TRASH TALK: WHO USES WHICH REUSABLE PRODUCT? USER INSIGHTS AND DESIGN OPPORTUNITIES FOR SINGLE-USE ALTERNATIVES

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ABSTRACT

Single-use products often end up in the environment as waste, threatening ecosystems and human life. This indicates a need to transition towards sustainable reuse routines. In this study, we investigate to what extent reusable products are already established in society and what design properties users require. We compare the results between user clusters and countries. To create a meaningful list of reusable products to investigate, we distinguish four categories based on typical barriers by means of focus groups (n=3) and interviews (n=32). Next, we did a survey (n=3000) in three countries (Belgium, Russia, U.S.) to define user clusters and investigate product usage and design requirements. Most established products are hard-material products such as lunch boxes, while intimate hygiene products, such as menstrual cups, are not established yet. Multifunctionality and compactness are the most indicated product requirements. There are significant differences between countries and clusters for both research questions. We conclude that different types of users have different needs: while a sharing system might work for one group, a customizable option would be more suitable for others.

Keywords: Long-term reuse behaviour, Sustainability, Circular economy, Cross-country study, User centred design

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Cite this article: Herweyers, L., Du Bois, E., Moons, I. (2023) 'Trash Talk: Who Uses Which Reusable Product? User Insights and Design Opportunities for Single-Use Alternatives', in *Proceedings of the International Conference on Engineering Design (ICED23),* Bordeaux, France, 24-28 July 2023. DOI:10.1017/pds.2023.365

1 INTRODUCTION

Since the introduction of single-use products (SUP), many objects transitioned from having value to being considered waste after only a very short usage period (Greenwood *et al.*, 2021). Next to resource depletion and greenhouse gas emissions, the immense amount of waste created each day alongside mismanagement of waste processing has contributed to significant pollution worldwide. Many disposable products are made of plastic, as the material has several advantages such as being light-weight, affordable, and flexible (Heidbreder *et al.*, 2019). Plastics were introduced to the broad public in the 1950s and the first single-use shopping bags were introduced in 1965 (UNEP, 2021). Between the 1970s and 1990s, plastic consumption more than tripled (UNEP, 2022), and the total amount of plastics produced is forecasted to reach 445 million metric tons in 2025 (Statista, 2020). When plastics end up in the environment, they can threaten ecosystems and human life (Wright *et al.*, 2013). Plastics don't biodegrade, so larger items eventually break down into smaller particles, the so-called microplastics. Since the discovery of the Great Pacific Garbage Patch in 1997, whose area is still rapidly increasing (Lebreton *et al.*, 2018), more and more research has been done on the potentially harmful effects of macro- and microplastics (Cox *et al.*, 2019). Next to plastics, other materials are also widely used in disposable products. For example, cardboard packaging makes up 33% of global packaging demand, followed by flexible plastics (26%) and rigid plastics (19%) (Statista, 2022a). As societal awareness is rising regarding the environmental impact of waste, 70% of consumers in Europe are concerned about plastic packaging while only 1% worry about cardboard packaging (Statista, 2022b). The potential negative impact of plastics has reached the broad public, while the impact of paper and cardboard, mainly in the production phase, is less well known. Inaccurate ideas about the ecological impact of other materials than plastic such as cardboard and bio-based plastics often result in well-meant, though environmentally unfriendly behaviour, such as replacing single-use plastic items with single-use cardboard items instead of adopting reusable products.

The transition from a throw-away culture towards reuse routines is key to tackling the mountains of waste that are created each day. Since the ban on several SUP by the European Union (European Parliament, 2019) went into place, several reusable alternatives are popping up, one more successfully implemented than the other. Examples are reusable produce bags, drinking bottles, and straws. If a reusable product is not used at least a minimal number of times, there will be no environmental gain, on the contrary. Reusable products are often more durable, consist of more material, and in general, their production costs more energy and water than single-use items (Herberz *et al.*, 2020). Besides this, the usage phase (e.g. cleaning process) of these products is often more resource intensive as well (Blanca-Alcubilla *et al.*, 2020). According to a life cycle assessment (LCA) study, a stainless steel straw should be reused at least 150 times instead of using a new single-use plastic straw each time, in order to become better for the environment (Chang and Tan, 2021). In this paper, the minimum amount of times a product should be reused before it is better for the environment than its single-use alternative is referred to as the 'breakeven point'. What has to be taken into account, is that LCA studies are not flawless and often refrain to take incorrect disposal into account, but they can provide a rough estimation of the breakeven point. Each additional reuse cycle decreases the overall environmental impact of the product, so it is vitally important to make sure that reusable products and related services persuade and support people in adopting sustainable reuse behaviour and creating long-lasting routines. Consequently, understanding this is essential for the design of successful reusable products.

1.1 Objective

In order to reach long-term usage of reusable products and move beyond the breakeven point, a thorough understanding of the user is important to tackle the barriers to implementing new reuse routines in people's daily lives. A combination of individual and cultural, societal, and social norms and values determine people's mindset and attitude towards reusable products. Next to this, situational factors can facilitate or complicate effective usage. Regarding existing products, some are already well established and accepted in society, while others receive more doubts and backlash. In this study, we investigate whether different user groups, distinguished and described according to individual and context-related variables, differ in their current reuse behaviour and preferences regarding certain reusable products, and we open a discussion on why. We also look at differences between countries to

https://doi.org/10.1017/pds.2023.365 Published online by Cambridge University Press

address the monocultural focus omnipresent in previous research (Chwialkowska *et al.*, 2020) and cultural values. The study includes a cross-national sample of consumers from the United States (U.S.), Russia, and Flanders (Belgium), all developed countries but with different pro-environmental behaviours: Belgium scores 58,20 on the Environmental Performance Index, while the U.S. and Russia score respectively 51,10 and 37,50 (Wolf *et al.*, 2022).

The following research questions are formulated:
RQ1: To what extent are certain reusable products in different categories already established in society?
RQ1.1: How does this differ between countries?
RQ1.2: How does this differ between user groups?
RQ2: What do different user groups and countries expect and require from future reusable products?

1.2 Theoretical framework

To create meaningful user groups to predict and investigate differences in the avoidance of SUP and the (long-term) acceptance of reusable products, we adopt variables from social-psychological models, such as the Theory of Planned Behaviour (TPB). The model states that three main processes; attitude, subjective norms, and perceived behavioural control, lead to behavioural intent, which is, according to TPB, the most decisive determinant of behaviour (Ajzen, 1985). However, the intention-behaviour gap (Sheeran and Webb, 2016) is a well-described phenomenon that illustrates the frequently occurring contradiction between people's intention and actual behaviour, hence our interest in comparing the actual behaviour of different user groups based on i.a. intention. Besides these variables, other factors also influence behaviour, such as personal values and norms, habitual behaviour, and objective constraints, as proposed in the Comprehensive Action Determination Model (CADM) (Klöckner and Blöbaum, 2010), which we also include in our study. Apart from socio-demographical characteristics, we use the following profiling variables, based on previous research on the adoption of ecological behaviour, to further describe the clusters: environmental concern (Dunlap *et al.*, 2000), green self-identity (Whitmarsh and O'Neill, 2010), and current pro-environmental behaviour (Maki *et al.*, 2019).

2 MATERIALS AND METHODS

2.1 Data collection and sample

We did a quantitative survey with a cross-national sample of 3,000 respondents from three countries, i.e. the United States (U.S.) (N=1,000), Russia (N=1,000), and Belgium (Flanders) (N=1,000). The survey method was chosen because it enabled us to collect a large amount of data in a relatively short time and provided the possibility to collect information on a broad range of things, such as demographics, past and current behaviour, and attitudes (Jones *et al.*, 2013). On top of this, the data allowed us to perform a cluster analysis, enabling us to construct the consumer groups and make comparisons. Data were collected online by a professional market research agency (Kantar) during a three-week period in April 2021. The same quota for gender and age were used in all countries, based on the mean of the demographic data in each country (gender: male = 50%; age: 18-34 years old = 29%, 35-34 years old = 34%, 55+ = 37%). The questionnaire was originally constructed in English, and translated into Russian and Dutch (Flemish), the native language of our respondents in respectively Russia and Flanders, Belgium. The Russian version was proofread by two separate native speakers and compared with the English version to resolve inconsistencies. The Dutch version was proofread by a professional English - Dutch translator. In total, 5,060 respondents filled in the survey, of which 3,000 responses were valid. Data collection stopped when the age and gender quota were reached. A control question and speed check filtered out unreliable submissions and were not included in the quota.

2.2 Questionnaire

The first part of the survey consisted of questions on demographic characteristics, including age, gender, living area, income, employment situation, education, and family situation. This was followed by seven statements on self-reported habitual behaviour regarding the usage of SUP with a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Next, nine examples of reusable alternatives for single-use plastics were presented, to which the respondents had to answer how often they use those products, ranging from never (1) to always (5). There was also an option 'not

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applicable' for, e.g. people that don't menstruate and thus don't need a menstrual cup. The following question asked for the reasons to pose ecological behaviour in general, with ten statements. The next block related to people's attitudes. The first question consisted of four statements regarding attitude towards single-use plastics avoidance, with a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5), followed by two statements on attitude and behaviour before and after the COVID-19 pandemic, and a question specifically asking people's attitudes regarding hygiene and safety related to SUP and alternatives. The last question of this block consisted of another five-point Likert scale question with four statements on the intention to use reusable products in the near future. The next block considered situational factors. This included a Likert-scale question with six statements on perceived behavioural control (such as time, price, and ease of use). The next block was more focused on design and asked for preferred characteristics of and requirements for good reusable products. This consisted of eleven items with multiple answers possible, ranging from 'I like it when they can be personalised', to 'I find it annoying to clean/ maintain them'. The next block regarded subjective norm, followed by green self-identity (both multiple-item Likert-scale statements).

2.3 Cluster analysis

We first conducted a factor analysis with reliability test (Cronbach alpha) of the items for all variables, of which the results indicated a good fit. We did a cluster analysis to categorize the respondents, for which we used the variables intentions, attitudes, subjective norms, situational constraints, hygienic constraints and habits. We used Ward's hierarchical clustering with squared Euclidean distance to identify a preliminary set of cluster solutions. This also served as a basis to determine the number of clusters, which resulted in a four-cluster solution. The next step included a non-hierarchical, k-means clustering procedure. Below, we shortly describe the resulting clusters with demographic characteristics and descriptive variables environmental concern, green self-identity, and pro-environmental behaviour for pro-environmental reasons. The labels reflect each cluster's intention to avoid SUP (SUP) and the factors that contribute to these intentions.

(i) SUP avoiders (616 respondents, 21%) have the highest intention to avoid SUP, as well as attitude and subjective norms towards reusable alternatives. Neither contextual nor hygienic factors influence their reuse behaviour. They show the highest green self-identity and environmental concern and already often consciously behave pro-environmentally. They are mostly women, highly educated with high incomes. They mainly reside in Belgium.
(ii) Situation-driven SUP users (871 respondents, 29%) indicate the second highest willingness to avoid SUP, as well as attitude and subjective norms towards reusable alternatives, and green self-identity, environmental concern, and pro-environmental behaviour in general. Compared with SUP avoiders and apathetic, their habitual usage of SUP, hygienic concerns and situational constraints have more influence on their intention to use reusable products. They are gender balanced and significantly younger than the other clusters. They reside mostly in U.S. and Russia.
(iii) The apathetic (920 respondents, 31%) have the second to lowest intentions, attitudes, subjective norms and pro-environmental behaviours towards reusable alternatives, and also their green self-identity and environmental concern are low. Habits, situational constraints, and hygienic concerns do not really affect this cluster. They are mostly men with high incomes who live equally across the three countries.
(iv) SUP addicts (593 respondents, 20%) have the lowest intentions, attitudes, and subjective norm to avoid SUP, as well as low green self-identity and environmental concern. Their existing SUP habits and situational constraints on reusable alternatives are significant barriers towards sustainable behaviour. they are mainly men with high incomes from the U.S. and Russia.

2.4 Product selection

We made a list of nine reusable products that can be classified into four categories: (i) on the go, (ii) daily shopping, (iii) at home, and (iv) intimate hygiene. The categories were defined based on consumer focus groups (n=3) and interviews (n=32). The focus groups took place in January 2020 and the interviews in October and November 2020. Each focus group lasted for about 1,5 hours and took place on campus. We did each focus group with a different user group, based on attitude and self-reported pro-environmental behaviour (from very un-ecologically minded towards very eco-minded), and asked for typical products they used and what the barriers are towards adoption and long-term reuse of these products. We did the interviews online due to COVID-19 regulations with 32

https://doi.org/10.1017/pds.2023.365 Published online by Cambridge University Press

respondents with different demographic backgrounds (gender, age, family situation, income, residence type), and asked more in-depth questions about (possible) barriers for long-term usage of a wide range of reusable products. Each interview lasted for about one hour.

From the results, we could divide products into four categories based on typical contexts and barriers. We found forgetfulness, spontaneity, and weight and volume for 'on the go' products, existing routines and time- constraints for daily shopping, practicality and ease for 'at home' products, and hygiene, usability, trust, and shame for intimate hygiene products. Barriers typical for all products are the cleaning process and time investment. Some products fit into two categories. In the category 'on the go', we selected a reusable coffee cup, drinking bottle, and lunch box or food wrap. The category daily shopping included a reusable jar, lunch box or wrap, and produce bags (reusable bags for fruits and vegetables). The category at home encompasses products solely used at home, for which we selected reusable razors, reusable jars, and the food hugger as an alternative to cling film. For intimate hygiene, we chose a razor, menstrual cup/ pads, and washable diapers. The products were chosen based on how often they were mentioned in the focus groups and interviews, and their wide availability and familiarity.

3 RESULTS

3.1 Products

We compare the means (M) and standard deviations (SD) of the results of the question how often the respondents use each reusable product in a list of nine products, ranging from never (1) to always (5) (table 1). In the questionnaire, there was a 6th option 'not applicable' that the respondents had to indicate if they did not use the single-use version of the reusable product either. The 'not applicable' option is not included in the analysis and considered a missing value. For the comparison between both the countries and clusters, we did a one-way ANOVA to check significance and a Bonferroni t-test to check which countries and clusters are significantly different.

Table 1. How often do you use this reusable product (total relevant sample)

Product	Reusable jar	Coffee cup	Lunch box/wrap	Razor	Drinking bottle	Produce bags	Food huggers	Menstrual cup/pads	Washable diapers
Mean	3.88	3.67	3.64	3.54	3.52	3.48	2.41	1.59	1.52
SD	1.076	1.423	1.318	1.446	1.282	1.318	1.258	1.169	1.005

3.1.1 Country

A one-way ANOVA showed significant differences between all three countries for lunch boxes or wraps and reusable produce bags. The lunchbox is quite popular in Belgium (most used reusable product, M 4.03) and also in Russia (M 3.73) but less in the U.S. (M 3.11). Produce bags are most popular in Russia (M 3.79), also in Belgium (M 3.57), and as with the lunch box, less in the U.S. (M 3.08). There is no significant difference between the U.S. and Belgium regarding the mean for drinking bottles (respectively M 3.67 and M 3.70), reusable glass jars (M 3.75 and M 3.84), and reusable razors (M 3.40 and M 3.24), which are all relatively popular. However, there is a significant difference between those two countries and Russia (drinking bottles M 3.19, glass jars M 4.05, Razors M 3.90). Russia and the U.S. show very similar results regarding reusable coffee cups and food wraps but differ significantly from Belgium (respectively M 3.78, M 3.84, and M 3.33 for coffee cups and M 2.47, M 2.58, and M 2.14 for food huggers). Belgium and Russia score similarly for menstrual cups/pads (both M 1.48) and washable diapers (respectively M 1.31 and M 1.36), but differ significantly from the U.S. who scores higher on both products (M 1.82 and M 1.87). However, even the results from the U.S. are still considered low. In general, reusable food wraps, menstrual cups or pads, and washable diapers seem to not be established yet in any of the countries.

3.1.2 Cluster

A one-way ANOVA showed significant differences between the four clusters for reusable drinking bottles, glass jars, produce bags, and coffee cups. We can consistently see that the SUP addicts have the lowest usage of reusable alternatives ($M < 3.50$), apathetic the second-to-lowest, situation-driven SUP users the second-to-highest and SUP avoiders the highest ($M > 4.00$) for these products. This also

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accounts for the usage of lunch boxes/ wraps, but the results for SUP addicts and apathetic do not differ significantly (respectively M 3.24 and M 3.39). Situation-driven and SUP avoiders score similarly on the usage of food huggers (respectively M 2.77 and M 2.83) but differ significantly with the SUP addicts (M 1.81) and apathetic (M 2.20). Regarding razors, situation-driven and SUP avoiders score similarly (M 3.70 and M 3.80) but differ significantly from SUP addicts and apathetic (M 3.30 and M 3.36) who mutually also score similarly. For menstrual cups and washable diapers, situation-driven and SUP avoiders score similar (M 1.88 and M 1.73 for menstrual cups and 1.84 and 1.61 for washable diapers) but significantly different from SUP addicts (M 1.22 and M 1.16) and apathetic (M 1.44 and M 1.36) who also differ from one another. Only regarding the menstrual cup or pads and the diapers, the situation-driven users score slightly higher than the SUP avoiders, although usage frequency is low across all four clusters.

3.2 Product requirements

The respondents were requested to indicate statements they agree with regarding reusable products, with no limitation on the number of statements. The statement 'I find it handy when they are multifunctional' is indicated most often by the respondents (55%), followed by 'I prefer them to be compact' (38%) and 'I think quality is more important than price' (38%). 18% think price is more important than quality. 18% prefer to be the sole owner of a product, 16% find it important that a product is attractive, and 14% want a product to be customizable. The least indicated statements are 'I want to show the product to my friends and family' (9%) and 'I feel silly or weird while using them in public' (5%). Regarding the typical barriers, 27% indicate they forget to bring the products with them, and 24% find it annoying to clean the products. The graphs below (figure 1 and 2) show how much percentage of the respondents of each country and cluster indicated each statement.

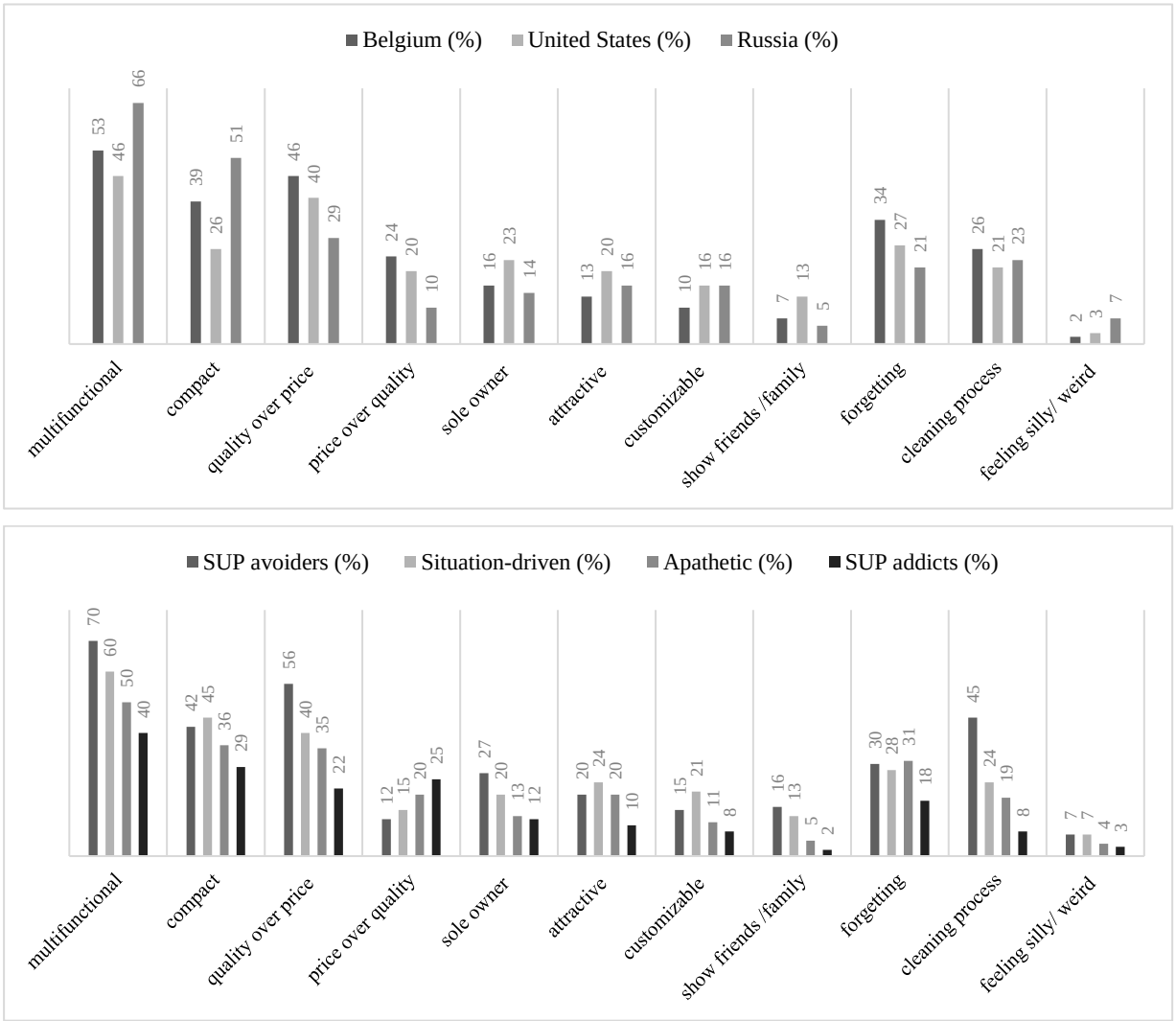

Figure 1 and 2. Requirements and barriers indicated per country and cluster

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Regarding the clusters, it is important to note that overall more statements are indicated by the SUP avoiders and situation-driven SUP users, than the apathetic and SUP addicts.

4 DISCUSSION

This study addresses continued, long-term usage of reusable products, and compares clusters of users based on i.a. attitude and intentions, and countries. Its main purpose is to gain insights into the differences between the user groups and open a discussion on the reasons why, and create drivers and requirements for the future design of reusable products.

4.1 Products

Hard material products such as lunchboxes, coffee cups, drinking bottles, razors, and jars seem to be most commonly used among all respondents. They are usually made out of hard plastic, metal, or glass. A potential explanation can be that they are easy to clean and wear and tear is less visible on these types of materials. Another explanation is the market growth for said products, such as the rise of the reusable coffee cup market, and the increase in tourism and tea- and coffee-drinking habits (Nester, 2022). Products made out of soft materials such as food huggers, diapers, menstrual pads and -cups are not that popular, and produce bags are situated in the middle. The materials are generally more vulnerable and less easy to clean. In the case of diapers and menstrual products, trust and safety can be decisive factors, as well as shame, perceived user friendliness and lack of familiarity. Produce bags might be not that frequently used because they are not always necessary and easy to forget. It is interesting to note that less visible products, such as several 'at home' and 'intimate hygiene' products, are less commonly used. This could be due to the absence of subjective norm: other people giving the example and showcasing the products.

4.1.1 Countries

Overall, reusable products are not necessarily more popular in one country compared to another, but there are clear differences in which products are more established already in which country. This is probably culturally defined, and related to what kind of products are considered 'normal' already in what country. For example, lunch boxes are most popular in Belgium, jars in Russia, and coffee cups in the U.S. Another argument is that the reusable product might have never really been replaced with a single-use equivalent to begin with, so the reusable product was always the norm, which could be the case with the safety razor in Russia. According to literature, residents from eastern European countries have a higher durability expectation and willingness to repair (European Commission, 2018). Intimate hygiene-related products are not popular in any country, which makes us conclude that they are not yet established anywhere.

4.1.2 Clusters

As expected, SUP avoiders use almost all reusable alternatives more frequently than, in descending order, situation-driven SUP users, apathetic, and SUP addicts. We can conclude that having a positive attitude, green self-identity, and subjective norm towards more environmentally friendly and SUP-avoidance intentions is related to more usage of reusable alternatives. However, the intimate-hygiene products are not well established in all four categories, and the SUP avoiders score even lower than the situation-driven SUP users. This could be due to unfamiliarity, incompatibility with current behaviours, invisibility, and prejudice towards the products. Also the shame and taboo around menstruation and bodily fluids in general could lead to hesitance regarding trying new products and talking about it with peers.

4.2 Product requirements

In general, practical aspects are considered most important, such as multifunctionality, quality, and whether the product is compact. This can be linked to the predefined barriers, such as weight, volume, and practicality. Barely one-fifth of the respondents indicated that they find price more important than quality, but this could be an underestimation of the real number since the respondents might be prone to social desirability bias and believe they are expected to value quality over price. Although in general there is a low preference for sole ownership, it can be linked to a higher demand for customizable options and an urge to show the product to the social environment. For some groups,

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such as the SUP avoiders, and residents from the U.S., this can be an ideal solution, but for most people (only 18% indicated they want to have full ownership over a product) a shared-ownership system might be the better option. Such a system could also assist in reaching the breakeven point of the product faster (Amasawa *et al.*, 2020).

4.2.1 Countries

Russian respondents indicated practicality, compactness, and multifunctionality more often than the other two countries. They don't feel the need to show the product to others as much as e.g. the U.S. and they are also a bit more hesitant to use them in public. This could be explained by the country's focus on collectivism compared to Western individualism (Rahman, 2019), and their unfamiliarity with several reusable products. This is in line with the most commonly used products in Russia: reusable jars, which are quite common everywhere and mostly used at home. Individualism could also explain why residents of the U.S. prefer to be the sole owner of a product, want the product to be attractive and value the option to personalise the product more. They like to show the products they've bought as a way of making a statement or showing their identity. They strive towards the value of being different and important (Singelis *et al.*, 1995). That could also explain the popularity of e.g. coffee cups in the U.S. Belgians, on the other hand, do not value attractiveness and the option to personalise that much. They score slightly higher than the other two countries in their need to show the product to their social environment and they are less awkward about using it in public (although all three countries score low on this one). They also experience more barriers to the use of reusables, such as forgetfulness and annoyance when needing to clean the product. They score high on the need for multifunctionality and practicality, and clearly value quality more than price. When we compare the three countries on the Hofstede dimensions, Belgium and Russia both score high on long-term orientation, in comparison with the U.S. (Hofstede, 1983; Hofstede Insights, 2022). Hence, the focus on quality, practicality and multifunctionality and less on attractiveness and customization could be explained.

4.2.2 Clusters

In general, SUP avoiders indicate more statements than SUP addicts. This could be explained by the fact that they already adopted more reusable products in their daily lives and routines, and have more clear ideas of what they expect in reusable products, and what the barriers are. For example, the statement that it is annoying to clean the products is indicated by 45% of SUP avoiders, and only 8% of SUP addicts. This is probably because SUP avoiders have been in contact with these barriers, and most SUP addicts have not. One-fourth of SUP addicts find price more important than quality, against 12% of SUP avoiders. This could be explained by the SUP addicts' preference for cheap, disposable products. They are least interested in paying a higher price for reusable products compared to the other clusters. In comparison, 56% of SUP avoiders think quality is more important than price. They probably know better that quality is key for a good reusable product, and think more long-term. Also, as SUP avoiders are much more focussed on achieving other than economic values (i.e ecological and social values), it seems logical that they value quality over price. Although most statements are mainly indicated by the SUP avoiders, attractiveness and personalisation are chosen more by the situation-driven SUP users. As they are more vulnerable to situational constraints (context factors, legislation, proximity, etc.), attractive and customizable designs could help them overcome these barriers.

4.3 Limitations and generalization

Although they don't have the exact same size, all clusters are considered to be large enough to be able to generalize the results, as they are based on a large sample of 3000 respondents and fairly equally divided. The participants are mainly residing in cities, so although quota were used, the sample does probably not provide a completely reliable sample of the full population of the countries, but it gives a good impression. Regarding the products, it is possible that not all the respondents were familiar with the products, or understood the description. The continued, long-term behaviour is self-reported and might be inaccurate or wrongly memorized. The sample group for e.g. reusable menstrual products is a lot smaller than the others since the product is not applicable to many respondents (for example people that do not menstruate).

https://doi.org/10.1017/pds.2023.365 Published online by Cambridge University Press

5 CONCLUSION AND RECOMMENDATIONS

We can conclude that the frequency of usage of reusable products is related to a negative attitude towards SUP, a high environmental concern and green self-identity, and previous ecological behaviour. Hard-material products, often those that are used outside of the home and seen in public, are more popular (e.g. drinking bottles, glass jars, lunch boxes) than soft-material products that are harder to clean, show more wear and tear, are related to shame or taboo, or less visible and used in the private atmosphere. (e.g. food huggers, menstrual products, diapers). There is no clear distinction in the frequency of use of reusable products between the three countries, but each country has different products that are most popular (e.g. coffee cups in the U.S., jars and produce bags in Russia, lunch boxes and drinking bottles in Belgium). Products related to intimate hygiene such as reusable menstrual products and diapers are not yet widely accepted by any group (clusters nor countries), which could be the result of a lack of information and taboo or shame related to the products. From the product requirements, we composed three recommendations for designers:

- Focus on practicality, durability and quality. Make products multifunctional or take away barriers such as forgetfulness and an extensive cleaning process, and provide compact products that minimize weight and volume, especially when used outside of the home.
- Design different solutions for different types of users. For some users, a sharing system might be a good solution since it decreases several barriers such as forgetfulness and cleaning process (e.g. Belgian consumers, or SUP addicts and apathetic). For others, a personal and customizable, more attractive product could be the best solution (e.g. Americans and SUP avoiders).
- Focus on making products related to intimate hygiene more approachable and well-known, for example by taboo-breaking (marketing) campaigns, creating new narratives around menstruation and childcare, and accessible design.

Future research should look into further explaining the differences between the countries by investigating the culture and the historical background of reuse practices. More insights are needed into the specific requirements for reusable products (e.g. what kind of multifunctionality or customisation do people expect?), and the relationship between material flexibility and acceptance of reusable products. Regarding specific categories of reusable products, such as intimate hygiene, more research is needed on the influence of taboo and shame related to bodily fluids in the context of sustainability. The same experiment could be done with different (types of) products.

ACKNOWLEDGMENTS

Thanks to Camilla Barbarossa and Patrick De Pelsmacker for assisting with the statistical analysis.

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https://doi.org/10.1017/pds.2023.365 Published online by Cambridge University Press