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Barriers to Mainstream Adoption of Circular Packaging in Indonesia

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Abstract: Achieving the mainstream adoption of circular packaging is essential for mitigating the environmental impacts of plastic waste. Its widespread adoption, however, remains hindered by significant user barriers. This study investigates the barriers to user adoption of upstream packaging solutions in Indonesia with the aim of reducing plastic packaging waste. Through a mixed-methods approach including case studies, expert workshops, and focus group discussions, nine key barriers were identified and analysed. These include inconvenience, resistance to changing habits and behaviours, higher costs and deposit schemes, contamination and hygiene concerns, wear and tear, functional and performance limitations, a lack of awareness about the environmental impacts, limited availability and variety, and a lack of trust. This research advances the literature by offering a detailed analysis of these barriers, categorising them into sociocultural, economic, contextual, and regulatory aspects. Additionally, barriers specific to Indonesia were identified such as a shift from being served to self-service refilling, some people not having smartphones, poor cellular signals in rural areas, a preference for plastic packaging due to its resale value, and a preference for cash payments due to limited access to credit or bank cards. The findings highlight the need for tailored, multidisciplinary strategies to overcome these barriers and promote the adoption of circular packaging solutions. This research provides valuable insights for researchers studying circular design, businesses seeking to innovate upstream packaging solutions, and policymakers aiming to develop regulations that support the adoption of circular packaging practices.

Keywords: reusable packaging systems (RPSs); user adoption barriers; plastic waste; single-use packaging waste; user acceptance issue; design for sustainable behaviour; circular packaging; Indonesia; sachets; refillable packaging

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1. Introduction

Plastic, valued for its light weight, affordability, and durability, is extensively used in consumer products worldwide [1]. Alarmingly, nearly a third of all plastics produced are intended for single use [2], destined to become waste. This growing accumulation of plastic waste poses serious threats to human health [3,4] and ecosystems globally [5,6]. Specifically, the growing accumulation of plastic waste contributes to the release of toxic chemicals and microplastics into the environment, which can enter the human body through

food, water, and air, posing risks to the immune, reproductive, and endocrine systems. In ecosystems, plastic debris harms marine and terrestrial wildlife through ingestion, entanglement, and habitat disruption, ultimately threatening biodiversity and ecosystem resilience. Indonesia has emerged as a major contributor to global plastic pollution [7–9]. Factors such as high population densities in coastal areas and limited, inefficient waste management services have been identified as the primary drivers of the country's significant plastic emissions [8,10]. Addressing Indonesia's plastic pollution problem offers a critical opportunity to reduce global plastic emissions, particularly to the oceans.

This research is part of an interdisciplinary research initiative conducted by the Plastics in Indonesian Societies (PISCES) Partnership (www.piscespartnership.org) and is supported by UKRI through the Global Challenges Research Fund running from 2021 to 2025. The project adopts a systemic approach to reducing plastic waste across the value chain, aiming to develop evidence-based solutions for systemic change in Indonesia. While numerous studies have focused on quantifying plastic pollution, particularly in marine environments [11], research on upstream strategies—solutions targeting the root causes of plastic pollution—is limited. Upstream packaging solutions refer to strategies that aim to prevent packaging waste before it is created, typically at the design and manufacturing stages by redesigning how products are delivered, consumed, and reused. In Indonesia, initiatives like Siklus (https://www.siklus.com/, accessed on 15 March 2022) and Allas (https://zerowastelivinglab.enviu.org/our-ventures/allas/, accessed on 15 March 2022) are leading the way in eliminating plastic packaging waste, but more research is needed to expand the implementation and adoption of these upstream solutions.

Upstream packaging strategies, which focus on redesigning products and delivery systems to prevent waste at the source, offer transformative potential for addressing plastic pollution [12]. While some research has explored user adoption barriers and enablers for such solutions, the focus has primarily been on European contexts [13–15]. Barriers and enablers in low- and middle-income countries, such as Indonesia, may differ significantly in nature and relevance. Our study addresses this knowledge gap by identifying user adoption barriers specific to low- and middle-income urban and peri-urban contexts in Indonesia. Understanding these barriers is essential for tailoring upstream packaging solutions that can accelerate the transition to a circular economy. To this end, the research is guided by the following question: what are the user adoption barriers hindering implementation of upstream packaging solutions in low- and middle-income peri-urban Indonesia? This paper is organised as follows: Section 2 reviews the existing literature on the user adoption barriers of upstream packaging solutions and introduces the upstream packaging framework employed in this study. Section 3 details the research methods, including case studies, workshops, and focus group discussions (FGDs). Section 4 presents the four categories of barriers identified in this study, while Section 5 details the results. Section 6 discusses the contributions to existing knowledge, and Section 7 highlights the limitations and suggests directions for further research. Finally, Section 8 concludes by summarising the findings and implications of this study.

2. User Adoption Barriers of Upstream Packaging Solutions

The transition from single-use packaging to reusable alternatives presents significant challenges. Previous research has identified several factors that can influence the large-scale implementation of reusable packaging systems (RPSs) [16–18]. Among these, user adoption is a critical determinant of success [13,19]. The literature further highlights a range of factors that hinder user adoption. To synthesise these findings, we have categorised the user adoption barriers identified in the literature into nine distinct groups, as summarised

in Table 1. This categorisation provides a foundation for understanding the challenges associated with implementing upstream packaging services.

Table 1. User adoption barriers of upstream packaging services were explored in the existing literature and categorised into nine groups.

User Adoption Barriers	Existing Literature
Inconvenience	Coelho, et al., 2020 [16]; Jiang et al., 2020 [20]; Lofthouse et al., 2009 [21]; Lofthouse and Bhamra, 2006 [22]; Miao et al., 2023 [19]; Singh & Cooper, 2017 [23]; Steinhorst & Beyerl, 2021 [24]; Zhu et al., 2022 [25]
Resistance to changing habits and behaviours	Bradley, et al., 2023 [26]; Sæter et al., 2020 [27]; Tassel and Aurisicchio, 2020 [28]
Higher costs or deposit schemes	Kunamaneni et al., 2019 [29]; Long et al., 2022 [13]; Miao et al., 2023 [19]
Contamination and hygiene concerns	Baxter et al., 2016 [30]; Bradley et al., 2023 [26], Long et al., 2022 [13]; Miao et al., 2023 [19]; Numata & Managi, 2012 [31]
Wear and tear on the packaging	Magnier & Gil-P'erez, 2021 [32]; Miao et al., 2023 [19]; White et al., 2016 [33]
Functional and performance limitations	Miao et al., 2023 [19]; Tassel & Aurisicchio, 2023 [28]
Lack of awareness about environmental impacts	Coelho et al., 2020 [16]; Miao et al., 2023 [19]
Limited availability and variety	Miao et al., 2023 [19]
Lack of trust	Miao et al., 2023 [19]; Yu et al., 2023 [34]

2.1. Inconvenience

Inconvenience has been widely recognised as a barrier to adopting upstream packaging solutions by various authors [16,19–25]. This barrier refers to the additional effort or complexity perceived by consumers when switching to reusable packaging solutions. These include the need to carry empty containers back to a store, extra time spent on returning packaging for cleaning or refilling, or difficulties in storage at home. For example, Jiang et al. [20] studied the collection modes of reusable takeaway containers and the preferences of consumers and service providers. For consumers under the age of 20, the inconvenience of washing the dishes was one of the factors influencing the adoption of this RPS model studied. Such findings highlight the practical obstacles that may deter consumers from embracing reusable packaging solutions.

2.2. Resistance to Changing Habits and Behaviours

Changing habits and behaviours represents another significant barrier to the adoption of reusable packaging systems [26,29]. Consumers are often entrenched in the convenience of single-use packaging, which requires minimal effort and responsibility after consumption. Transitioning to upstream packaging solutions necessitates a shift in routine behaviours, such as remembering to bring reusable containers to stores or cleaning them after use. Tassel and Aurisocchio [28] conducted a literature review on reuse and recycling models and behaviours relevant to fast-moving consumer goods and emphasised the need for further research into consumer behaviour to facilitate widespread adoption of e reuse models. Similarly, Sæter et al. [27] emphasises the critical role of habit change in implementing RPSs, suggesting that effective strategies must address these ingrained behaviours to promote adoption.

2.3. Higher Costs or Deposit Schemes

Upstream packaging solutions sometimes require an initial investment, higher product costs, or deposits on containers to incentivize their return. These financial requirements can deter consumers, especially when they are uncertain about how frequently they will use the product [13]. Concerns about potential issues with deposit refunds, such as businesses withholding refunds due to packaging damage, further exacerbate this barrier [13]. Similarly, Miao et al. [19] also found that consumers are sometimes concerned about losing the chance to get their deposit back if the reusable packaging gets damaged. The upfront cost or deposit can be seen as a disadvantage compared to the immediate, lower cost of disposable packaging. Kunamaneni et al. [29] explored consumer attitudes and behaviour towards the reuse of household care products and emphasised the difficulty of determining the correct deposit rate. The authors noted that while a deposit rate set too high could discourage adoption, setting it too low might undermine the effectiveness of the return incentive, posing a significant challenge for reusable product adoption.

2.4. Contamination and Hygiene Concerns

Hygiene concerns are a significant barrier to adopting reusable packaging, particularly when the packaging has been used by others or has interacted with external substances [13,19,26,30,31]. Consumers may worry about improper cleaning, contamination from previous contents, or the transmission of germs, which can discourage the use of reusable containers, particularly in food-related applications. Such apprehensions often lead to aversion towards using reusable packaging [30]. Baxter et al. [30] developed the HUT contamination model, identifying hygiene, utility, and territory as the three primary mechanisms that drive the perceptions of contamination. Their study emphasised that material properties are the main indicators of contamination, with improper cleaning or visible marks amplifying consumer concerns. These factors collectively discourage the adoption of reusable containers in contexts where hygiene is perceived as critical.

2.5. Perceived Wear and Tear on the Packaging

Over time, reusable packaging can exhibit signs of wear and tear such as scratches, dents, or fading, which may negatively impact consumer satisfaction and perceptions of quality. The wear and tear on packaging can also signal contamination, triggering concerns about health and safety [19,32,33]. This deterioration not only raises doubts about the hygiene and functionality of the packaging but may also necessitate frequent replacements, which could offset the intended environmental benefits of reuse.

2.6. Functional and Performance Limitations

These relate to the practical aspects of reusable packaging, such as its ability to inform consumers, preserve contents, and provide adequate protection. Miao et al. [19] pointed out that research on packaging functions has primarily focused on single-use packaging, leaving a gap in understanding how the absence of certain functions in RPSs affects consumer perceptions. Tassel and Aurisicchio [28] also identified this barrier in their article in which they examined how people use refillable fast-moving consumer goods at home. They identified various performance issues related to users' habits that cause people to use too much or throw away these products too soon and pinpointed when these behaviours happen during the consumer journey. The findings of their study have led to the creation of several strategies to encourage more reuse and reduce the environmental impact. These strategies include incentivizing the continued use of original reuse facilitators and standardising reuse facilitators for compatibility across brands/products [28].

2.7. Lack of Awareness About Environmental Impacts

Consumers may not be fully aware of the environmental benefits of reusable packaging [16,19]. For example, Miao et al. [19] identified that some participants were unclear on how RPSs were a better option for conserving natural resources, pointing out that the production, operation, and maintenance of reusable containers still consumed resources. Such misconceptions can hinder adoption by undermining the perceived environmental advantages of reusable packaging.

2.8. Limited Availability and Variety

If reusable packaging options are not readily available or if they do not offer the variety needed to meet consumers' needs across different products and uses, adoption can be limited [19]. The success of reusable packaging systems depends on their accessibility and the ability to cater to diverse consumer preferences and requirements. Without adequate availability or variety, consumers may find it challenging to integrate RPSs into their daily routines, reducing their willingness to transition from single-use alternatives.

2.9. Lack of Trust

Trust is a critical factor influencing consumer adoption of reusable packaging systems due to concerns about the reliability, quality, and safety of these systems [19]. Yu et al. [34] explored the adoption intentions of home-refill delivery services for fast-moving consumer goods in Indonesia, employing an extended technology acceptance model that integrated variables like environmental concern, green perceived value, and trust. Their study found that environmental concerns correlate with green perceived values and trust, both of which contribute to forming positive attitudes toward home-refill delivery services. Yu et al. [34] further identified that trust is linked to consumer perceptions about the reliability and credibility of the service, focusing on whether the service will behave as expected and fulfil its promises. Their findings suggest that a lack of trust can act as a barrier to adopting home-refill delivery services, which, in this study, aligns with the mobile refill station archetype. This section has explored the complex landscape of user adoption barriers for reusable packaging systems, synthesising existing research and identifying nine distinct barrier types. These barriers reflect the multifaceted challenges associated with transitioning to RPSs, spanning functional, behavioural, and systemic aspects. In the next section, we examine how these nine barriers interrelate and cluster under broader categories, corresponding to sociocultural, economic, or contextual aspects.

3. Circular Packaging Adoption Framework

Our analysis of the nine barriers identified in Section 2 revealed interconnections among these factors, which can be clustered under three groups that correspond to sociocultural, economic, or contextual aspects. These categories provide a structured lens through which the challenges to adopting circular packaging solutions can be understood and addressed. In addition to these three aspects, regulatory barriers play an important role in the widespread implementation of upstream packaging solutions. Regulations establish the legal and policy frameworks that influence company practices and consumer behaviours, directly impacting users' interaction and adoption [35]. Regulatory mechanisms play a crucial role in shaping market behaviour by either enabling or restricting the adoption of sustainable practices. In Indonesia, for instance, policies enforced by the Food and Drug Administration (Badan Pengawas Obat dan Makanan, BPOM) exemplify these regulatory challenges. BPOM currently regards refill products as being in the research or pilot stage rather than fully operational systems for product delivery. This perception underscores the regulatory hurdles in scaling sustainable packaging solutions [36]. Additionally, some

regulatory frameworks focus on the disposal phase, prioritising collection rates. While these policies primarily target end-of-life management, they also present opportunities to integrate preventative measures at earlier stages, such as product design, manufacturing, and use [37].

Considering the significance of regulatory factors, we incorporated this dimension into our research process. Consequently, our study extends beyond the initial three categories to include a fourth dimension: regulatory barriers.

This comprehensive review informed the theoretical development of a circular packaging adoption framework, which summarises the identified barriers and categorises them under sociocultural, economic, contextual, and regulatory aspects, as outlined in Table 2.

Table 2. Framework describing the barriers for circular packaging adoption.

User Adoption Barriers	Sociocultural Barriers	Inconvenience Resistance to changing habits and behaviour Contamination and hygiene concerns Perceived wear and tear on the packaging Lack of awareness about environmental impacts Lack of Trust
	Economic Barriers	Higher costs or deposit schemes
	Contextual Barriers	Functional and performance limitations Limited availability and variety
	Regulatory Barriers	

3.1. Sociocultural Barriers

Sociocultural barriers arise from the habits, traditions, beliefs, and social norms of different groups of people. These barriers can include but are not limited to factors such as user acceptance, social roles, norms, and lifestyle factors that could affect the applicability/adaptability of the existing plastic packaging solutions. In this study, we have identified six types of sociocultural barriers: inconvenience, resistance to changing habits and behaviours, concerns about contamination and hygiene, perceived wear and tear on packaging, a lack of knowledge about the environmental impacts, and a lack of trust.

3.2. Economic Barriers

Economic barriers are related to the economic aspects of implementing the packaging solutions pertaining to the organisation of money, income, wealth, etc. These barriers can include a higher cost of products and deposit requirements which can deter users and limit the adoption of alternatives to single-use plastic packaging.

3.3. Contextual Barriers

Contextual barriers depend on or relate to the circumstances and setting in which packaging solutions are introduced. These barriers are influenced by the functionality, performance, and availability of reusable packaging systems. We have identified the two types of contextual barriers in this study as functional and performance issues and a lack of availability and variety.

3.4. Regulatory Barriers

Regulatory barriers stem from laws and regulations that govern the use and disposal of packaging materials. These barriers can significantly impact the applicability, adaptability, and scalability of reusable plastic packaging solutions. Many governments at national, regional, and municipal levels have introduced regulations and legislation specifically

targeting plastic usage and disposal. These measures are designed primarily to reduce plastic consumption and enhance waste management practices. Examples include bans and levies on plastic packaging and single-use products, as well as requirements for refillable and reusable packaging systems.

This next section presents the findings of the workshops with experts, organised according to each packaging archetype as discussed during the sessions.

4. Methodology

A combination of methods including case studies, expert workshops, storyboards and FGDs was used to identify user adoption barriers to solutions that tackle the plastic packaging waste problem in Indonesia. Figure 1 presents the methodology adopted in this research, summarising the sequence of the research activities.

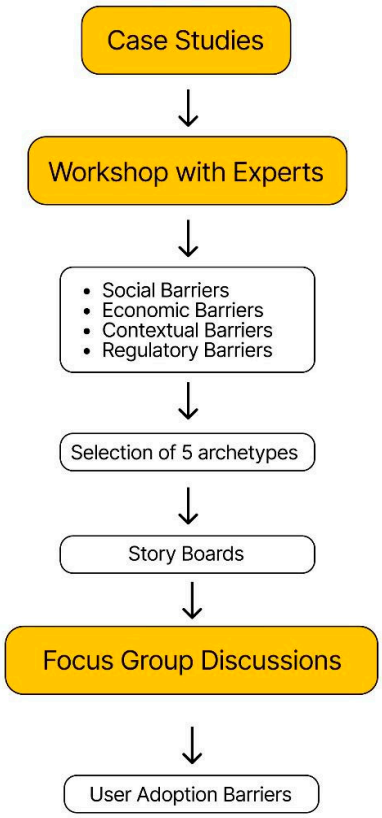

Figure 1. Methodology diagram shows the utilised methods and the outputs of the research.

We applied the categorisation from our previously developed UPS framework [12] to explore the applicability of the existing upstream packaging solutions in Indonesia. The research focuses on identifying barriers to implementing each archetype in Indonesia. Solutions that aim to solve the plastic packaging pollution issue by applying circular strategies, such as reusing, recycling, and composting, exist. The UPS framework offers a systematic approach to think about and analyse these existing solutions by categorising them under 10 archetypes according to the upstream packaging strategies that they employed and their sectors [12]. The framework groups these 10 archetypes under 3 overarching strategies: reuse, elimination, and material circulation (Figure 2).

Figure 2. Upstream packaging strategies framework showing 10 archetypes and 17 sub-archetypes of existing packaging solutions.

We developed case studies corresponding to each of the ten archetypes of the UPS framework [12] to provide detailed information about the archetypes to experts who participated in the workshop. Data regarding these cases were sourced from the official websites of the respective businesses. A booklet containing the case studies was prepared and emailed to the experts prior to the workshop, allowing them to familiarise themselves with the material in advance.

The workshops, a participatory design technique, involved a group of participants engaging in focused discussions and activities on a specific topic. Given the geographical spread of the experts across different cities in Indonesia, we conducted two online workshops. This method proved effective for gathering valuable insights from participants with expertise in the social, contextual, economic, or regulatory aspects of Indonesia. Participants were selected through recommendations from our project partners. Each workshop lasted three hours and focused on presenting and discussing the 10 archetypes and 17 case studies, with an emphasis on identifying the social, contextual, economic, or regulatory barriers specific to the Indonesian context. The workshops were video recorded and transcribed for further analysis.

Following the workshops, we conducted a content analysis of the data, which helped identify the key social, contextual, economic, and regulatory factors related to each archetype. More details about the content analysis are included in Section 5.2. Based on these results, we selected five archetypes for further investigation to better understand the barriers to user adoption in Indonesia through direct user interactions.

To communicate the context and user journey for these five selected archetypes, we created storyboards. Storyboards are visual narratives that help generate empathy and capture essential social, environmental, and technical factors, making it easier to gain deeper insights into the user adoption potential of these five archetypes and identify barriers at each stage of the user journey; we organised FGDs with 30 local residents in Indonesia. After the sessions were completed, the recordings were transcribed and translated.

5. Results

5.1. Case Studies

Case studies represented existing practices associated with each of the ten archetypes within the UPS framework. The cases were developed to inform and prepare experts before the workshop. The case studies were used during the workshop to evaluate the potential for implementing these archetypes in Indonesia and identifying barriers to user adoption.

As seen in Table 3, we selected 17 cases that were representative of the archetypes. Case studies are included in Appendix A. The narratives of these case studies were crafted to be easily understandable for the experts. Each case study was presented in a consistent way that described the nine key features:

1. Value Proposition: This refers to the unique offerings and benefits that a business provides to its customers. It clarifies whether customers are paying for the content itself, the use of containers that deliver the content, or a combination of both.
2. Scale: the scope and extent of operations of the solution, indicating its size and level of activity.
3. Market Reach: the geographic and demographic spread of the solution, showing where and to whom it is available.
4. Stakeholders: individuals or groups involved in or affected by a business or enterprise, including suppliers, stores, and consumers.
5. Location of Purchase: The specific places where the solution is provided to the customers, such as stores or online platforms.
6. Place of Consumption: the location where the solution is accessed, used, or consumed by the customer.
7. Delivery Method: the process by which the solution is provided to the consumer, such as via automated machines or direct delivery.
8. Container Ownership: it refers to who owns the packaging or containers.
9. Collection, Return, or Disposal of Containers: the system or method by which consumers return used containers or packaging to a designated point for reuse or recycling.

5.2. Workshops with Experts

We conducted two online workshops with seven experts to assess and identify the upstream packaging strategies that can be adopted by the Indonesian people. The aim of this study was to assess the applicability and adaptability of the existing plastic packaging solutions to Indonesian contexts by identifying the social, economic, environmental, and regulatory barriers to implementing these solutions.

We recruited seven participants who are experts in the social, economic, contextual and regulatory aspects of Indonesia (see Table 4). Before the workshop, the facilitator emailed the identified archetypes and case studies to participants and asked them to read through and become familiar with the cases. At the beginning of the workshop, the facilitator gave a short presentation about the archetypes and case studies and answered the questions of the participants. Then, the facilitator presented each archetype and related case study and asked participants questions about each archetype. The questions explored the potential barriers of each case, considering the social, environmental, economic, and regulatory aspects of implementing the cases in Indonesia.

Table 3. A total of 17 case studies were created to present 'real-life' examples for each of the 10 archetypes.

UPS Archetype [12]	Case Study
Refill Stations	Algramo [38] Water ATM [39] Ecover [40]
Mobile Refill Stations	Algramo Mobile [41]
Refill at Home Solutions	Soda Stream [42] Faith in Nature [43]
Pre-filled (Returnable)	EcoPure [44] Loop [45] Kecipir [46] Koinpack [47]
Reusable Takeaway and Delivery	Alas [48] Ozzi [49] CupClub [50]
B2B Reusable Packages	Swedish Return System [51]
Packaging Solutions Led by Elimination	Lush Cosmetics [52]
Compostable Packaging	BioFreshPak [53]
Substitution to a Non-Plastic Material	KeepClip [54]
Plastic Recycling	Evolve [55]

Table 4. Expertise areas of the experts involved in the workshops.

Experts		Expertise Area
Workshop 1	1	An Indonesian academic who is an expert on community empowerment and poverty in coastal communities.
	2	An academic whose expertise area is on the economics of pollution and climate change, valuing environmental services.
	3	An Indonesian expert working in a leading position in a company that creates and implements circular packaging solutions in Indonesia.
Workshop 2	4	An Indonesian expert from an industry association whose expertise area is sustainable waste management and recycling within the packaging industry in Southeast Asia.
	5	An Indonesian academic who is an expert on waste management services in Indonesia.
	6	An Indonesian academic who is an expert on community empowerment with a focus on local and national regulations and policies.
	7	An expert working in a leading position in a company that creates and implements circular systemic change solutions in Indonesia.

The workshops were conducted in February 2022. Each workshop lasted around three hours. The structure of the workshop and the questions are presented in Appendix B. Workshops were recorded on Zoom. The experts' consent was obtained before the session (see Appendix C). After the workshops, each session was transcribed. We used a content analysis method to analyse the collected data. Transcribed data were coded for each archetype. A total of 102 codes were identified, and they were clustered into different barrier categories. Meaningful clusters emerged from the codes, and subcategories of the barrier categories were identified. The codes corresponding to each archetype are presented in Appendix D. The results from the expert workshops, aligned with each archetype, are presented below:

1. Refill Stations: The results from the expert workshops indicate that refill stations in Indonesia face several barriers that may hinder their widespread adoption. A major sociocultural barrier identified is inconvenience and resistance to changing habits and behaviours. This requires a significant shift in consumer behaviour, transitioning from using disposable packaging to consistently carrying and reusing containers. Economic barriers also play a critical role, particularly factors such as price, affordability, and the practice of buying on credit. For example, some consumers prefer to have their purchases recorded on credit, with the option to pay later. This preference was viewed as both an economic barrier and a cultural habit.

2. Refill-at-home solutions: Sociocultural, economic, and contextual barriers regarding the adoption of refill-at-home solutions in Indonesia were identified. Sociocultural barriers were mainly rooted in convenience and traditional shopping behaviours, alongside economic concerns about purchasing power. One barrier related to bulk buying was about transporting large packages home, particularly as motorcycles are one of the primary modes of transportation in Indonesia.

3. Home delivery solutions: We identified several barriers that impact the adoption of home delivery solutions in Indonesia. Economically, the concerns are centred around affordability, with many consumers, especially those in lower-income groups, preferring immediate and cheaper purchasing options such as buying products in single-use plastic packaging from warungs or stores. Additionally, a high deposit can also pose a significant economic barrier. Some of the main sociocultural barriers mentioned were hygiene and the fact that online shopping is a new behaviour for some people.

4. Reusable takeout and delivery containers: Regarding reusable takeout and delivery containers, the hygiene barrier dominated discussions, with concerns about the cleanliness of reused containers and their acceptance in the food service industry. One participant said "Cleaning is a concern. Hygiene of the reused container is a barrier. Especially places where water quality is not good". Additionally, the perceived higher cost of reusable containers compared to single-use options was identified as an economic barrier.

5. Returning on-the-go packaging: Predominantly, sociocultural and economic barriers were identified and discussed in relation to "return on the go" packaging solutions in Indonesia. For example, returning packaging after use is not a typical behaviour among Indonesian consumers. This barrier is often due to the inconvenience of carrying used packaging back to a collection point and the lack of established habits supporting such practices. Economically, the concept is challenging as it may not resonate with consumers who see no immediate cost benefit in returning packaging compared to disposing of it. Moreover, the infrastructure for collecting and processing returned packages is underdeveloped, complicating the logistics of implementing such a system efficiently across varied geographic and urban settings.

6. Compostable packaging: The barriers for adopting compostable packaging in Indonesia are primarily sociocultural and contextual. An example of a sociocultural barrier is that there is a lack of awareness and misunderstanding about compostable materials, with many people mistaking them for traditional plastics. This can result in contaminating the recycling streams. Among the contextual barriers, the local environmental conditions pose significant challenges; the high humidity and varying temperatures in Indonesia can affect the integrity and decomposition rate of compostable materials.

7. Packaging solutions led by elimination: The barriers related to this archetype are related to price and the local environmental conditions. Participants argued that the unpackaged goods may not withstand the humid and warm weather; this could make users hesitant to adopt minimal packaging solutions.

8. B2B reusable packages: Regulatory barriers were a primary concern for the B2B reusable package archetype. Participants stated that new legislations could promote the use of reusable packaging in business operations. Additionally, sociocultural barriers were discussed, highlighting the challenges of convincing businesses to switch to reusable packaging solutions, especially when disposable options are perceived as more straightforward and cost-effective.

9. Substitutions to non-plastic materials: Sociocultural barriers were identified regarding substitutions to the non-plastic material archetype. For example, participants stated that canned drinks are not common in Indonesia and changing from familiar plastic products to alternatives may be a barrier for them.

10. Plastic recycling: Contextual barriers were a key concern for this archetype. Participants discussed inadequate waste management infrastructure that makes the collection and sorting of recyclable plastics inefficient or non-existent.

The barriers identified across different packaging types underscore the complex interplay of sociocultural, economic, contextual, and regulatory challenges specific to each archetype. We selected five archetypes to understand the user adoption barrier in more detail. The next section presents this selection process.

5.3. Selecting the Archetypes for Focus Group Discussions

Among the ten archetypes, we selected five for further research based on the previous research including case studies and expert workshops. The selection criteria and the process are outlined below:

- Results of the expert workshops: Based on the results of the expert workshops, some solutions were eliminated due to their lack of relevance to the Indonesian context. Each solution was carefully evaluated based on its purpose and the relevance of its services and products to address specific challenges that exist in Indonesia.
- Targeting a wider audience: Previously conducted case studies and expert workshops showed that certain existing solutions are mainly adopted by high-income, environmentally conscious consumers in urban areas. In this study, we aimed to target a wider demographic, including people from low- and middle-income backgrounds and those from rural and peri-urban areas.
- Sector: we selected solutions from different sectors to ensure a broad range of packaging types and better understand various adoption barriers

Table 5 presents the five archetypes of upstream packaging strategies that were selected for the FGD study. They were inspired by existing solutions such as Algramo, Allas, MIWA, and Koinpack.

It is important to mention that we did not use these existing solutions in our research as they are. We generalised the solutions and developed cases that are based on these solutions. As a result, there might be some differences in the solutions presented below compared to the available versions of these solutions in commerce.

5.4. Storyboards

Storyboards were prepared to present the idea, context, and touch points of the five selected archetypes from the purchase to disposal stages (Figure 3). The degree of detail was decided considering the effectiveness of the information at focusing the attention of the participants on the specific activities required to use the concepts. These activities include paying the deposit, washing the reusable packaging, and returning the reusable packaging, etc. Text-based narrations as captions were added to supplement the visuals.

Table 5. Selected archetypes of upstream packaging strategies.

Archetype/Existing Solution	Description	Relevance to Indonesia	Target Audience	Sector
1- Refill stations in small markets/Algramo 0.1	Eliminates single-use packaging by providing refill stations for daily use products	Addresses the sachet problem by offering affordable quantities.	Mass market	Everyday products (e.g., rice and oil)
2- Mobile refill stations/Algramo 0.2	A mobile refill station on an electric tricycle that travels to neighbourhoods close to customers' homes	Fits Indonesia's motorcycle culture; offers affordable product quantities.	Mass market	Everyday products, starting with detergents
3- Reusable takeaway and delivery/Allas	Reusable food containers for takeaway and delivery services	Reduces single-use plastic from rising online food delivery waste.	Users who already use online food takeaway services	Food delivery and takeaway
4- Refill stations in big markets/MIWA	A modular refill system in grocery stores for dry foods offering reusable containers	It offers container reuse options, but affordability is a barrier for mass adoption.	Medium- and high-income households	Dry foods (e.g., pasta and coffee)
5- Pre-filled packaging/Koinpack	Small reusable packages for daily needs in small shops (warungs)	Convenient like sachets but less affordable due to deposit system.	Medium- and high-income households	Everyday products (e.g., rice and oil)

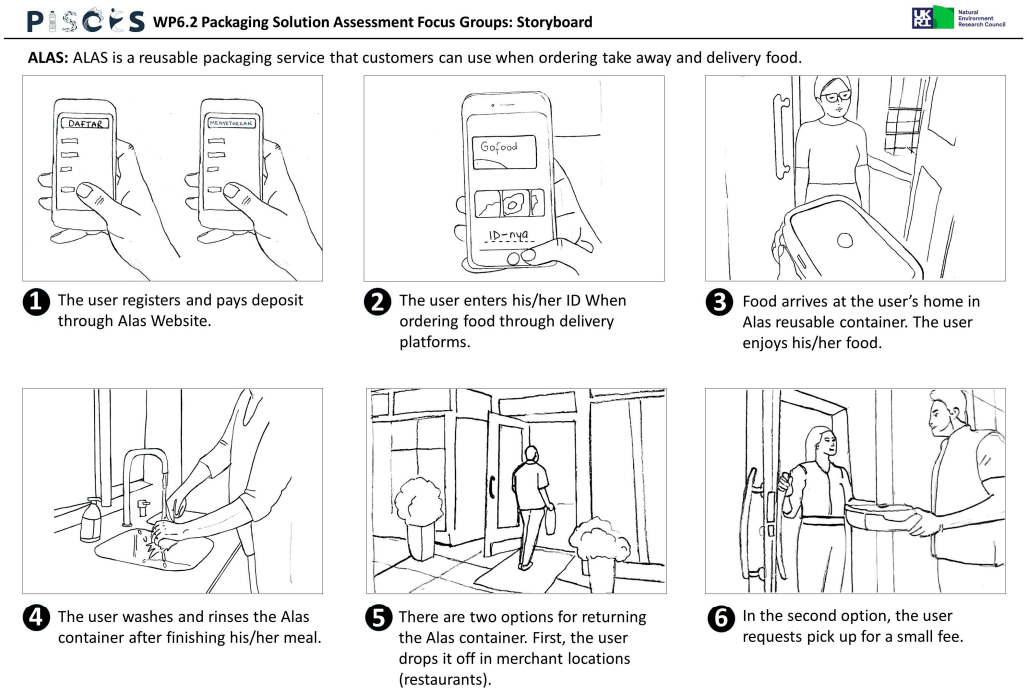

Figure 3. Storyboards for the five selected archetypes were created, featuring text-based captions that highlight key touchpoints and activities.

5.5. Focus Group Discussions

We conducted five FGDs in Banyuwangi, Indonesia, with 30 participants in total (Figure 4). The aim of the FGDs was to identify the user adoption barriers of existing packaging solutions throughout the entire user journey, from purchase to use and disposal.

Figure 4. We conducted 5 FGDs in Banyuwangi, Indonesia, with 30 participants in total.

Participant Selection and Recruitment:

The sessions were conducted in Bahasa Indonesia, the local language. Participants included adults responsible for household shopping and waste management who used single-use packaging and/or who used refillable, returnable, and reusable packaging solutions. The participant selection criteria were as follows:

- Urban and rural residents and people with and without access to waste management infrastructure;
- Low-income and middle-income households;
- Males and females.

We recruited thirty participants in total, with five/six participants per FGD session. Participants were aged between 18 and 43 years old. Eight of them were men, and twenty-two of them were women. The number of women was higher than the number of men because mostly women manage the household shopping needs, make purchase decisions, and manage household waste in the selected area. Prior to the sessions, participants were provided with information forms, and consent to record the sessions was obtained through a consent form (see Appendix E). Each session lasted around 90 min. Participants engaged with the user journey posters that illustrate the key stages of each packaging solution. Discussions focused on barriers to adoption. During each stage of the user journey, from purchase to use and disposal, participants were guided by structured questions to identify these barriers. The structure of the FGDs and the questions asked can be found in Appendix F.

We employed content analysis to analyse the data collected. The transcribed data were coded by solution type, with specific codes identified and categorised into various barrier categories. These categories were then grouped into meaningful clusters and subcategories.

The specific codes associated with each solution are detailed in Appendix G. Table 6 summarises the results of the FGDs. The results are also presented below for each solution.

- Algramo 0.1-inspired solution: According to the results of the FGD study, we identified sociocultural and economic user adoption barriers for the Algramo solution, which encourages the use of refillable containers to reduce plastic waste. Sociocultural barriers play a significant role, where the inconvenience of carrying personal containers deters users accustomed to the ease of purchasing directly from local stores known as warungs. Furthermore, another challenge is that this solution would require a shift from being served by the warung (which is a preferred and established habit) to being actively involved in the refilling process. In addition, this solution would require educating consumers on how to use the service and the refilling machine. Finally, there is also an economic barrier identified due to the reluctance to pay a deposit for the containers.
- Algramo 0.2-inspired solution: Sociocultural, economic, and technological barriers were identified regarding the Algramo mobile refill station. The results of the FGDs show that the majority of the barriers are related to technology. Technological barriers are listed under the contextual barrier category in this study. Issues such as using a touchscreen, not owning smartphones, and poor cellular data signals in rural areas were some of the main technological barriers identified by participants. Additionally, sociocultural barriers were mentioned. For example, convenience issues were mentioned as potential users were reluctant to wait for the van's arrival, preferring immediate access to products. Moreover, significant behavioural changes are required for adoption: some participants were not motivated to switch from their usual shopping routines to waiting for a mobile service. Finally, the economic barrier mentioned was that individuals prefer to use plastic packaging because they can resell it post-use, providing them with a return on their purchases.
- MIWA-inspired solution: The FGD study results on MIWA revealed both sociocultural and technological barriers to user adoption. Sociocultural barriers encompass issues of convenience and ingrained user habits and behaviours. Participants expressed that mobile apps are seen as complicated and expressed a preference for the straightforward nature of online shopping, which they found easier than navigating MIWA's services. Additionally, a preference among some consumers to pay in cash was also discussed, noting that not everyone in Indonesia has access to a credit or bank card. Technological barriers mentioned included the challenges associated with downloading and using a mobile app. These challenges are often due to the inconvenience they represent or a lack of familiarity with such technology.
- ALLAS-inspired solution: The FGD study results highlighted the sociocultural barriers of the Allas food takeaway and delivery solution. Primarily, hygiene concerns were mentioned as impacting user acceptance. Participants expressed discomfort with the idea of eating from containers that have been used by others, stemming from a belief that such containers cannot be sufficiently sanitised to meet their standards of cleanliness. Additionally, inconvenience was noted as a barrier; some participants expressed a preference for returning the containers immediately after the food is delivered. The reason for this preference is to eliminate the burden of having to go to a drop-off point to return the containers.
- Koinpack-inspired solution: The FGD results regarding Koinpack highlighted brand loyalty as the primary barrier related to habits and behaviour change, significantly impacting user adoption. Participants expressed hesitation due to the uncertainty about the brands of the products contained within the packages. They emphasised

their needs specifically about skin care and their preference for sticking with familiar brands that they normally use.

Table 6. The sociocultural, economic, and contextual barriers identified in the FGD study for five selected archetypes, highlighting key user adoption barriers.

Solution	Barrer Category	Barrier
Refill stations in small markets/Algramo 0.1	Sociocultural	Inconvenience of carrying personal containers
		Shift from being served to self-service refilling
		Limited knowledge on the refilling process
	Economic	Reluctance to pay deposit for containers.
Mobile refill stations/Algramo 0.2	Sociocultural	Reluctance to wait for the van's arrival
		Preference for immediate purchases
		Resistance to changing shopping routines
	Contextual Barriers	Issues with using a touchscreen
		Some people do not have smartphones
		Poor cellular signals in rural areas
	Economic	Preference for plastic packaging due to its resale value
Refill stations in big markets/MIWA	Sociocultural	Inconvenience
		Preference for simpler online shopping
	Contextual Barriers	Preference for cash payments due to limited access to credit or bank cards
		Challenges with downloading and using mobile apps
Reusable takeaway and delivery/Allas	Sociocultural	Hygiene concerns regarding reused containers
		Inconvenience in returning containers to drop-off points
Pre-filled packaging/Koinpack	Sociocultural	Brand loyalty issues particularly with skincare products
	Contextual Barriers	Limited availability and variety (reluctance to switch from familiar brands)

6. Discussion

This paper addresses a gap in the existing research by focusing on user adoption barriers of upstream packaging solutions particularly in the context of Indonesia. It offers valuable insights into the multifaceted nature of the user adoption barriers of upstream packaging solutions by identifying and categorising these barriers into sociocultural, economic, contextual, and regulatory aspects.

The contributions of this research are threefold. Firstly, it organises existing user adoption barriers into nine distinct groups: inconvenience, habits and behaviour change, higher costs or deposits, contamination and hygiene concerns, wear and tear on packaging, functional and performance issues, a lack of knowledge about the environmental impacts, a lack of availability and variety, and a lack of trust. This categorization not only clarifies the complexities involved but also enhances the understanding of how these barriers interconnect. Secondly, the research elaborates on the interrelationships among these barriers by clustering them into four categories: sociocultural, economic, contextual, and regulatory. This categorization provides a structured approach to better understand these barriers, which can benefit both research and practical interventions aimed at enhancing the adoption of sustainable packaging solutions. Thirdly, this study extends beyond the

existing literature by identifying unique user adoption barriers specific to low- and middle-income households in Indonesia through expert workshops and FGDs. We compared these findings with existing research, discussing the similarities and differences across each of the nine barrier categories below.

- Inconvenience: Inconvenience factors such as carrying containers back to stores, the additional time required for cleaning, and storage difficulties at home were widely discussed as barriers to adopting upstream packaging solutions in the literature [16,19–25]. This research echoes similar findings, highlighting inconvenience as a significant barrier. It also identified the inconvenience factors specific to Indonesia such as carrying containers to warungs and the waiting time for the mobile refill station to arrive.
- Resistance to changing habits and behaviours: Changing habits and behaviours is highlighted as a significant barrier in the existing literature [27–29]. The findings of this study provided insights to this barrier such as the cultural habit of buying on credit when using refill machines. Additionally, the service provided by the warung owner, such as serving and bagging the items and picking the items for the customer, is considered a plus for Indonesians. They are used to this commonly provided service and found it more convenient than using a refill machine.
- Higher costs or deposit schemes: Similarly to the existing research [13,19,29], this study identified higher costs or deposits as a user adoption barrier.
- Contamination and hygiene concerns: This study adds new dimensions to existing research by focusing on factors specific to Indonesia that influence participants' perceptions of hygiene. Participants expressed significant concerns about hygiene in areas with contaminated water, attributing their scepticism about water cleanliness to underdeveloped waste management and sewage systems. This lack of infrastructure fosters doubts about the efficacy of cleaning methods used for reusable packaging, underscoring the critical link between public utilities and consumer trust in product sanitation.
- Perceived wear and tear on packaging: The wear and tear on reusable packaging, such as scratches, dents, or fading, was not discussed in our workshops and FGDs. However, it was considered part of the hygiene of the reusable containers.
- Functional and performance limitations: User adoption barriers related to functional and performance issues have been addressed in only a few studies [19,28]. Similarly, in our study, this barrier was mentioned by the participants a couple of times regarding the complexity of using technology and mobile apps for refill stations.
- Lack of awareness about environmental impacts: Existing research indicated users' concerns about the environmental benefits of reusable packaging, with concerns about the sustainability of plastics and the significant resources needed for the production and maintenance of reusable containers [14,19]. In our study, a key issue associated with this barrier was the general lack of awareness and indifference towards environmental impacts. A recent life cycle assessment by Stefanini et al. [56] also highlights that bioplastics, while often perceived as more sustainable, do not always outperform traditional plastics across all environmental impact categories, particularly regarding water and land use, raising further questions about their suitability in low-resource settings. The participants mentioned the necessity of educating consumers about the positive environmental effects of reusable packaging systems. Additionally, our findings pointed out the lack of awareness about packaging materials, specifically the lack of knowledge about compostable materials.
- Limited availability and variety: The existing literature highlights that limited availability and variety of reusable packaging options can hinder adoption [19]. Similarly, participants of the workshops and FGDs discussed brand loyalty as one of the bar-

riers of upstream packaging solutions, specifically regarding the Koinpack-inspired solution.

- Lack of trust: Concerns about the quality and safety of the product provided as a part of RPSs [19] and the reliability and credibility of RPSs [34] were studied as part of the lack of trust barrier in the literature. However, this barrier was not prominently mentioned in our study.

Compared to other low- and middle-income countries, the Indonesian context presents some unique barriers influencing the adoption of circular packaging. In Malaysia, for instance, consumer acceptance of green packaging is largely driven by emotional, social, and functional values, reflecting a relatively higher level of environmental awareness and access to alternatives [57]. Similarly, young consumers in urban Malaysia tend to engage in impulsive online purchases of eco-friendly products, as they are influenced by social media trends and peer dynamics [58]. These factors were not identified in our study. Furthermore, sociocultural factors such as the preference for plastic packaging due to its resale value and hygiene perception highlight behaviours that are rarely seen in comparative studies [57,58]. These factors underscore the need for context-specific, multidisciplinary approaches to address the structural, cultural, and regulatory dimensions of sustainable packaging adoption in Indonesia [35]

7. Limitations and Further Research

This study provides valuable insights into the barriers to the adoption of upstream packaging solutions in Indonesia, though limitations should be acknowledged. This study focused on a selection of packaging archetypes inspired by existing solutions. There are other innovative packaging solutions not covered in this study that could offer different insights and implications. Future research should explore a wider variety of packaging solutions to identify additional barriers and opportunities.

The findings are specific to the Indonesian context, as they are influenced by local cultural, economic, and infrastructural factors. While these insights are valuable, they may not be directly applicable to other countries or regions. Comparative studies across different countries could provide a more comprehensive understanding of the global applicability of these findings.

This study primarily focused on specific regions in Indonesia, which may not fully represent the diverse demographic and cultural contexts across the entire country. Future studies should aim to include a broader range of participants from different regions to ensure more generalisable results.

Finally, future research should extend beyond the Indonesian context to examine how these barriers manifest in other low- and middle-income countries. Comparative studies across regions like Southeast Asia, sub-Saharan Africa, and Latin America can help uncover shared challenges and context-specific nuances. Exploring these dimensions will generate scalable insights to support a global transition towards sustainable packaging systems.

8. Conclusions

This research is valuable to a diverse range of stakeholders committed to advancing sustainable practices and reducing plastic waste. Firstly, researchers and academics studying circular design, circular packaging solutions, and user behaviour will benefit from the detailed analysis of adoption barriers. Secondly, businesses and entrepreneurs in the packaging and consumer goods industries can use the findings to design more user-friendly, cost-effective, and culturally appropriate upstream packaging solutions to accelerate the shift to a circular economy. Additionally, policymakers and government agencies can lever-

age the insights to develop targeted regulations and incentives that promote the adoption of upstream packaging solutions tailored to local contexts.

To support the widespread adoption of circular packaging in Indonesia and similar contexts, practitioners must address the complex web of sociocultural, economic, and contextual barriers. One effective strategy is to co-design solutions with local users, especially those from low- and middle-income communities. Involving users in the design process helps ensure that new packaging systems are not only technically viable but also align with everyday habits and constraints, such as cash-based payments or limited digital access. Additionally, simplifying user interaction with reuse systems can reduce adoption barriers. For instance, providing user assistance at refill stations and integrating drop-off options within familiar retail environments like warungs can help consumers overcome hesitation linked to inconvenience or technology use. Equally important is the establishment of reliable cleaning systems for reusable containers to build trust and address hygiene concerns.

From a policy perspective, two key recommendations emerge as critical enablers of circular packaging in Indonesia. First, regulatory reform is needed to update the Indonesian Food and Drug Administration's classification of refill systems. Rather than treating them as experimental or pilot-stage interventions, a regulatory framework should be developed to formally recognise and support reusable and refillable packaging models. This would provide businesses with clear guidelines and legal assurance. Second, economic incentives should be introduced to support early adoption. Tax breaks, grants, or subsidies for companies investing in reuse infrastructure especially those targeting low-income markets could expand access to circular packaging solutions.

Consumer education is also essential to shift mindsets and behaviours around packaging. Awareness campaigns should connect circular packaging directly to visible local benefits, such as cleaner neighbourhoods and improved health from reduced plastic burning. Additionally, public information efforts should clarify the environmental advantages of reusable packaging over single-use alternatives and correct misconceptions about compostable materials, which are often mistaken for traditional plastics. Educating consumers on how to properly use, sort, and dispose of these materials is vital to prevent contamination in recycling streams and foster informed participation in the circular economy.

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Data Availability Statement: The data supporting the findings of this study are not publicly available due to ethical considerations related to participant confidentiality and the terms of consent. Transcripts and recordings from focus group discussions and expert workshops contain sensitive information and cannot be shared openly. However, anonymised excerpts and summary tables are available from the corresponding author upon reasonable request and subject to ethical approval.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Case Studies

1- REFILL STATIONS

1-ALGRAMO: Refill stations to sell products in small quantities in reusable containers

Algramo is a Chilean start-up that aims to eliminate the use of single-use packaging by offering products through refill stations. Algramo installs automated machines in stores and sells affordable quantities of everyday products such as rice, lentils, chickpeas, detergent, and cooking oil. Customers pay for the quantity they buy. To use the machine a customer places a reusable container on the ledge. Then, they insert coins and they machine dispenses the product. Customers can fill their own packaging or they can pay a deposit to use Algramo's reusable containers.

After their success in Chile, Algramo started to work with Unilever, Walmart, and Nestlé's Purina. They also started to provide RFID tagged containers and vending machines with IoT technology. They have pilot programs in the US and Indonesia and are set to expand to new markets including the UK and Mexico.

Key features

- **Value Proposition:** Consumers pay through an app for the content and for using the smart container.
- **Location of purchase:** Store
- **Scale:** Algramo is currently piloting its smart system.
- **Place of Consumption:** At-home
- **Market Reach:** Santiago, Chile; New York City, USA; Jakarta, Indonesia.
- **Delivery Method:** Automated machines
- **Stakeholders:** Suppliers, stores, consumers
- **Container Ownership:** Smart containers with RFID technology which has a deposit are sold to consumers.
- **Collection of containers:** Consumers bring the packaging back to the provider.

1- REFILL STATIONS

2-WATER ATM: A water vending machine that makes drinking water equitable

Water ATM is a scheme run by private water companies and the government of India. It provides water for consumers on the streets of India through automated machines that are solar-powered and cloud connected allowing remote tracking of water quality and daily transactions. Consumer fill their own bottle and pay for only the amount of water dispensed. Consumers can pay using cash or top-up cards.

Customer own their own bottles and fills them at his convenience. Water vending provides an opportunity for existing water business operators, provided adequate support is given by local governments or governing bodies.

Key features

- **Value Proposition:** Consumers pay for the water.
- **Location of purchase:** Public Spaces-Open Environment
- **Scale:** Water ATMs are widely used in India. They are built, owned and operated by private companies.
- **Place of Consumption:** On-the-go
- **Market Reach:** India
- **Delivery Method:** Automated machines
- **Stakeholders:** Private companies, government, consumers
- **Container Ownership:** Consumer-owned container - consumers fill the containers that they own.

1- REFILL STATIONS

3-ECOVER: A refill station to elevate the experience and create the habit of refilling

Ecover is a UK based company that produces a range of cleaning products. The company launched a campaign called 'Refillution' to encourage consumers to refill their packages in the refill stations. The packages are made from post-consumer recycled plastic bottles that can be reused and refilled up to 50 times. Ecover has 650+ refill stations throughout the UK. Consumers can use the store locator to find the nearest local refill station. The design of Ecover refill stations focused on nudging shoppers to consider refills and on the challenges that users face during use such as convenience, messy refilling experiences, and behaviour change.

Key features

- **Value Proposition:** Consumers pay for the content.
- **Location of purchase:** Consumers can refill their packages at the local refill stations at the stores.
- **Scale:** Commercially available
- **Place of Consumption:** Customers use their products at home.
- **Market Reach:** Ecover has 650+ refill stations throughout the UK.
- **Delivery Method:** Human distribution. Consumers can refill their packages at the local refill stations at the stores.
- **Stakeholders:** Suppliers of raw materials, logistic service providers, retailers, consumers
- **Container Ownership:** Packaging that can be refilled up to 50 times is sold with the product.
- **Collection of containers:** No collection. Packages can be recycled at the en of their use-life.

2- REFILL AT HOME SOLUTIONS

4-SODA STREAM: Appliance and reusable bottles for making sparkling beverages at home

SodaStream is keen on lowering plastic consumption around the world while delivering quality soft drinks in an environmentally friendly way. It is a soda making machine that can prevent the use of single-use bottles. Consumers buy the machine, a refillable carbonating container, and reusable bottles to make their own drink at home. They can use the water from the tap, CO2 is supplied in returnable cylinders and a variety of flavored syrups are also available. A single CO^2 cylinder can carbonate up to 60 litres of water. One of the advantages for the consumers is customisation that they can mix flavours and control the level of carbonation according to their preferences. In terms of convenience to users, this solution eliminates the need to go to the grocery store to buy and carry beverage bottles.

Key features

- **Value Proposition:** Consumers pay for the machine, reusable bottles, for the refillable carbonating cylinder, and the syrups.
- **Scale:** Sodastream has a widespread usage with 15 million household users.
- **Market Reach:** Distributes through more than 90,000 individual retail stores in 46 countries.
- **Stakeholders:** retailers, consumers
- **Location of purchase:** Consumers can buy the machine and the other supplies form a store or order from the online store.
- **Place of Consumption:** Customers enjoy their beverages at home.
- **Delivery Method:** Human distribution
- **Container Ownership:** The machine and other parts are owned by the consumers.
- **Collection of containers:** Refillable carbonating cylinders can be returned through post or at the collecting points.

2- REFILL AT HOME SOLUTIONS

5- FAITH IN NTURE: ≥5lt refill packages to enable consumers to refill their small containers at home

Faith in Nature is a natural skincare company founded in the UK in 1974. They offer 5 litre and 20 litre bottles to encourage consumers to refill their small containers at home. These big packages are used for laundry liquid, hand wash, body-wash, shampoo, conditioner, hand and body lotion, and washing up liquid. Consumers can buy them in grocery stores or through their online store. Besides making it easier to refill at home, they also have many local refill stations. Bigger bottles have advantages for the environment as they require less plastic. The 5 litre containers are made of HDPE, which is widely recyclable. Although Faith in Nature requests the packages back, they do not refill their containers. Customers need to post empty containers back to Faith In Nature via a Freepost address. They are trialling new methods so that all large format bottles returned to them can either be washed and refilled or recycled and remoulded into new large packages.

Key features

- **Value Proposition:** Consumers pay for the product and packaging.
- **Scale:** Commercially available
- **Market Reach:** Faith in Nature sells products globally.
- **Stakeholders:** Suppliers of raw materials, logistic service providers, retailers, consumers
- **Location of purchase:** Products cn be purchased from the stores or through the online store.
- **Place of Consumption:** Customers use their products at home.
- **Delivery Method:** Human distribution
- **Container Ownership:** HDPE packaging is sold with the product.
- **Collection of containers:** Consumers post empty containers back to Faith In Nature via a Freepost address.

3- HOME DELIVERY SOLUTIONS

6-ECO PURE: Door to door water delivery

EcoPure is a company that provides door to door delivery of water in 18.9 litre and 11 litre containers to households and offices. They offer the use of manual water dispensers and reusable bottles. Consumers pay for water, the delivery, and for using the containers and dispenser from EcoPure. The dispensers need to be cleaned and sanitised once a year. The company also offers this service for a fee. Similar services that tackle the issues of affordable, safe drinking water and single-use plastic waste from pre-bottled water. Danone Water Jugs is a scaled business operating in Latin America and Asia. Addressing drinking water needs through water and sanitation infrastructure development could be a more environmentally friendly option. However, where there is no infrastructure development, delivery services can be a viable option.

Key features

- **Value Proposition:** Consumers pay for water, the delivery, and for using the containers and dispenser from EcoPure.
- **Scale:** EcoPure is a scaled business and it was founded in 1995.
- **Market Reach:** Malta
- **Stakeholders:** Water supplier, consumers
- **Location of purchase:** Water is delivered to consumers' homesand offices.
- **Place of Consumption:** Customers enjoy their orders at home and their offices.
- **Delivery Method:** Human distribution
- **Container Ownership:** Water jugs are owned by EcoPure. Customers pay a deposit fee to use them.
- **Collection of Containers:** Water jugs are picked up from customers' homes.

3- HOME DELIVERY SOLUTIONS

7- LOOP: A reusable packaging service offering products in premium packaging

The system is designed for customer convenience as easy as buying something in a disposable package and throwing it away. Customers buy products in reusable packaging from retailers. Their orders are delivered in a reusable tote. When a customer has an empty container, they can return it by home collection or to any participating retailer. Then, the customer gets back a deposit that they paid for the package. If they've reordered the product, the deposit stays in their account and they don't pay it again.

The advantages for the consumer is that they do not need to clean or sort out the empty packaging. They also do not need to carry heavy shopping bags home. Another advantage that Loop offers is premium packaging. Despite the impacts of cleaning, premium design, and transportation, it has a lower carbon footprint than single-use packaging. It also keeps the plastic and other packaging waste away from the environment.

Key features

- **Value Proposition:** Customers pay for the products and they pay a deposit for the reusable packaging.
- **Scale:** Currently, the brand is updating its service after the initial pilots in Paris and New York and online pilot models served in the UK, USA, and France.
- **Market Reach:** The service was piloted in UK, USA, and France.
- **Stakeholders:** Producers, retailers, container cleaning service provider (ecolab), delivery service provider.
- **Location of purchase:** Home
- **Place of Consumption:** At-home
- **Delivery Method:** Products are delivered to consumers' homes.
- **Container Ownership:** Loop wons the containers. Consumers pay a depost to use them.
- **Collection of Containers:** Pickup from Consumer

3- HOME DELIVERY SOLUTIONS

8- KECIPIR: An e-commerce business serving fresh and organic produce from local farmers

Kecipir is an e-commerce business in Indonesia serving fresh and organic produce from local farmers directly to urban consumers through a fully reusable, circular delivery system. Produce is first harvested on-demand through an app-based platform that ensures freshness and best quality, enhancing the user experience for consumers. Then, Kecipir helps deliver the produce directly from the farmer to the consumer in reusable crates. Reduced transport distances and a smaller number of parties involved makes the model economically effective. Kecipir's platform is price competitive as produce can be up to 50% cheaper than supermarket produce, making the model accessible to a wide range of consumers. On Java alone, 80% of fruits and vegetables are wrapped in single-use plastic which have no value in the informal recycling system. Using Kecipir, consumers have convenient and affordable access to organic produce. Farmers get a 40% increase in profit due to a fair and direct market.

Key features

- **Value Proposition:** Consumers pay for the delivery of the organic produce from local farmers directly to their homes.
- **Scale:** Pilot
- **Market Reach:** Indonesia
- **Stakeholders:** Farmers, consumers
- **Location of purchase:** Home
- **Place of Consumption:** Delivered produced is consumed at home.
- **Delivery Method:** The produce is delivered with a van to the consumers' home.
- **Container Ownership:** Reusable crates are owned by Kecipir company.
- **Collection of Containers:** Reusable crates are collected from the consumer at the time of delivery.

4- REUSABLE TAKEAWAY AND DELIVERY SOLUTIONS

9-ALAS: A reusable food and beverage delivery packaging service in Indonesia

ALAS is a returnable packaging both for consumers and restaurants in Indonesia, enabling them to have a more sustainable option when ordering food and beverage deliveries. The plastic waste problem grew with the increase of online food delivery in Indonesia. The aim of this solution is to move from single-use packaging to zero waste food delivery by providing a durable, reusable, and sustainable container and service. Customers order food from the restaurants and the food is delivered in ALAS packaging. Customers return the packaging (through pick-up/drop off) after enjoying their meal. ALAS receives the packaging, cleans and sanitizes it. Then, ALAS restocks the packaging to the restaurants.

ALAS started in June 2021 and is currently at the pilot stage.

Key features

- **Value Proposition:** Consumers pay through an app for the food and beverages and a deposit for the packaging.
- **Scale:** ALAS started in June 2021 and is currently at the pilot stage.
- **Market Reach:** Jakarta, Indonesia.
- **Stakeholders:** Restaurants, consumers
- **Location of purchase:** The food and beverage is delivered to consumers' homes in ALAS packaging.
- **Place of Consumption:** Customers enjoy their orders at home.
- **Delivery Method:** Human distribution
- **Container Ownership:** Packages that has a deposit are sold to consumers.
- **Collection of containers:** Consumers return the packaging back to the restaurants through pick-up or drop off.

4- REUSABLE TAKEAWAY AND DELIVERY SOLUTIONS

10- OZZI: Reusable container service for take-away food

Ozzi is a take-away container service for dining centres in organizations such as universities and companies. Ozzi sells containers, tokens and collection machines to organizations. Consumers pay the dining staff at the organization to buy food and use an Ozzi container. After finishing the food, consumers return their empty container and exchange it for a token at the Ozzi machines. They can use the token for their next meal by handing it to the dining staff. Consumers can leave the system anytime by giving the organization's dining staff their token to receive their deposit back. Containers are made out of recyclable material and reach up to 300 uses. Once a container has become worn down from repeated use it is recycled.

Key features

- **Value Proposition:** Consumers receive a container by a one-time purchase to get into the system. When they return the container to the Ozzi machine, they get a token.
- **Scale:** Commercially available
- **Market Reach:** Today they work with partners across the USA.
- **Stakeholders:** Dining centres in organizations such as universities and companies, container washing centres, consumers.
- **Location of purchase:** Consumers buy their food from any participating organisation.
- **Place of Consumption:** Cunsumers enjoy their meal on the go.
- **Delivery Method:** Human distribution - Consumers buy their meal with the reusable container from any participating organisation.
- **Container Ownership:** Containers are owned by the dining centres in organizations.
- **Collection of containers:** Consumers return their empty container and exchange it for a token at the Ozzi machines.

4- REUSABLE TAKEAWAY AND DELIVERY SOLUTIONS

11- CUPCLUB: Reusable and Returnable cup service for brands and retailers

CupClub is a reusable cup service for brands and retailers. Consumers subscribe to CupClub to use their cups in any of their participating coffee shops and pay the coffee shop for the coffee. Users can check the CupClub app for their nearest drop-off point, return the cups and they are ready for a new order. Cup Club picks up the cups daily from the drop-off points, washes them at commercial kitchens and delivers them to the participating shops who pay a monthly fee for their reusable cup service. CupClub uses RFID tagging to locate the cups. Each cup is designed to last a minimum of 132 use cycles. The cups are recycled into new cups a the end of their use-life.
CupCLub changed its name to ClubZero in October 2021. After that, the brand also included returnable takeaway food and beverage packaging besides cups. CupClub partnered with international brands including Nestle, Starbucks, McDonald's, Coca-Cola, Yum! Brands, Wendy's, Baxter Storey, John Lewis & Partners and Compass Group.

Key features

- **Value Proposition:** Consumers subscribe to CupClub to use the cups and pay to the brands and retailer for the beverage.
- **Scale:** Commercially available
- **Market Reach:** Today they serve customers across the EU and North America.
- **Stakeholders:** Brands, retailers, consumers
- **Location of purchase:** Consumers buy their beverage from any participating coffee shops or retailers.
- **Place of Consumption:** Customers enjoy their beverage on the go.
- **Delivery Method:** Human distribution - Consumers buy their beverage with the reusable cup from any participating coffee shops or retailers.
- **Container Ownership:** Cups are owned by CupClub and returned to the drop-off points by the consumers. Users easily find the drop-off points with the app system.
- **Collection of containers:** CupClub then manages the system of collection through a network of drop-off points, washing, and redistribution.

5- RETURN ON THE GO PAKCAGING

12- KOINPACK: Reusable and returnable packaging service to eliminate single-use packaging

Koinpack is a packaging solution in Indonesia that aims to replace sachets. Sachets are flexible plastic packages that low-income customers prefer to buy products such as shampoo, detergent, and dish soap in small formats. One of the main problems with sachets is their low end-of-life value thus these packages are not collected by waste pickers. They also cannot be recycled so they leak into the environment. Similar to sachets, Koinpack provides daily needs such as soaps, detergent, shampoo, and food in small packages. Koinpack enables its deposit and reward system through a QR code and an application at the Point of Sales. Customers, pay a deposit for each package and bring back the packaging after use to get their deposit back. The packages are then cleaned by Koinpack and transferred to producers for refilling. Another option for the customers is to get their Koinpack packages refilled. In that case consumers clean it themselves.

Key features

- **Value Proposition:** Consumers pay for the content and pay a deposit for the container.
- **Scale:** Koinpack kicked off its first pilot program at 2 sales points in March 2020. Currently, the company is at the start-up stage.
- **Market Reach:** Indonesia
- **Stakeholders:** FMCG producers, point of sales (local warungs, mini markets and waste-banks), consumers
- **Location of purchase:** Store
- **Place of Consumption:** At-home
- **Delivery Method:** Human distribution
- **Container Ownership:** Containers with QR codes have a deposit and they are owned by Koinpack.
- **Collection of containers:** Consumers bring the packaging back to the provider.

6- COMPOSTABLE PAKCAGING

13- BIOFRESHPAK: Bio-based, compostable, and breathable film to reduce food waste

BioFreshPak is a compostable plastic film developed by a team of experts led by Nextek in the UK and MIT in India. It is made from a blend of starch from cassava processing waste and other compostable polymers. This new material is developed aiming to reduce food waste and plastic waste. It is designed to replace standard commercial plastic film which is hardly recyclable and bio-based polymers for film such as PLA, which is slow to decompose outside of a controlled environment. One of the main advantages of BioFreshPak is that it reduces food waste by slowing the moisture loss and improving the storage stability of food during transport, even at high temperatures. BioFreshPak claimed to increase the shelf life of specific foods by two to five days without refrigeration. Research on the packs of pre-cut mushroom shows difference in standard film versus BioFreshPak bioplastic film (bottom) after seven days.
While the film is branded as home compostable, it has yet to be awarded certification for home composting in line with the EU composting standard EN13432.

Key features

Value Proposition: Consumers pay for the content and the packaging.

Scale: The project began in September 2017 and trials have been completed.

Market Reach: India

Stakeholders: Producers, retailers and stores, consumers

13

7- PACKAGING SOLUTIONS LED BY ELIMINATION OF PARTS

14- LUSH COSMETICS: Solid personal care products to eliminate the need for packaging

Lush Cosmetics is a British beauty company that sells solid personal care products for the hair, body, fragrance, oral, and beauty care categories. Most of their products are handmade and they can be taken home from the stores with no packaging. Similarly, the products purchased online are placed directly into the parcel box 'naked'. This strategy takes less storage space, reduces the transport expenses and the packaging material costs. The advantages for the consumers is that the products require less cupboard space and the consumers do not need to carry heavy bottles as solid products are lighter without the water content. Although there are advantages of solid products, they also present unique challenges such as listing the ingredients without a label and presenting the user instructions on how to use the product. Lush developed the Lush Lens App to solve these issues with product recognition. Consumers scan the product with their phone to get the information that they need.

Key features

Value Proposition: Consumers pay for the products without packaging.

Scale: Lush was founded in the UK in 1995, now has over 951 stores in 48 different countries.

Market Reach: 48 different countries globally.

Stakeholders: Suppliers of raw materials, logistic service providers, consumers

Location of purchase: Products can be purchased from the stores or through the online store.

Place of Consumption: Customers use their products at home.

Delivery Method: Human distribution

Container Ownership: No packaging is used for the solid products.

8-B2B REUSABLE PACKAGING

15- SWEDISH RETURN SYSTEM: B2B packaging system of reusable and returnable crates and pallets

Swedish Return System is an Industry-wide shared B2B packaging system. It was established in 1997 led by the Trade Association for Grocery of Sweden (SvDH) and the Swedish Food and Drinks Retailers Association (DLF).
The aim of the Swedish Return System is to replace single-use crates and pallets. In this system reusable and returnable crates and pallets are utilized for distribution by producers, wholesalers, and retailers. Customers pay a user fee and deposit for crates and half-sized pallets, and a daily rent and user fee for full-sized pallets. Swedish Return System manages take-back, washing, quality control, and reuse of the creates and pallets.
The products are put to shelves in these creates thus the grocery store staff save the time that is needed to unpack the products. As the creates weight less than 15 kg, nearly 10 kg lighter than a Euro-pallet, they are easier to handle and carry around.

Key features

Value Proposition: Customers pay a user fee and deposit for crates and half-sized pallets, and a daily rent and user fee for full-sized pallets.

Scale: There are more than 1,500 participating businesses.

Market Reach: Sweden

Stakeholders: Producers, wholesalers, retailers

Container Ownership: Creates and pallets are owned by Swedish Return System.

Collection of containers: Swedish Return System manages take-back, washing, quality control, and reuse of the creates and pallets.

Appendix B

Expert workshop structure

Workshop aim: the aim of this study is to assess the applicability/adaptability of the existing plastic packaging solutions to Indonesian contexts by identifying the social, economic, environmental, and regulatory barriers to implementing or adapting these solutions.

Activities:

There will be two workshops with different experts:

Group 1: Social and economic aspects (at least one expert on social aspects and at least one expert on economic aspects are required);

Group 2: Contextual and regulatory aspects (at least one expert on contextual aspects and at least one expert on regulatory aspects are required);

- Before the workshop, the facilitator emails the identified 10 archetypes and case studies to participants and asks them to read through and become familiar with the cases.
- At the beginning of the workshop, the facilitator explains the workshop and the agenda and answers the questions of the participants (2 min).
- The facilitator gives a short presentation about the archetypes and case studies and answers the questions of the participants (5 min).
- The facilitator presents each archetype and case study and asks the questions below to the participants for each archetype. The questions explore the potential barriers of each case, considering the social, environmental, economic, and regulatory aspects of implementing the cases in Indonesia (1,5 h).
- Questions for the Group 1: Social and Economic Aspects
- Do you think this archetype complies with the social aspects in Indonesia? Why?
- Supportive questions:
- Do you think this archetype complies with the norms in Indonesia? Why?
- Do you think Indonesians would accept this archetype if it is implemented in Indonesia or not? What could be the user acceptance problems or opportunities? Why?
- Do you think this archetype complies with the economic aspects in Indonesia? Why?
- Supportive question:
- Do you think a family with an average income in Indonesia would be able to afford the use of this archetype? Why?
- Questions for the Group 2: Contextual and Regulatory Aspects Group
- Do you think this archetype complies with the infrastructure and technology in Indonesia? Why?
- Do you think this archetype complies with the regulatory aspects in Indonesia? Why?

Concluding discussion: Experts discuss the final points, and the facilitator answers the questions (10 min). The workshop will take 1 h and 30 min.

Appendix C

An example of the expert workshop consent form.

CONSENT FORM

[redacted] Case Study Assessment Workshop

Name of the principal investigator [redacted]

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 21/01/2022 AND 21/03/2022

The participant (or their legal representative) should complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☒	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☒	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☒	☐
Who have you spoken to about the study?		
Do you understand that you will not be referred to by name in any report concerning this study?	☒	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☒	☐
• You don't have to give any reason for withdrawing	☒	☐
• Choosing not to participate or withdrawing will not affect your rights	☒	☐
• You can withdraw your data any time until 10 days after your participation	☒	☐
I agree to the workshop being audio and video recorded	☒	☐
I agree to the use of non-attributable quotes when the study is written up or published	☒	☐
The procedures regarding confidentiality have been explained to me	☒	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☒	☐
I agree to take part in this study.	☒	☐

Signature of research participant:	
Print name: [redacted]	Date: 11 February 2022

Appendix D

Table A1. List of codes derived from the expert workshops.

Number	Code	Category
	1. Refill Stations	
Algramo		
1	brand loyalty (high- and middle-income group)	sociocultural
2	price	economic
3	affordability	
4	buying on credit (low-income group)	
5	should be easy to use	sociocultural inconvenience
6	vending machines are not common	sociocultural
7	educating people about the concept and how it works	
8	refill is a new behaviour	
9	bringing a container is a new behaviour	
10	changing purchasing habits	
11	sachets are popular	
12	finding the right location for the vending machines	contextual
13	maintenance of the equipment	
Water ATM		
14	inconvenience	sociocultural inconvenience
15	remembering to bring a bottle	sociocultural habits and behaviour change
16	it needs to be normal to use the new thing	
17	confidence of the user: people might not feel confident to use something that is not normal	
18	educating people to use it	
19	bringing tumblers	
20	hygiene	sociocultural barriers and habits and behaviour change
21	regular maintenance of the machine	contextual barriers-technical
22	people with low-income would not want to pay for water	economic barrier
23	people with low incomes boil the water	
24	bottled water is very cheap	
Ecover		
25	some people do not care about the environment	sociocultural barriers: lack of knowledge about the environmental impacts
26	the price should be affordable	economic barriers
27	it should be possible to buy affordable amounts	
28	forgetting to bring containers	sociocultural barriers: habits and behaviour change
29	buying small amounts may not feel normal	

Table A1. *Cont.*

Number	Code	Category
	2. Refill at home solutions	
Soda Stream		
30	identifying the right target audience	contextual barriers: technical
31	people do not like/drink soda	sociocultural barriers
	Faith in Nature	
32	a 5 L package is huge	sociocultural barriers: inconvenience
33	not practical	
34	transporting large packages home is difficult	sociocultural barriers: inconvenience
35	it should be easy to carry with a motorcycle	
36	persuading people to use a new thing	
37	the habit of buying in bulk is not common	sociocultural barriers: habits and behaviour change
38	storage problem	sociocultural barriers: inconvenience
39	no purchasing power to buy in bulk	economic barrier
	3. Home Delivery Solutions	
EcoPure		
40	people with low incomes boil the water	economic barrier
41	this is for people with middle and high incomes	
Loop		
42	online shopping is a new behaviour for some people	sociocultural barriers
43	hygiene	
44	should be easy to use	
45	deposit can be a barrier if it is high	economic barrier
46	deposit does not work for most people	
47	this packaging is expensive	
48	containers should be robust	contextual barriers: technical
49	proper labelling telling what is inside	
Kecipir		
50	not for people with low incomes	economic barrier
51	more expensive than the farmers' market	
52	need to change people's behaviour	sociocultural barriers: habits and behaviour change
53	some people like to choose their fruits and vegetables	
54	identifying the right target audience is difficult	contextual barriers: technical

Table A1. *Cont.*

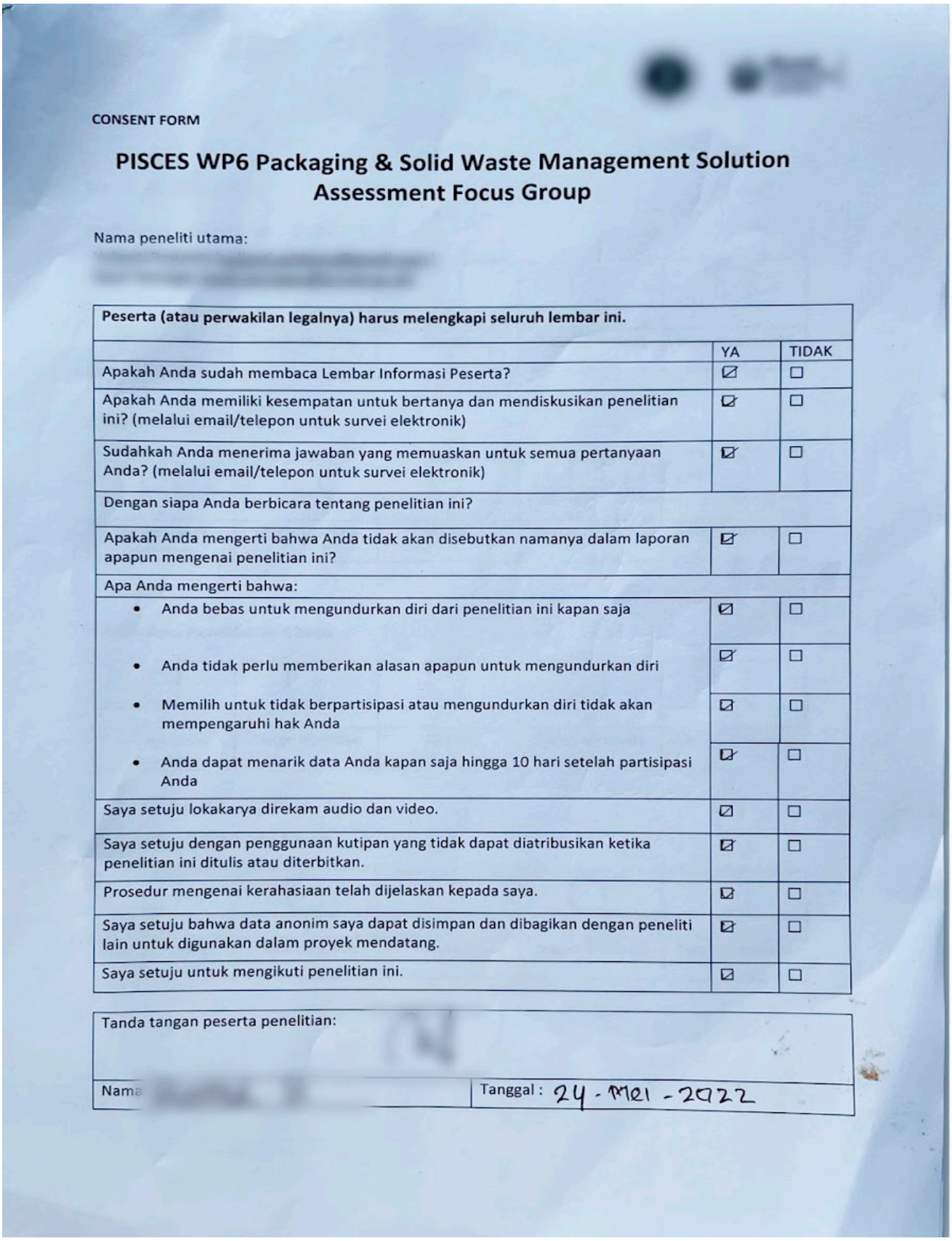
Number	Code	Category
	4. Reusable Takeout and Delivery	
Alas		
55	hygiene	sociocultural barriers: contamination and hygiene concerns
56	the packaging should fit the Indonesian food (rice and stew type)	
57	not for people who do not care about the environment	sociocultural barriers
58	need to make it trendy with good packaging	contextual barriers
59	spillage is a problem as it is transported with motorcycles	
60	Expensive	economic barriers
61	not for people with low incomes	
Ozzi		
62	maintenance of the machine	contextual barriers
63	people would not take good care of the machine	sociocultural barriers
64	expensive for people with low incomes	economic barriers
CupClub		
65	downloading the app is a hassle	sociocultural barriers
66	people forget to bring tumbler	behaviour change
67	all the other coffee shops need to use this model collaboration between other coffee shops is difficult	contextual barriers
	5. Return on-the-go Packaging	
Koinpack		
68	price is important	economic barrier
69	this is for the middle and upper class	
70	brand loyalty can be a barrier	sociocultural barriers
71	Inconvenience	sociocultural barriers
72	they do not need to bring sachets back	
73	return is a hassle	sociocultural barriers
74	people do not understand that sachets are the problem	
75	educating people about why sachets are problem	
76	open burning is considered to be a normal behaviour	
77	hygiene	sociocultural barriers
78	awareness about environmental problems is necessary	sociocultural barriers
79	people need to hear about this solution	
80	we need legislation to change people's behaviour	regulatory barrier
81	legislation to ban sachets is needed	
82	lack of waste management services	contextual barriers

Table A1. *Cont.*

Number	Code	Category
	6. Compostable Packaging	
BioFreshPak		
83	people may mistake it with plastic	sociocultural barriers
84	waste segregation at home is a problem	
85	it can contaminate the recycling stream	
86	it is a challenge to keep it away from the plastic recycle stream	contextual barriers
87	Indonesia is a hot and wet country; how long does it take to degrade	
88	packaging may dissolve before the expiry date of the product	
	7. Packaging Solutions Led by Elimination	
Lush Cosmetics		
89	expensive	economic barriers
90	how long would they last in Indonesia, which is a hot and wet country	contextual barriers
	8. B2B Reusable Packages	
Swedish Crates		
91	convincing the retailers to use this	contextual barriers
92	identifying where can you use this in a business's supply chain	
93	hygiene needs to be guaranteed	
94	we need the legislation to make this much more cost effective	regulatory barriers
	9. Substitution to a Non-Plastic Material	
KeepClip		
95	canned drinks are not common	sociocultural barriers
	10. Plastic Recycling	
Evolve-Waitrose		
96	waste collection and management are the problems	contextual barriers
97	the recycling system is a problem	
98	without collection you cannot recycle	
	final overall comments by the participants	
99	the government should incentivize using recycled content	regulatory barriers
100	the government should encourage these solutions	
101	the government should nudge businesses to this direction	
102	regulations are needed to incentivize businesses to use these solutions	

Appendix E

An example of the FGD consent form.



CONSENT FORM

PISCES WP6 Packaging & Solid Waste Management Solution Assessment Focus Group

Nama peneliti utama:

Peserta (atau perwakilan legalnya) harus melengkapi seluruh lembar ini.		
	YA	TIDAK
Apakah Anda sudah membaca Lembar Informasi Peserta?	☑	☐
Apakah Anda memiliki kesempatan untuk bertanya dan mendiskusikan penelitian ini? (melalui email/telepon untuk survei elektronik)	☑	☐
Sudahkah Anda menerima jawaban yang memuaskan untuk semua pertanyaan Anda? (melalui email/telepon untuk survei elektronik)	☑	☐
Dengan siapa Anda berbicara tentang penelitian ini?		
Apakah Anda mengerti bahwa Anda tidak akan disebutkan namanya dalam laporan apapun mengenai penelitian ini?	☑	☐
Apa Anda mengerti bahwa:		
• Anda bebas untuk mengundurkan diri dari penelitian ini kapan saja	☑	☐
• Anda tidak perlu memberikan alasan apapun untuk mengundurkan diri	☑	☐
• Memilih untuk tidak berpartisipasi atau mengundurkan diri tidak akan mempengaruhi hak Anda	☑	☐
• Anda dapat menarik data Anda kapan saja hingga 10 hari setelah partisipasi Anda	☑	☐
Saya setuju lokakarya direkam audio dan video.	☑	☐
Saya setuju dengan penggunaan kutipan yang tidak dapat diatribusikan ketika penelitian ini ditulis atau diterbitkan.	☑	☐
Prosedur mengenai kerahasiaan telah dijelaskan kepada saya.	☑	☐
Saya setuju bahwa data anonim saya dapat disimpan dan dibagikan dengan peneliti lain untuk digunakan dalam proyek mendatang.	☑	☐
Saya setuju untuk mengikuti penelitian ini.	☑	☐

Tanda tangan peserta penelitian:	
Nama	Tanggal : 24 - MEI - 2022

Appendix F

Table A2. FGD structure including the research protocol, explanation of the stages of the user journeys, and group discussion.

Steps	Research Activities	Details of the Research Activities
Step 1	Research protocol	Before the FGD session, the research protocol, including the participant information sheet and the consent form, is sent to inform the participants. Five/six participants are invited to the venue for each FGD session.
Step 2	FGD Introduction: explaining the case	The visualised user journey of the first case is shown and explained to participants. They are given a few minutes to learn how the stages of the user journey work for this case. Subsequently, the moderator explains each service touchpoint to ensure participants fully understand.
Step 3	Individual reflection	Participants are invited to use the posits and write on them about what they like and do not like; they see for each stage of the user journey from purchase to use and disposal.
Step 5	Group discussion	Participants are invited to sit around the table. The moderator asks them questions about each stage of the user journey from purchase to use and disposal to identify the user adoption issues. I. Do you think you would use it if it were available in your neighbourhood? Why? Why not? II. What do you think about the purchase/use/reuse or disposal process of this case? III. Do you think there is anything that can be improved about the purchase/use/reuse or disposal process of this case? IV. The moderator asks participants to rate the level of their user acceptance for the purchase/use/reuse or disposal process of the case according to this scale: strongly unacceptable, unacceptable, neutral, acceptable, and strongly acceptable.
Step 6	5 cases	The same process is repeated for the other remaining cases.
Step 7	Conclusion	The moderator answers the questions of the participants and closes the FGD session.

Appendix G

Table A3. List of codes derived from the data collected in focus group discussions.

Number	Code	Category
Algramo 0.1		
1	do not want to pay the deposit	economic
	prefer to pay cash	economic
2	do not care about the environmental problems	sociocultural: environmental awareness
3	do not want to carry their container	sociocultural: inconvenience
4	too difficult	sociocultural: inconvenience
5	easier to buy directly from the warung	sociocultural: inconvenience
6	too complicated	sociocultural: inconvenience
7	it is difficult for old people	sociocultural: inconvenience
8	want something not too complicated	sociocultural: inconvenience

Table A3. *Cont.*

Number	Code	Category
9	it is difficult for villagers	sociocultural: inconvenience
10	do not want to put in extra effort	sociocultural: inconvenience
11	putting money in the card is an extra work	sociocultural: inconvenience
12	do not have any containers for this purpose	sociocultural: inconvenience
13	educating people how to use this service	sociocultural: habits and behaviour change
14	teaching people how to use these machines	sociocultural: habits and behaviour change
15	want the warung to do all the steps for them	sociocultural: habits and behaviour change
16	want to be served	sociocultural: habits and behaviour change
17	Maintaining the hygiene of the reused containers	sociocultural: contamination and hygiene concerns
Algramo 0.2		
1	a touch screen is too complicated	contextual: technological barriers
2	old people do not know how to use technology	contextual: technological barriers
3	there must be someone to help to use the touchscreen	contextual: technologic barriers
4	the cellular data signal is not good in rural areas	contextual: technologic barriers
5	old people do not have smartphones	contextual: technologic barriers
6	some people do not have smartphones	contextual: technologic barriers
7	prefer paying cash also because not all people have ''androids''	contextual: technologic barriers
8	must be a fixed schedule to visit the neighbourhood	sociocultural: inconvenience
9	do not want to wait for the van to come	sociocultural: inconvenience
10	not convenient for urgent needs	sociocultural: inconvenience
11	not bothered to use it	sociocultural: habits and behaviour change
12	there must be someone to help customers	sociocultural: habits and behaviour change
13	want to use plastic packaging because they sell it after use	economic
MIWA		
	do not want to download and use the mobile app	contextual: technological barriers
	using mobile app is hard for uneducated people	contextual: technological barriers
	some people do not have smartphones	contextual: technological barrier
	the mobile app should be easy to use and easy to understand	sociocultural: inconvenience
	Mobile apps are complicated	sociocultural: inconvenience
	online shopping is easier than using the MIWA service	sociocultural: inconvenience
	want to pay in cash	sociocultural: habits and behaviour change

Table A3. *Cont.*

Number	Code	Category
ALAS		
	it is important to know the cleaning process of containers	sociocultural: hygiene
	doubtful of the hygiene and sterilisation	sociocultural: hygiene
	not comfortable with eating out of containers used by someone else	sociocultural: hygiene
	containers cannot be hygienic it is not possible	sociocultural: hygiene
	want to return the container just after the food is delivered	sociocultural: inconvenience
Koinpack		
	not sure about the brand of the product in the packages	sociocultural: habits and behaviour change
	my skincare products are special for my skin	sociocultural: habits and behaviour change
	Want the brand they normally go for	sociocultural: habits and behaviour change

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