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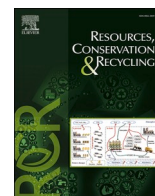
Miao, Xueqing; Magnier, Lise; Mugge, Ruth

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Switching to reuse? An exploration of consumers' perceptions and behaviour towards reusable packaging systems

Xueqing Miao [a,*], Lise Magnier [a], Ruth Mugge [a,b]

[a] *Faculty of Industrial Design Engineering, Delft University of Technology, Landbergstraat 15, Delft, 2628CE, The Netherlands*
[b] *Amsterdam Business School, University of Amsterdam, Plantage Muidergracht 12, Amsterdam, 1018TV, The Netherlands*

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ABSTRACT

Reusable packaging systems (RPSs) can significantly reduce single-use packaging waste. However, knowledge about consumers' adoption of this kind of packaging is scarce. We adopted a qualitative approach using in-depth interviews with consumers ($n = 27$) who had actually used an RPS and follow-up phone interviews to capture consumer behaviour at home. This exploratory study examines how packaging and system design not only influence usage by consumers but also serve as enablers and barriers for consumers at different stages of the consumption process. Our findings uncover that although consumers generally exhibited positive attitudes and good feelings about reducing packaging waste by using an RPS, they also raised concerns, such as about product quality, safety, contamination and financial investments, and they expressed scepticism about the environmental impacts through using the system and reported inconveniences at different stages. These results provide a comprehensive understanding of consumers' perceptions of RPSs and can facilitate further development.

1. Introduction

Product packaging serves multiple functions, including efficient product storage, product protection and preservation, promoting hygiene and safety, and facilitating distribution (Rundh, 2005). However, most packages have a short lifetime, becoming waste immediately after the contents are consumed or transferred. Although the recycling and recovery rate in the European Union (EU) has increased steadily, the volume of packaging waste generated per citizen increased from 163.3 kg in 2007 to 177.2 kg per citizen in 2020 (Eurostat, 2022). Consequently, excessive packaging production and consumption pose a threat to the natural environment and human health through a waste of resources, littering and accumulation, as well as landfilling and incineration.

Past research has mainly focused on reducing and recycling but has largely ignored the reuse of packaging, which can successfully limit the use of virgin material and have a positive environmental impact on waste reduction and resource conservation (Ertz et al., 2017). The International Organization for Standardization [ISO] defined reusable packaging as 'packaging or packaging components that have been designed to accomplish a minimum number of trips or rotations in a system for reuse' (ISO:18,603, 2013). With a fast-growing need for

sustainable consumption, retail is actively exploring possibilities for various packaging reuse models. As a result, numerous companies have implemented reusable packaging systems (RPSs) for fast-moving consumer goods (FMCG). For instance, Ecover offers refillable packages for cleaning products that consumers can fill in-store from bulk dispensers; and British supermarket chain Tesco in partnership with Loop provides some daily products packaged in reusable containers and requests consumers to return empty packages for reuse purposes. RPSs can be broadly divided into two types (Greenwood et al., 2021; Muranko et al., 2021): (1) returnable packaging systems, where the companies in the supply chain repeatedly clean and refill the packaging with products (e. g. Tesco) and (2) refillable packaging systems, where consumers are responsible for the cleaning and refilling of the packaging (e.g. Ecover). It is important to highlight that some RPSs integrate features of both types in one system (Coelho et al., 2020). For example, the RPS investigated in the present study consists of packages that can either be repeatedly refilled and cleaned by consumers or returned to the company to be cleaned and then reused by another consumer.

Although these solutions are promising to lower the amount of packaging waste, their success strongly depends on consumer adoption. Nowadays, consumers are paying more attention to the environmental impact of their consumption, but this awareness does not necessarily

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* Corresponding author.
  E-mail address: X.Miao@tudelft.nl (X. Miao).

lead to behaviour change (Heidbreder et al., 2019; Herrmann et al., 2022). There is a limited understanding of consumer attitudes and behaviour towards RPSs. A few notable exceptions are studies investigating consumers' first responses by testing these systems via visuals and storyboards (e.g. Long et al., 2022; Miao et al., 2021). Other studies have used online surveys to explore different types of packaging and reuse models that consumers are willing to adopt (Greenwood et al., 2021; Jiang et al., 2020); emotional and social factors associated with consumers' shifts from single-use to reuse (Keller et al., 2021); and the role of context, motivations and culture in consumers' reuse behaviour (Ertz et al., 2017). Although these studies are valuable, they only provide fragmented knowledge about consumers' adoption and are limited to consumers' preliminary reactions to hypothetical usage. There is a need for research investigating consumer responses after the actual experience of an RPS.

This paper starts by presenting a literature review on why consumers have not yet widely adopted RPSs and describes the knowledge gap that is addressed by our study. Subsequently, we present the research methodology and elaborate on how participants used an RPS and were interviewed about this experience. Next, we elaborate on the results of the semi-structured interviews exploring consumers' general reactions to the RPS and the enablers and barriers of adoption. Finally, we discuss the theoretical and practical implications of our results and propose suggestions for future research, which can help shape future packaging solutions and increase their societal impact.

2. Potential barriers to consumer adoption of reusable packaging systems

Switching to reuse can be difficult. One recent consumer research indicated that although 85% of people want to buy products in reusable packaging, only 16% of people actually engage with RPSs (Poole, 2019), suggesting that consumers face barriers towards reuse. Previous literature has uncovered several factors that may negatively influence consumer adoption of RPS and broadly clustered these into three aspects: the inconvenience of reuse behaviours, contamination concerns about the shared access to the system and the hampered functional features of the reusable packaging. Below, we elaborated on each aspect.

2.1. Reusing packaging is inconvenient

As RPSs are not widely applied, consumer actions can be limited by a lack of availability of the reuse-enabling infrastructure (Singh and Cooper, 2017; Steinhorst and Beyerl, 2021). Meanwhile, recycling has become a deeply entrenched norm, and well-established recycling schemes have been developed in past decades in many European countries. Consequently, consumers are more willing to recycle the packaging than reuse it (Greenwood et al., 2021; Kunamaneni et al., 2019). Using RPSs can be perceived as inconvenient, resulting in a shopping experience that consumes much time and effort, such as returning empty packaging to retailers or refilling products in-store (Jiang et al., 2020; Lofthouse et al., 2009; Zhu et al., 2022). A limited product range and the possibility that specific products will be unavailable increase the uncertainty of the purchase (Beitzen-Heineke et al., 2017). Furthermore, a potentially higher packaging cost or an upfront deposit hinders consumer adoption (e.g. Long et al., 2022). However, to our knowledge, all prior results are generated from consumer responses to hypothetical usage, making it difficult to capture what inconveniences may occur during the actual use of RPSs.

2.2. Repeated usage and shared access bring contamination concerns

Reusable packaging is designed for multiple uses and can only be considered environmentally better than its single-use equivalent after it has been reused a minimum number of times (Cottafava et al., 2021). This can be challenging for consumers because frequent washing,

transportation and refilling will cause signs of use and superficial damage on the packaging over time. This wear and tear on the packaging can act as a contamination cue, activate concerns about health and safety (White et al., 2016) and thus hinder acceptance (Magnier and Gil-Pérez, 2021) or trigger replacement. In addition, research on contaminated interactions revealed that people are less willing to use products that belong or have belonged to someone else due to the fear of contamination (Baxter et al., 2016). Some hygiene issues also emerge in the use context of RPSs, such as sharing use of the system with unfamiliar users or seeing others touch the packaging (Long et al., 2022). It is however not yet fully understood how these concerns influence consumer adoption.

2.3. The functions of packaging in RPSs can be hampered

Packaging provides a wide range of functionalities and benefits that consumers consider crucial (Löfgren and Witell, 2005). Packaging is capable of attracting consumer attention, triggering aesthetic appreciation (Celhay and Trinquecoste, 2015), and bringing expectations about price and quality, taste, naturalness and health (Becker et al., 2011; Magnier et al., 2016; Van Rompay et al., 2016). Furthermore, the packaging informs consumers regarding the contents, instructions, and storage conditions of products (Singh et al., 2016), ensures the hygiene of products against germs (Lindh et al., 2016), and prevents food waste and loss (e.g. Verghese et al., 2015; Steenis et al., 2017). Packaging can also facilitate product usage by making it easy to open, pour/take out the product, reseal and empty (Williams et al., 2012). It is also acknowledged that the environmental aspects of packaging design play a significant role in consumer choices (Rokka and Uusitalo, 2008; Magnier and Schoormans, 2015). However, those functions have thus far been investigated only in the context of single-use packaging. We lack an understanding of RPSs, especially how consumers perceive RPSs if certain packaging functions are missing due to the fundamental nature of reuse. It is worth exploring how these missing functions may influence consumers' purchase decisions and how to compensate for these through packaging or system design.

3. Method

3.1. Semi-structured interviews

Semi-structured, in-depth interviews were conducted with participants who used an RPS that was being implemented in a few, specialised supermarkets at the time the study took place (November/December 2021). This enabled us to test consumers' first impressions and reactions to an actual working system. We selected semi-structured interviews because participants can provide depth, insight and understanding from their personal perspectives on consumer behaviour, motivations and experiences concerning topics selected by researchers (Patton, 2002). Before data collection, the research set-up was piloted to test the procedure and questions.

3.2. Participants

We recruited participants via a university-based consumer panel. To enable in-person interviews, we selected 27 participants that lived close to the university, varying in age (18–74 years; mean: 50.6 years), gender (44% male; 56% female), monthly income and education level. Each participant received monetary compensation (15euro voucher) for their participation.

3.3. Stimulus and procedure

The RPS used in this study integrated the functions of filling products from airtight dispensers, weighing products and printing product information on labels. Instructions were presented on a touchscreen

embedded in the system. In this system, consumers can use their own reusable containers or pay a deposit to use the system's standard refillable packaging, which they can then use multiple times until they return it in the supermarket and get their deposit refunded. In the latter case, the standard packaging is cleaned by the RPS provider and reused by another consumer or properly recycled when it has too much damage. This allowed us to generate comprehensive consumer insights about the RPS, in supermarket-like settings (Fig. 1). Six dry food products (i.e. lentils, rice, porridge, coffee beans, cookies and crackers) were provided by the system (Fig. 2). No brand was specified for these products to prevent participants' potential biases.

The study consisted of two parts. First, in-person interviews took place in a consumer research lab facility of the university, where the RPS was installed. The lab facility ensured high-quality video and audio recordings. The second part consisted of follow-up phone interviews conducted about two weeks after the in-person interviews.

Each in-person interview lasted between 40 and 60 min. It started with an introduction about the procedure, data confidentiality and research purpose, after which the participant could ask questions. All participants signed informed consent. As a first task, each participant was asked to use the RPS by filling products from the dispensers in three different packages: two reusable packages of different sizes and one private container brought by the participant (Fig. 3). This encouraged participants to share their insights on different types of packaging and helped us understand their preferences. For all packages, participants first selected the food product, then dispensed it in the packaging, weighed the amount of food and printed a label. Through several semi-structured questions, participants described their general feelings about operating the RPS, their packaging preferences, what would motivate or dissuade their adoption of reusable alternatives, and the perceived environmental impact of the RPS. The interview concluded with questions about the participant's evaluation of different RPSs available on the market (Loop, Ecover, Pieter Pot and MIWA), which were presented as visuals and supporting text. After the interview, we asked participants to take the reusable container they had filled with cookies and use it at home. Finally, we scheduled a 10–15minute follow-up phone interview with each participant about two weeks after this interview. The follow-up interview aimed at understanding consumer behaviour (e.g. cleaning and storing) related to this refillable packaging at home, and collecting additional thoughts that came up after the interview, therefore providing a holistic overview of consumer behaviour in the different use stages of the RPS.

3.4. Data analysis

All interviews were audio-recorded, transcribed, and coded using Atlas.ti software. The coding followed an inductive procedure intending to group conceptually similar topics into more general codes. First, individual quotes were coded. Second, codes with similar meanings were
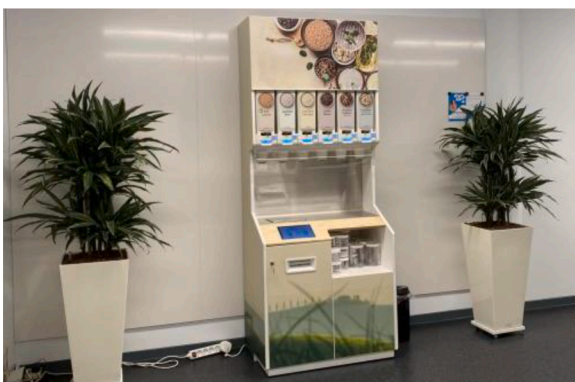

Fig. 1. Research set-up.

Fig. 2. Six food products provided by the system.

grouped into categories. Third, categories were clustered into three themes. To ensure reliability and avoid misinterpretation of the data, the organization of the codes, categories and themes was discussed and iterated amongst the research team. We prevented irrelevant or overlapping codes or categories. The last iteration of coding resulted in a final set of 132 codes and 16 categories fitting in three overarching themes. See Table 1 for an example of the coding structure.

4. Results

Our main research findings are presented in three themes and 16 categories. Fig. 4 provides an overview of the uncovered categories, which are organised according to three dimensions. First, the 16 categories are clustered vertically according to the three themes: consumers' general reactions to RPSs and important design aspects that impact their usage; possible enablers for consumers to switch to RPSs; and barriers that can result in a reluctance to use RPSs in the long term. Second, categories are organized horizontally based on the adoption stages where they occurred: pre-purchase evaluation, system usage and post-purchase behaviour. Third, these categories are related to the following three aspects of RPSs: reuse behaviours, the dispensing system and its features, and the reusable container and its features, which are marked by different symbols (Δ□○).

4.1. General reactions to the RPS experience

4.1.1. Positive attitude towards reuse models

Participants' initial reactions towards the RPS were predominantly favourable and they reported a high willingness to adopt reusable packaging to prevent domestic packaging waste if the product quality and price were satisfactory. This indicates that the potential for consumer acceptance of RPSs is promising.

Comparing the options of refilling and returning the package after usage, most participants preferred to keep reusing the same packaging as long as it remains functional rather than returning it every time for an empty replacement. This preference lies in their consideration of the energy consumption of collective cleaning and transportation, and because they did not believe that containers need to be cleaned and redistributed after each use. Therefore, most participants perceived that refilling the same packaging results in better environmental performance than returning it and getting a clean one to refill.

4.1.2. Design of the dispenser

Novelty. At first glance, participants indicated that the appearance of the RPS differed from the normal prepackaged products displayed on shelves. Most participants stated that the novel appearance surprised them and would trigger exploration while shopping.

Naturalness. Participants expected the dispenser to have a natural appearance because this would make them feel that the system enabled sustainable actions and was filled with superior products. Participants reported that several design elements, such as mild colours, natural
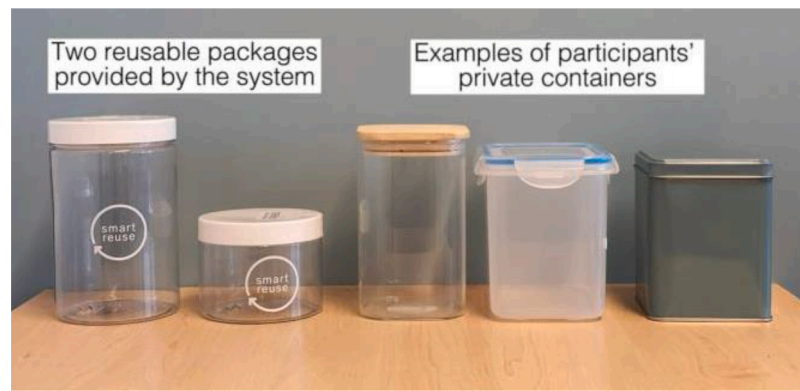
Fig. 3. Packages used in the study.

Table 1
An example of coding structure.

Theme	Categories	Codes
General reactions to the experience of an RPS	Design of the dispenser	Novel appearance triggers exploration Naturalness evokes an association with sustainable behaviour Transparency enables the evaluation of the content The product stock should be indicated Sensory interactions are enjoyable

materials and printed food pictures, could contribute to a natural appearance and stimulate purchase.

Transparency. Before filling the container, participants strongly desired to see what the product looks like. The opaque dispensers used in this study caused participants to feel more uncertain about the freshness and quality of the product inside. They indicated that opaque dispensers led to a high chance of getting unwanted items. Besides, participants could not assess how much food was available in the opaque dispenser, which made them afraid that the dispenser would not give them enough.

Sensory interactions. Compared to simply picking up a prepackaged product from the shelf, participants experienced several sensory interactions with products when they operated the RPS. These sensory interactions positively affected their evaluations. Participants reported that products came out of the dispenser with a pleasant pouring sound, which gave them a sense of joy. The smell of the food triggered direct contact with the food, which created positive inferences about quality and flavour and contributed to hedonic pleasure.

4.1.3. Complexity of using a new system

Participants reported that learning to use an RPS can at first be difficult, especially for those who are not confident in understanding digital instructions. Some participants stated they needed more explanations on how to use the system before starting its use. Clear step-by-step instructions and explanations of major functional components were deemed necessary to understand how to use the system properly.

Participants reported that manual control of the product flow was difficult. Consequently, some product spillage occurred; the overflow was regarded as food waste, which conflicted with the participants' intention to be sustainable and evoked feelings of embarrassment. Therefore, most participants wished for greater control and consistent product flow.

Some unpredictable system performance failures regarding the software (e.g. incorrect displays) or the mechanics (e.g. stuck products) occurred in the study. Participants stated they would be nervous and impatient if they were trying to solve such problems in a busy supermarket. It is worth noting that when failures occurred, participants tended to blame themselves rather than the system and questioned their competence in using the system. When this happened, the participants expected to receive quick responses or help from the system.

Most participants indicated that if they could not quickly solve the problem and adequately dispense their product, they would be frustrated and turn to a prepackaged product. Performance failures can thus interrupt the habit formation of buying products in reusable packaging to replace prepackaged products.

4.1.4. Design of the reusable container

Unlike single-use packaging, a reusable container is used multiple times. Consequently, consumers see and use it frequently in their daily life. As a result, participants reported the attractiveness of the container as important. Specifically, many of the participants stated that they favoured a minimalistic and transparent design. Most participants preferred stackable cuboid containers as those take up less room in kitchen cupboards. They also expected a variety of designs to fulfil different demands. Many participants stated they appreciated the option of using private containers.

In most refill systems, the RPS prints a sticker for the consumer after dispensing the product. This sticker is necessary to provide the information that is included on most conventional packaging. Participants stated the sticker should also be aesthetically pleasing and easily removable afterwards.

Next to the sticker, the lid was perceived as the most critical component of the reusable container. Participants reported it should be easy to open, reclosable and tight to ensure protection during transportation (to avoid leakage) and preservation at home (to keep products fresh).

Participants also identified several preferred features of the packaging material. They indicated that it should be safe for storing food, lightweight for transportation, scratch-proof over multiple reuse cycles, and recyclable at the end of its life.

Table 2 shows example quotes of participants.

4.2. Enablers to switch from single-use packaging to RPSs

4.2.1. Environmental value

Overall, participants were aware of the over-consumption of plastic packaging and the short lifespan of most FMCG packaging. Most participants complained that disposable plastic packaging constituted the major waste in their households. They were looking for solutions and saw RPSs as an opportunity to help them reduce their plastic consumption and waste.

Some products were perceived to have a stronger negative environmental impact in terms of packaging waste than others, such as products in robust packaging (e.g. detergent in hard plastic bottles, jam and spices in glass jars), products consumed frequently (e.g. pasta, rice and cereals), products packaged in excessive packaging (e.g. cookies and
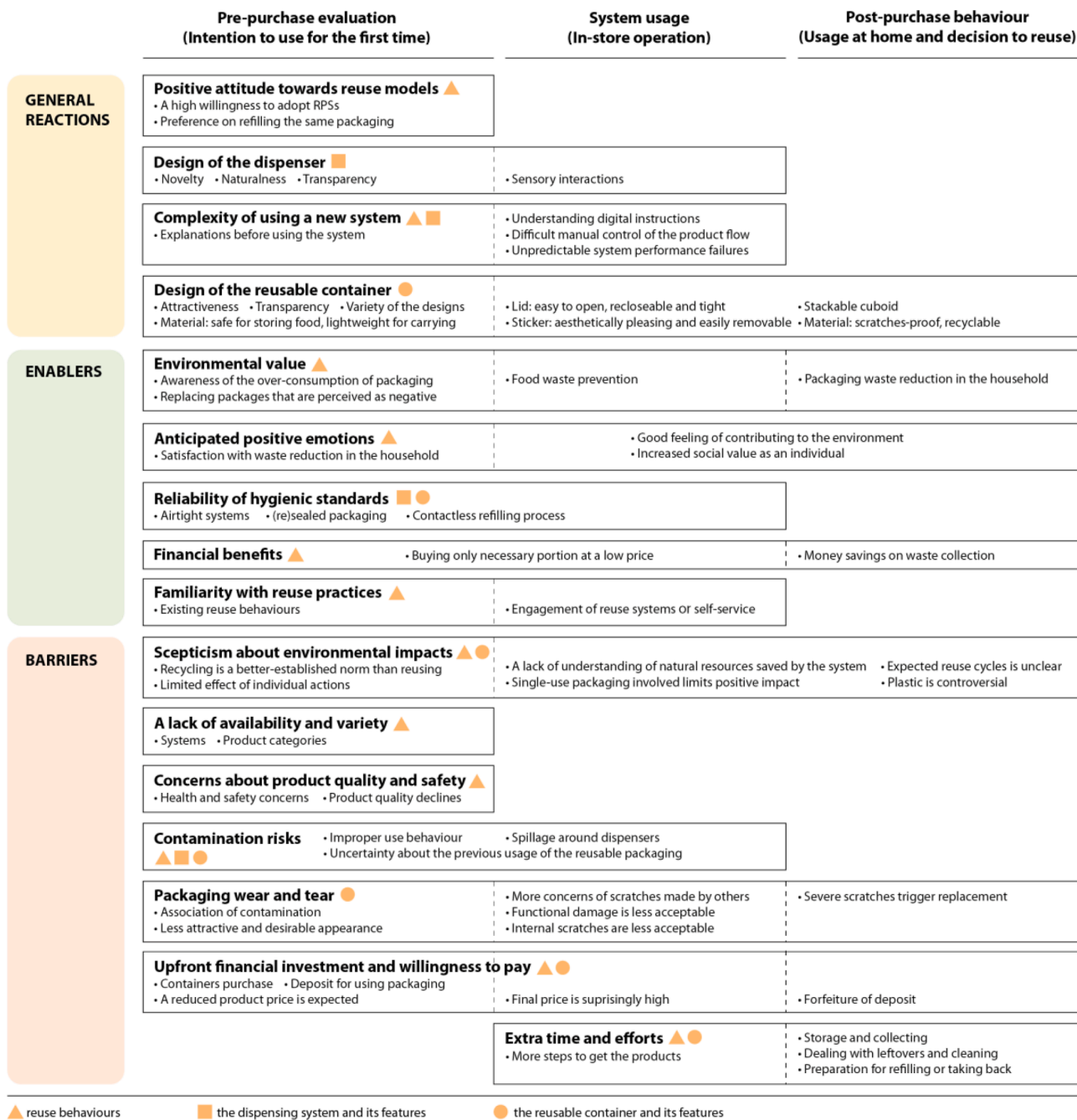
	Pre-purchase evaluation (Intention to use for the first time)	**System usage (In-store operation)**	**Post-purchase behaviour (Usage at home and decision to reuse)**
GENERAL REACTIONS	**Positive attitude towards reuse models** ▲ • A high willingness to adopt RPSs • Preference on refilling the same packaging		
	Design of the dispenser ■ • Novelty • Naturalness • Transparency	• Sensory interactions	
	Complexity of using a new system ▲■ • Explanations before using the system	• Understanding digital instructions • Difficult manual control of the product flow • Unpredictable system performance failures	
	Design of the reusable container ● • Attractiveness • Transparency • Variety of the designs • Material: safe for storing food, lightweight for carrying	• Lid: easy to open, recloseable and tight • Sticker: aesthetically pleasing and easily removable	• Stackable cuboid • Material: scratches-proof, recyclable
ENABLERS	**Environmental value** ▲ • Awareness of the over-consumption of packaging • Replacing packages that are perceived as negative	• Food waste prevention	• Packaging waste reduction in the household
	Anticipated positive emotions ▲ • Satisfaction with waste reduction in the household	• Good feeling of contributing to the environment • Increased social value as an individual	
	Reliability of hygienic standards ■● • Airtight systems • (re)sealed packaging • Contactless refilling process		
	Financial benefits ▲	• Buying only necessary portion at a low price	• Money savings on waste collection
	Familiarity with reuse practices ▲ • Existing reuse behaviours	• Engagement of reuse systems or self-service	
BARRIERS	**Scepticism about environmental impacts** ▲● • Recycling is a better-established norm than reusing • Limited effect of individual actions	• A lack of understanding of natural resources saved by the system • Single-use packaging involved limits positive impact	• Expected reuse cycles is unclear • Plastic is controversial
	A lack of availability and variety ▲ • Systems • Product categories		
	Concerns about product quality and safety ▲ • Health and safety concerns • Product quality declines		
	Contamination risks ▲■●	• Improper use behaviour • Spillage around dispensers • Uncertainty about the previous usage of the reusable packaging	
	Packaging wear and tear ● • Association of contamination • Less attractive and desirable appearance	• More concerns of scratches made by others • Functional damage is less acceptable • Internal scratches are less acceptable	• Severe scratches trigger replacement
	Upfront financial investment and willingness to pay ▲● • Containers purchase • Deposit for using packaging • A reduced product price is expected	• Final price is suprisingly high	• Forfeiture of deposit
		Extra time and efforts ▲● • More steps to get the products	• Storage and collecting • Dealing with leftovers and cleaning • Preparation for refilling or taking back

▲ reuse behaviours   ■ the dispensing system and its features   ● the reusable container and its features

Fig. 4. Overview of categories covering general reactions to RPSs, enablers and barriers of adoption of RPSs at different stages of the consumption process (from left to right: pre-purchase, system usage and post-purchase), and in relation to aspects of reuse behaviours (∆), the dispensing system (□) and the reusable container (○).

candies) and products packaged in non-recyclable packaging (e.g. coffee in laminated plastic packaging). Participants stated they were more likely to adopt RPSs to replace these types of prepackaged products. Organic products and fairtrade products were perceived as more suitable for use in RPSs.

Furthermore, participants stated that RPSs enabled them to customize product portions based on demands, which helped them better plan their product consumption and prevented food waste.

4.2.2. Anticipated positive emotions

Many participants anticipated that noticing less waste in their households would spark positive emotions; although they would only assess this reduction in general terms, rather than precisely quantifying the resources conserved, they anticipated satisfaction with this result.

Participants said that sometimes they were aware that reducing domestic packaging waste only represented a small step in terms of the overall environmental impact on society. Nevertheless, it gave them a good feeling of contributing to the environment and increased their perceived social value as an individual.

4.2.3. Reliability of hygienic standard

Participants generally felt that they could depend on the hygienic standard of the RPS in terms of safely storing products because it was a closed system and (re)sealed packaging maintained by professionals. Several participants compared dispensing products from an RPS with buying loose, unpackaged products in bulk with a scoop. RPSs were viewed as more hygienic because they were airtight and prevented consumers' direct contact with products.

Table 2

The categories and example quotes of the theme "General reactions to the RPS experience".

	Categories		Example of quotes
4.1.1	Positive attitude towards reuse models		"I generated much more plastic waste than other types of garbage. Yeah, it's awful. So, I'd be very pleased with those kinds of machines that reduce plastic." (P3)
4.1.2	Design of the dispenser	Novelty	"I've been surprised. When I'm surprised, I will also explore it. Because I don't know what that means for me. It's a new system." (P14)
		Naturalness	"It looks natural and gives the feeling that I'm sustainable, I'm buying something sustainable." (P22)
		Transparency	"The only thing is, you don't really see the product. So, what happens if you decide you don't want it after you see it?" (P13)
		Sensory interactions	"There was a swooshing sound and then this container was completely full. That was the relaxing part. You could smell everything when it came out. So, you had contact with the food itself. That was so nice." (P20)
4.1.3	Complexity of using a new system		"What's happening? Am I doing it wrong? Is this the idea? Because you know it should work. It feels a bit like you're silly because you don't understand it." (P6)
4.1.4	Design of the reusable container		"The lid is easy to screw on and screw off. It seems like the food or the product is well protected in it." (P23)

Participants also indicated they would prefer to adopt RPSs for dry food and long shelf-life products rather than for fluids and fresh products. The latter were associated with risks concerning leakage and loss of product freshness.

4.2.4. Financial benefits

A financial benefit mentioned frequently by participants was that using an RPS helped them save money through customizing product portions instead of being restricted to a predetermined package size. Participants also stated that reusing the packaging enabled them to produce less waste in their household, thereby reducing their waste collection charge.

4.2.5. Familiarity with reuse practices

Shifting behaviour from buying a single-use package to an RPS requires forming new habits. For participants who had the habit of transferring products from disposable packages to their private containers at home, using an RPS to directly fill their containers in the supermarket was considered to be more efficient and reduce packaging waste.

Participants also reported that engaging in similar types of self-service (e.g. buying bulk candies, filling freshly-squeezed juice in bottles) and reuse systems (e.g. returning empty beverage bottles to the deposit-refund system) could help them switch to RPSs. Furthermore, participants engaging in sustainable actions, such as purchasing organic products and using reusable shopping bags, were overall positive about adopting RPSs in their daily routines.

Table 3 shows example quotes of participants.

4.3. Barriers to long-term adoption of RPSs

While participants reported several enablers that could help them transition from single-use packaging to RPSs, they also pointed out some barriers that may hinder their adoption.

Table 3

The categories and example quotes of the theme "Enablers to switch from single-use packaging to RPSs".

	Categories	Example of quotes
4.2.1	Environmental value	"When you buy too much, the product quality goes down. Then I'd have to throw it away. And in the system, I can choose what I need. So, there is not so much waste." (P8)
4.2.2	Anticipated positive emotions	"I feel that I'm a better person. I think I'm helping the world in my own small way." (P9)
4.2.3	Reliability of hygienic standard	"You don't have to touch food with your hands. When using a scoop, other people might touch the food with their hands. Here you can only push buttons […] It feels much cleaner." (P4)
4.2.4	Financial benefits	"In many cities, you have to pay for your garbage by weight. So, when people have the experience of reducing their garbage by using these kinds of containers, they benefit themselves by lowering the cost." (P3)
4.2.5	Familiarity with reuse practices	"That [bringing a container] is the same as bringing your own shopping bags and not buying another plastic bag every time. So, it's kind of a new routine." (P15)

4.3.1. Scepticism about environmental impacts

Although most participants exhibited a positive attitude towards the sustainability of the system and a good feeling about using an RPS, some questioned the overall environmental impacts. For instance, some participants perceived recycling as a better-established social norm. They trusted the effectiveness of recycling and felt more at ease recycling than reusing. Correspondingly, participants expressed that reuse by individuals has a limited effect, and that collective action by society was more promising to make a difference.

Some participants reported they did not understand how using the system saves natural resources. Participants believed that the raw materials and energy needed to manufacture reusable containers and systems should not be overlooked. They also recognized that operating and maintaining systems required resources. Furthermore, they indicated that when the system still involved single-use packaging (e.g. secondary and tertiary packaging), the overall packaging waste reduction and environmental impacts would be limited.

When comparing different packaging materials in RPS examples (e.g. Loop uses metal containers, Pieter Pot uses glass jars, and Ecover and MIWA use plastic containers), some participants reported it was difficult to associate plastic packaging with sustainability even if it was reusable because plastic is controversial and widely viewed as being bad for the environment. Participants also questioned how many cycles a reusable container will complete in its lifetime.

4.3.2. A lack of availability and variety

Some participants reported low awareness of RPSs due to a lack of availability. When RPSs were not offered in their neighbourhood, participants indicated that they would not seek such an RPS. Besides, participants stated that not all of the products they are used to buying might be available in RPSs. As they usually put little effort into thinking during grocery shopping and just purchase the same products, participants said it would not be easy to switch products to the ones provided in RPSs just for the sake of pursuing sustainability.

4.3.3. Concerns about product quality and safety

Most participants reported that they were used to checking the information on the product packaging before purchase. They stated that if this information was not present on the reusable packaging, it should be easily available elsewhere, such as displayed on dispensers. The most important information mentioned by participants consisted of ingredients, nutrition facts and expiration dates. These help them evaluate the product's quality and freshness, which are considered more important than pursuing sustainability. A lack of information (e.g. allergens)

can also trigger health and safety concerns.

When participants mentioned the expiration date, they also questioned how long the products had already been in dispensers, as they perceived the product quality may decline quickly over time in the system compared to prepackaged products.

4.3.4. Contamination risks

Participants stated that they had become more sensitive to product hygiene after the breakout of COVID-19. Some participants reported that observing others' improper use (e.g. using noticeably dirty containers to dispense products) and the degree of intimate contact with the packaging (e.g. touching and putting it back after opening the lid) would trigger their contamination concerns.

Furthermore, participants generally associated fewer contamination risks with non-food products than with food products. Possible spillage around dispensers may evoke negative associations of improper use and unsatisfactory hygienic standards. Participants suggested that frequent cleaning of the system and communicating its cleanness were necessary to reduce their concerns.

In addition, participants expressed uncertainty about the previous usage and a lack of cues about the cleanness of the reusable packaging provided by the system. Even though most participants claimed they trusted that the packaging had been professionally cleaned, they wished to be provided with some indications that the packaging had been properly cleaned.

4.3.5. Packaging wear and tear

As reusable packages are designed for multiple uses, signs of wear and tear (e.g. scratches and other damage) may appear on the surface over time. Participants associated such wear and tear with contamination and bacteria, thereby triggering health and safety concerns.

Although signs of wear and tear on the reusable containers make the packaging less attractive and desirable in general, participants felt that it was more important for them to look neat than new. Participants reported worrying less about scratches made by themselves than those made by others. Superficial damage was more acceptable than functional damage. External scratches were more acceptable than internal ones because external scratches are not in direct contact with the product. However, severe scratches may trigger participants to return the packaging or switch to their private containers. To avoid wear and tear, participants stated that they would compare and select the neatest-looking container due to their habit of buying a new product.

4.3.6. Upfront financial investments and willingness to pay

Adopting RPSs on a large scale requires consumers to use many reusable packages at home. Buying containers or paying the deposit for reusable packaging increases the upfront investments necessary to use the system. Participants also expressed concerns about packaging damage that may cause them to forfeit their deposit.

Participants also stated that RPSs should reduce the product price to reward their waste-reduction efforts to bring and reuse the packaging. They were not willing to pay a premium unless the product quality was superior. Nevertheless, other participants recognized that using a sustainable system can be more costly considering the manufacturing and operating cost of the system.

Another barrier relating to the price mentioned by participants was that the final price was only shown when weighing the product and it was sometimes surprisingly high. Considering that items cannot be put back into the dispenser for reasons of hygiene, participants stated they would leave the filled packaging at the supermarket. These abandoned items will be problematic for the supermarket and were considered food waste because they cannot be sold again.

4.3.7. Extra time and effort

Compared to buying prepackaged products, using RPSs requires more time and effort at different stages of adoption.

Preparation for reuse. Before going to the store, participants reported they would need to plan, such as checking which products should be refilled and deciding on the amount and type of packaging to bring. Or they would need to carry empty packages if they decided to return them to get a refund. Remembering to bring the packaging also increased the mental effort involved because several participants stated they did their grocery shopping spontaneously after work. Taking the packaging with them the whole day was therefore not convenient.

In-store operation. Compared to grabbing prepackaged products from the shelf, using RPSs involves more steps to get the desired products, which increases consumers' cognitive load, especially if consumers would need to queue for the product dispenser in a busy supermarket.

Storage and collecting. Participants stated that when they had several reusable packages, they wanted to store them together. Therefore, they needed to make enough space for storage. If they decided to return empty packages, they need to collect them after each use.

Dealing with leftovers. Many participants stated they usually buy more products before they run out of them. Consequently, small amounts of the product may be left in the reusable packaging when participants intended to refill it. Dealing with leftovers was considered a hassle. To tackle this issue, some participants stated they would keep some spare containers at home for refilling. However, they noted that those containers will take up more space.

Cleaning. Most participants reported they wanted to wash their packaging conveniently. Some participants stated it was a hassle to completely empty the packaging and wash the residue from inside the packaging by hand, especially if the product is fluid or sticky.

Table 4 shows example quotes of participants.

5. General discussion

5.1. Theoretical implications

This paper provides a comprehensive overview of the different enablers and barriers that influence consumer adoption of RPSs at different usage stages. Our research corroborates and extends the existing literature in different ways.

First, we contribute to the literature on the design and form-giving of RPSs. Specifically, we add knowledge on the design of dispensers, while prior studies have focused on reusable packaging (e.g. Long et al., 2022; Madria and Tangsoc, 2019). Our study revealed that by having a novel appearance, dispensers could trigger consumers' exploration. Next, a natural appearance of the dispensers appeared to be congruent with the sustainable nature of RPSs. Furthermore, transparency was deemed important and contributed to positive inferences about product quality and freshness. These findings extend and corroborate prior research on single-use packaging demonstrating that transparent packaging attracts attention in-store, provides a visual cue for consumers to evaluate freshness and quality, and enhances the product's trustworthiness (Billeter et al., 2012; Simmonds and Spence, 2017). The effect of transparency appeared to be reinforced by the sound of product flow and the product's smell, which evoked hedonic pleasure. Despite these positive design features in RPSs, consumers also reported difficulties (e.g. controlling the product flow from dispensers, understanding digital instructions, etc.) in effectively using the new system for the first time, resulting in high learning costs. This corresponds to prior research on product newness, which demonstrated that when the functional attributes of a new product are different from those of existing products stored in consumers' memory, it can be difficult for consumers to transfer relevant knowledge on attributes and usage to this new product (Mugge and Dahl, 2013). Therefore, even though novelty may stimulate consumers' interest and curiosity in the shopping experience, consumers will also look for familiar aspects that ease the perceived complexity and the learning burden of the novel offering by drawing on existing knowledge. Correspondingly, our results show that consumers who had already performed reuse behaviours and had engaged in similar systems

Table 4
The categories and example quotes of the theme "Barriers to long-term adoption of RPSs".

	Categories	Example of quotes	
4.3.1	Scepticism about environmental impacts	"I'm not even sure whether this is more environmentally friendly than just producing a new container that isn't reusable. You can also make the packaging cheap and not use so many raw materials." (P23)	
4.3.2	A lack of availability and variety	"It depends on the product. You'll use the system only if it can provide the product you want." (P5)	
4.3.3	Concerns about product quality and safety	"When you have something like cookies, quite often when they're exposed to the air, they become soft. So, oxygen shouldn't have an influence on the product – and not heat either." (P11)	
4.3.4	Contamination risks	"Another thing is that people bring their own containers and they are not clean and their containers are touching the machines and get some cross-contamination as well." (P2)	
4.3.5	Packaging wear and tear	"There are scratches. Um, that may be a hygiene issue, because if there are scratches, there may be bacteria in the scratches." (P6)	
4.3.6	Upfront financial investments and willingness to pay	"It looks expensive. I think it's a compliment that it looks expensive, but you don't want that to be turned off. You want to show people it's not only durable but also probably economically attractive to do this." (P13)	
4.3.7	Extra time and effort	Preparation for reuse	"You have to be prepared when you go shopping […] I often do my groceries spontaneously after work or before I pick up the kids. So, you have to remind yourself to take this with you before you go." (P13)
		In-store operation	"You have to open the lid, put the container under the system, you have to perform a few actions. It takes me more effort than when I take just one package from the shelf." (P6)
		Storage and collecting	"You have to keep a lot of stuff at home. So, you need space for these. That will be a negative thing." (P13)
		Dealing with leftovers	"I want to refill, but there's still something left. Yeah, perhaps then you just buy a new pot. But what you wouldn't want is that you have everything twice because you didn't finish it. Then you buy a new one that doesn't fit in the cupboard." (P15)
		Cleaning	"If this one can't go in the dishwasher, that's a disadvantage for me to take into account." (P16)

appeared more prone to adopt this new RPS. In addition, we noticed that when any performance failure occurred, consumers tended to attribute the responsibility to themselves rather than the system, and felt they were not competent in using the system. Anxiety caused by in-store crowding could exacerbate this negative attribution (Dabholkar and Spaid, 2012), which might further impede the consumer from executing subsequent actions in the system.

Second, the findings extend research on product contamination (e.g. Argo et al., 2006; Baxter et al., 2016) that can lead to reluctance in adopting RPSs or undesired early replacement of reusable containers. According to Baxter et al. (2016), contamination is driven by three mechanisms, namely hygiene, utility and territory. Our findings suggest that all three contamination mechanisms may occur for RPSs. First,

although consumers generally trust the hygienic standards of RPSs, their sensitivity to disgust and observation of contaminated interaction with other users can activate hygiene concerns. Next, the signs of wear and tear on the packaging, generated over multiple reuses, may evoke territorial contamination by being marked by strangers (Baxter et al., 2016). Furthermore, our findings demonstrate that reusable packages with severe scratches in places in contact with the packed products or with functional damage are deemed less acceptable because these scratches may represent contaminants and a reduced aesthetic and functional value of the packaging. This is consistent with prior studies about utility contamination concerns (Baxter et al., 2017; Wallner et al., 2022). These visual imperfections make the packaging less desirable and decrease consumers' reuse intentions or trigger the replacement of containers, supporting previous research on returnable packaging (Magnier and Gil-Pérez, 2021). We contribute by showing that this effect could happen with both refillable packages offered by the system and consumers' private containers, although consumers minded less about wear and tear on their private containers. It is important to note that perceptions of contamination have important implications for the actual sustainability of RPS. To be environmentally better than an equivalent single-use package, it is crucial to ensure reusable packaging achieves a certain number of cycles before consumers deem them unacceptable to reuse due to wear and tear (Baird et al., 2022).

Third, our study enriches consumer perception regarding the environmental impact of RPSs in the literature. Prior studies mainly focussed on comparing RPSs' emissions, energy and water usage, as well as food and packaging waste to those of disposable packaging (Beitzen-Heineke et al., 2017; Verghese et al., 2015), but consumer perceptions of RPSs' environmental value were not yet widely discussed. Overall, our results indicate that participants are generally positive about the environmental value of RPSs. Previous studies about pro-environmental behaviour suggested that sustainable actions can elicit positive emotions and a 'warm glow', which are viewed as an intrinsic reward and an increase in social worth (e.g. Hartmann et al., 2017; Tezer and Bodur, 2020). We found this warm glow also exists in the context of RPSs usage as consumers perceived a good feeling about preventing packaging waste and an increased social value as individuals. Nevertheless, the results of our study also demonstrated the challenge of consumers' scepticism towards the environmental impact of RPSs. This scepticism is triggered by the experienced difficulty in making inferences about the environmental benefits of RPSs and a lack of feedback to assess the outcome of reuse behaviours. Past research suggested that green scepticism negatively impacts consumers' evaluation of a product's environmental friendliness (Grebmer and Diefenbach, 2020) and decreases consumer intention to perform pro-environmental behaviours (Leonidou and Skarmeas, 2017). Consequently, there is a need to reduce scepticism about RPSs by providing trustworthy information and knowledge about the environmental impact of RPSs in comparison to single-use packaging for consumers to make informed purchase decisions.

Finally, our study suggests that, on the long term, the success of RPSs strongly depends on new habit formation. While most consumers exhibited a high willingness to adopt RPSs, they also reported a lack of availability and product variety, uncertainty about product freshness, higher costs, and inconveniences related to the usage of RPSs. These factors may require consumers to make compromises when replacing their habitually purchased products with reusable alternatives. Therefore, consumers' purchase intentions may not always translate into actual buying behaviour in the context of RPSs, corresponding to the 'intention-behaviour gap' widely acknowledged in environmental consumerism (e.g. Carrington et al., 2014; Gupta and Ogden, 2009). Furthermore, prior research suggested that the difficulty to form a new habit contributes to this gap (Bhamra et al., 2011). To use RPSs, consumers need to alter existing routines and develop new shopping patterns. Such changes are difficult because they require breaking well-ingrained unsustainable habits (buying products in single-use packages) to form new sustainable ones (reusing packaging through a

system). Insights from psychology suggest that changing the environmental context can contribute to habit change because, in a new context, people will more easily review their behaviours and form new mental connections between this context and new behaviour (Mazar et al., 2021; Verplanken and Whitmarsh, 2021). It is questionable whether existing RPSs trigger a sufficient change in the environmental context to achieve such habit disruptions, as RPSs are generally implemented in stores next to traditionally single-use packaging, and therefore only represent a relatively small part of the total store space. To break habits, supermarkets and RPS designers should aim to make these context changes more prominent so that consumers can form new routines to use RPSs.

5.2. Practical implications for developing RPSs

In this section, we illustrate how practitioners can tackle barriers to adopting RPSs through design and marketing communication.

5.2.1. Reusable packaging system design

First, it is crucial to expand the availability and compatibility of RPSs to facilitate consumers' refill or return behaviour in different stores. For instance, retailers can select product categories for RPSs based on purchasing volume and supporting consumer decision-making on these FMCG.

Second, consumers are used to evaluating products based on their packaging. In most RPSs, consumers read product information displayed on dispensers or receive labels afterwards, leading to a packaging-information separation that differs from prepackaged products. Furthermore, consumers see the final price only after they have dispensed the products into the packaging. Informing consumers in advance about the price could prevent them from abandoning filled containers due to unexpectedly high prices. To offer sufficient information for consumers, smart technology can be implemented in RPSs. For instance, barcode systems or radio frequency identification (RFID) tags can track the location and contents of products and aid in managing value chains (Mahmoudi and Parviziomran, 2020), thereby conveying important information to the supply chain and consumers. This can compensate for the potential lack of communicative functions and increase the communicative power of the packaging in the RPS.

Third, regarding the structural and material durability of the packaging, consumers were more willing to reuse packaging that was robust for product protection, resistant to changes in appearance, and easy to clean. This suggests that it is important to select materials that age gracefully and are not easily damaged or contaminated (Lilley et al., 2016; Greenwood et al., 2021). According to White et al. (2016), positioning wear and tear as a virtue (e.g. by emphasizing the environmental benefits of multiple reuse cycles) could also increase the acceptance of reusable packaging with signs of usage.

5.2.2. Marketing communication on environmental impact

We advise practitioners to inform consumers about the conditions under which the environmental impact of RPSs is more virtuous than that of single-use packaging. For example, consumers expect that refilling the same packaging has a better environmental impact than returning the refillable packaging. However, this conflicts with the LCA of RPSs, which demonstrated that return shows slightly lower impacts than refill due to the differences between cleaning at home and collective cleaning by businesses (Greenwood et al., 2021). Consumers are not always correct in their perceptions of what is sustainable, suggesting that more communication is needed. Furthermore, past studies showed that consumers generally preferred paper, glass and wood packaging over plastic packaging (Fernqvist et al., 2015; Greenwood et al., 2021). Consequently, when plastic is used in RPSs consumers tend to doubt their sustainability, indicating that the environmental impact of reusable plastics could be communicated better. We suggest that practitioners could reduce consumers' scepticism and evoke anticipated

positive emotions by communicating the environmental and social impacts of RPSs, such as:

a Emission and energy savings, packaging waste reduction and food waste prevention;
b Environmental friendliness of the packaging (material);
c Guidance on how to prolong the lifespan of reusable packaging and clarification on waste management of obsolete packages;
d Tailored feedback about personal environmental contributions to emphasize the effectiveness of repeated RPSs usage.

5.2.3. Forming a new habit with RPSs

To help consumers form a new habit with RPS, practitioners should consider strategies that make the new habit more attractive and effortless (Bhamra et al., 2011; Verplanken and Whitmarsh, 2021). For instance, consumers complain that the cost of reusable packaging can be a barrier to start using RPSs. Instead of encouraging high consumer reuse rates through a deposit-refund system, free use of reusable containers may stimulate consumers to try out the RPS to break the old habit, as the first step to establishing a new habit. Next, an effortless repetition requires a stable and effective context that allows unobstructed and fast performance.

In addition to the in-store RPS, it may also be effective to promote RPSs in the online context where a larger context change can easily be implemented. For instance, incentives can be provided in a supermarket application to indicate which products are available for consumers in reusable packaging. The online context will also make it easier for consumers to return containers after use because they are delivered and picked up at their door.

5.3. Limitations and future research

The first limitation of this research is that only Dutch participants were included. The Dutch generally have a high education level and environmental awareness. Future research could recruit a wider range of participants from different cultural contexts. Second, the study took place in a lab setting and the researcher cleaned and reset the system after each session. In comparison to field studies in supermarkets, this lab setting enabled us to include a diverse range of participants and gain an understanding of general perceptions. Nevertheless, it may also have limited the external validity. Furthermore, our follow-up interviews aimed to understand the post-purchase usage of reusable packaging through self-reported behaviour. Consequently, there was no observation of their use at home or of repeated purchases in the supermarket. Future field research could investigate consumers' repeated interactions with RPSs. Third, we only explored one specific refillable packaging system with six dry food products. Some responses may differ for other RPS models (e.g. a returnable packaging system through a delivery service) or other product categories (e.g. liquid products, fresh products and non-food products).

6. Conclusion

RPSs present a promising solution to tackle packaging waste by rethinking consumption patterns, thereby contributing to a societal transformation and more sustainable lifestyles. To increase adoption, practitioners should not only actively attract consumers to choose RPSs as alternatives in the pre-purchase stage but also reduce barriers and promote enablers to encourage consumers' long-term usage.

Our research aims to give an initial overview of factors influencing consumers' adoption in different stages. We encourage future research to explore specific interventions built on our insights to increase the adoption of RPSs and contribute to a more sustainable society.

CRediT authorship contribution statement

Xueqing Miao: Conceptualization, Methodology, Investigation, Writing – original draft, Visualization, Writing – review & editing. **Lise Magnier:** Methodology, Writing – review & editing, Supervision. **Ruth Mugge:** Methodology, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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