPS be designed to facilitate inclusivity and diversity? • How can packaging be designed to include consumers with visual impairments?

Economic	Customer retention	• How can return points be designed for convenience? i.e interactions and location
Technical	Standards and protocol	• How can RPS be designed to evoke transparency on cleaning practices?

Table 2a – All design research questions identified by participants (Consumer Perspective).

	Factor (Bradley & Corsini, 2023)	**Question**
Environment	Material Selection and Production	• How can the design of packaging reduce the environmental impact of increased product/material weight?
	Transportation	• How can RPS be designed to evoke trust during product transit?
Social	Awareness	• How can design help to separate packaging from marketing?
	Consumer Perception	• How can design change industry perception of packaging as a product to a system? How can design improve the instore reuse retail experience? How can reusable products be designed to integrate within the entire service chain? How can design aid the conveyance of reliability and cleanliness?
	Consumer Behaviours	• How can the design of a system make reuse the default option? How can design research help to identify the product categories that are most suitable for reuse? How can design research help to define the unintended consequences of reusable packaging within the different product categories?
	Policies and Legislation	• Who is responsible for standardising RP? How can a shared standard be achieved that facilitates reuse?
Economic	Material, Infrastructure and Operational Costs	• How can RPS be designed to ensure profitability? How can RPS be designed to reduce the risk of investment?
	Customer Retention	• How can design research assist the collection of consumer data to incentivise circular business models?
Technical	Logistics	• How can design research help to define the steps of transitioning from single-use to RPS? • How can design research help to define the new actors within RPS supply chains? • How can RPS be optimised to streamline the flow of reusable packaging/ containers? • How can design research help to define a standardised criteria for reusable packaging across industries? • How can the design of primary reuse systems be influenced by secondary/ tertiary packaging systems? • How can RPS design be universal for multiple FMCG product categories? • How would design build a better infrastructure where all stakeholders are making good business? • What does it mean for companies to have standardised packaging that is interchanged in an open system?
	Management	• How can design research aid the upskilling of packaging designers transitioning to reuse? • How can design research utilise stakeholder communication and connections to collect data and convince businesses to adopt refined business models? • How can design research influence and initiate collaboration between stakeholders? i.e consumers, retailers and producers • How can RPS be designed to foster collaboration across the value chain?

	• How can RPS design motivate other stakeholders to collaborate within the management and design of the system?
Maintenance and infrastructure	• How can design research help to define liability within the system? • How can design research identify the challenges providers, retailers and suppliers of RPS face?
Technology	• How can design research establish effective data collection practices throughout the consumer journey?
Product Features	• How can design assist the brand unique selling point vs standardisation challenge?
Standards and Protocols	• How can RPS be designed to ensure packaging hygiene and cleanliness is maintained? • How can the design of a RPS help to identify the responsible stakeholders and their associated roles/ responsibilities? • How can design research aid the definition of effective green products?

Table 2b – All design research questions identified by participants (Industry Perspective).

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