



Beyond a mediocre customer experience in the circular economy: The satisfaction of contributing to the ecological transition

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ABSTRACT

This article aims to understand and explain the differences in circular (versus traditional) economy consumption habits. It explores the customer experience's role in influencing satisfaction and reuse decisions. Data is collected through a mixed-methods case study. Specifically, the article looks at an innovative ecological sanitation system for urban households aiming at collecting human waste for valorization. Among the participating households, 46 persons provided data: 12 were interviewed about their motives for and experience of using dry sanitation and participating in the waste collection process, 42 answered a user profile survey focusing on demographics and basic individual values, and 36 submitted diary entries (123 in total) providing detailed descriptions and evolutions of their experiences. Based on this rich dataset, the findings highlight that the customer experience is largely inferior to that of using traditional sanitation systems because it is inconsistent, inconvenient and requires significant customer efforts (e.g., voluntary participation, creativity, and bricolage skills). Nonetheless, this mediocre experience is counterbalanced by the customer's personal values and beliefs, as well as the satisfaction of achieving a more responsible and sustainable activity.

1. Introduction

In the UK, the average adult uses more than 50,000 liters of water when flushing, as well as produces 730 liters of urine and 91 kg of feces a year (Hu et al., 2016; Pathy et al., 2021). It is estimated that recovering energy from human waste, such as transforming the nutrients contained in urine and feces into agricultural fertilizers, will become a \$6 billion market worldwide by 2030 (Van Voorhis et al., 2018). The circular economy paradigm enables such a transition by promoting zero waste generation through a 'closing the loop' approach (Bocken et al., 2016; Ellen MacArthur Foundation, 2013; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Lüdeke-Freund et al., 2018; Stahel, 2016). This paradigm focuses on two pillars of sustainability: environmental and financial value creation (Geissdoerfer et al., 2017), promoting leveraging renewable technologies, consumer empowerment, and the development of new ecosystems and networks to create a positive environmental impact. However, a transition based on circular solutions "requires essential changes in current production and consumption patterns" (Kirchherr et al., 2018, p. 266, emphasis added). Research should, thus,

adopt a customer-centric approach to complement and enrich provider-oriented manufacturing studies (Clube and Tennant, 2020; Pecorari and Lima, 2021; Schallehn et al., 2019; Tunn et al., 2020).

New consumption practices in the circular economy include subscribing to rental services instead of buying new products; reusing, repairing, or renovating (e.g., preventive product maintenance and care); as well as sorting waste and recycling (Camacho-Otero et al., 2018; Elzinga et al., 2020; Lieder et al., 2018; Morris et al., 2021; Pecorari and Lima, 2021; Schallehn et al., 2019; Tunn et al., 2020; van Boerdonk et al., 2021; van Weelden et al., 2016). Engaging in the circular economy requires consumers to adapt their behaviors. For example, in the post-use phase of a product life cycle, consumers can visit a repair café to learn how to have household goods fixed and/or donate them to charity so they can be redistributed, both of which are deviations from the traditional throwaway behavior (Camacho-Otero et al., 2018; Schallehn et al., 2019). Although a wide range of literature has focused on recycling (e.g., Bekin et al., 2007), there are more radical sustainable behaviors that require extensive time and effort, such as the logistics encountered by consumers aiming for zero waste.

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However, customer acceptance of circular solutions has been difficult to achieve. For example, a recent study found that “consumers are frequently reluctant to use cloth diapers because these systems demand more consumer effort” (Hoffmann et al., 2020, p. 3). More research is therefore needed to better understand circular economy practices (those “beyond recycling”) and, more specifically, how and why customers adopt such practices despite “the personal trade-offs” and “amount of extra work these practices entail” (Bekin et al., 2007, p. 279). Thus, the purpose of this article is to understand and explain the differences in circular (versus traditional) economy consumption habits. To do so, this article empirically explores the role played by the customer experience in influencing satisfaction and reuse decisions in the context of dry sanitation systems.

The remainder of this article is structured as follows. First, the previous literature dealing with the issue of customer acceptance and involvement in the circular economy is presented, and a theoretical framework for understanding and explaining the key components of a customer experience is introduced. Second, the methodology behind the case study of the chosen circular solution is described. Third, the findings related to the individual context, the touchpoints and qualities of the customer experience, and evaluative outcomes are reported. Fourth, the study’s contributions are discussed, managerial recommendations are offered, and recommendations for further research are provided. Finally, concluding remarks are given.

2. Customer experience in the circular economy

2.1. Involving customers in closing resource loops

The 3-R hierarchy of waste management (reducing, reusing, and recycling) is fundamentally anchored in minimizing waste, rather than creating new resources. Contrary to recycling and upcycling practices, the process of repurposing or “reframing” waste into a new value proposition can increase the “resourcefulness” of existing materials (Guyader et al., 2020). The transition to a circular economy based on resource recovery and other solutions to transform waste into value, or to reprocess disposed products into new ones, faces important customer acceptance issues. Indeed, such solutions require extensive customer involvement and a consequent shift away from traditional consumption habits, resulting in a very different customer experience. Although there is a general lack of willingness from customers to change their consumption habits toward more sustainable and durable ones (White et al., 2019), extant literature has found that consumers are passive, and knowledge about their adoption of circular solutions is limited (Asgari and Asgari, 2021; Camacho-Otero et al., 2018; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Kirchherr et al., 2017; Khitous et al., 2020; Morris et al., 2021; Schallehn et al., 2019).

In the circular economy, consumers play a significant and active role in closing the loops, leading to more *circular touch points* between the company and consumers over multiple interactions, and thus an extended customer experience (Lüdeke-Freund et al., 2018; van Boerdonk et al., 2021). However, little research has been undertaken to better understand the factors related to the customer experience in the circular economy, and studies that have been carried out have mostly focused on product-service system (PSS) issues. In the business-to-business (B2B) context of maintenance service provision for trucks, for example, research has largely focused on studying customer experience factors (physical product, virtual social environment, customer support, self-service technology, etc.) and how those influence the adoption of PSS solutions (Pecorari and Lima, 2021). Yet the B2B context is different from consumer markets, where customer experience with PSS (those related to used products through second-hand, remanufacturing, and renting models) requires adopting a long-term, rather than transactional, perspective (Schallehn et al., 2019). Ultimately, PSS solutions do not capture the breadth of circular economy initiatives. For example, contamination concerns in garment rental solutions (e.g.,

visual and odour-related) have emerged as negatively influencing the customer experience, ultimately leading customers to reject this circular solution (Clube and Tennant, 2020). In general, the literature has paid limited attention to the role of customers in fostering the adoption of circular economy solutions and more specifically to the key components of the customer experience of using such solutions. Interestingly, ecological sanitation solutions represent an innovative and rather extreme form of circular solution resource recovery, an area that is under-researched in the literature (Kirchherr et al., 2017). Previous studies show the potential for urine-based fertilizer and feces-based compost, but they also highlight the problem of user acceptance (Gao et al., 2017; Hu et al., 2016; Malila et al., 2019; Oarga Mulec et al., 2016; Pathy et al., 2021). However, most studies were conducted in rural areas in China, a very idiosyncratic research context. There is thus the need for an empirical investigation of such circular solutions in urban settings in the Western world, where it represents a significant market opportunity (Van Voorhis et al., 2018). This research adopts the perspective that customer acceptance depends on how the experience of a circular solution is perceived by the user, as well as the role the experience plays in influencing satisfaction and reuse decisions.

2.2. Customer experience

Customer experience is a broad concept encompassing a range of actions and reactions that occur over the course of a relationship with a provider (Lemon and Verhoef, 2016). The customer experience research emphasizes the importance of the settings in which the experience takes place. In particular, scholars have differentiated customer experience in hedonic and utilitarian settings. Hedonic contexts are designed to facilitate the creation of engaging, memorable, and highly emotional experiences (Zomerdiijk and Voss, 2010). Research has also explored more standard, everyday, or mundane experiences, which are broadly referred to as utilitarian contexts (Rychalski and Hudson, 2017; Siebert et al., 2010). For instance, in hospitals, retail banks, and postal and courier services, the customer experience involves obtaining information, products, and services out of necessity rather than personal desire (Beltagui et al., 2016; Ponsignon et al., 2015).

De Keyser et al. (2020) carried out an extensive review of extant customer experience literature to provide conceptual clarity in this fast-growing and fragmented field. Their analysis culminated in the development of a nomenclature centered on three structural components that comprises every customer experience: touchpoints, contexts, and qualities (TCQ). They argued that these components are to be examined collectively to provide a sound understanding of the key factors that inform the decision of consumers whether to “pursue the journey and their overall relationship with the organization” (p. 442). The TCQ nomenclature provides a robust conceptual framework that is relevant to study and understand how customers perceive their experiences with a service provider. The nomenclature has been increasingly used in recent empirical studies to investigate diverse types of customer experiences in various consumption contexts (Bolton et al., 2022). Following, we outline each component and associated dimension of the nomenclature, which directly informs the conceptual framework that underpins this research.

First, an experience is formed through a series of ‘touchpoints’ or interactions with the firm (Lemon and Verhoef, 2016) encompassing multiple digital, physical, or relational stimuli (Siebert et al., 2010; Zeithaml et al., 2020). These touchpoints may reside across the entirety of an experience, ranging from a customer’s initial search to post-experience phases (van Boerdonk et al., 2021; Voorhees et al., 2017). Second, the notion of ‘individual context’ relates to the consumer’s own worldview, independent of their experience with a firm (De Keyser et al., 2020). Because an experience is subjective, individual, and context-bound, the consumers’ predispositions, as well as their belief and value system, play a role in influencing experience perceptions and judgment (Becker and Jaakkola, 2020). Third, ‘qualities’ describe how

customers react and respond to stimuli within individual touchpoints or interactions (Keiningham et al., 2020). Among the different dimensions identified by De Keyser et al. (2020), sensorial, emotional, and cognitive responses, as well as a form of behavioral response (customer participation), are the most commonly studied. Sensorial responses represent reactions to stimuli that engage or challenge one or several customer senses, for example, touch or odour-related sensations. Marketing researchers have long emphasized the importance of sensory perceptions for customer experience formation (De Keyser et al., 2020; Zeithaml et al., 2020). These customer emotions are fundamental affective reactions driving and describing how experiences are felt. Cognitive responses are judgments about the quality or superiority of an interaction experience. Customer participation refers to the notion that customers perform activities and/or provide resources that are essential for the experience to take place (Dong and Sivakumar, 2017).

Crucially, De Keyser et al. (2020, p. 442) argued that “any TCQ combination results in a value judgement that motivates or demotivates customers to pursue [...] their overall relationship with the organization”. This statement highlights the importance of accounting for the range of possible outcomes from the experience, consistent with the notion that consumer reactions to interactions and evaluative outcomes are distinct concepts (Becker and Jaakkola, 2020). Evaluative outcomes describe the overall impression, judgment, and future behavior of customers from their involvement and interactions with a service provider (De Keyser et al., 2020). Typical outcomes examined in customer experience studies include customer value (Leroi-Werelds, 2019; Zeithaml et al., 2020), satisfaction, and loyalty (Becker and Jaakkola, 2020).

2.3. Summary

Circular economy solutions providers offer experiences that rely on substantive customer involvement and comprise multiple touchpoints. Capturing and understanding the customer experience is therefore required to better apprehend the market potential of such solutions. Drawing on De Keyser et al.'s (2020) seminal nomenclature, we propose a conceptual framework that summarizes the main insights from the customer experience literature and can adequately support the empirical study as illustrated in Fig. 1. Consistent with the TCQ nomenclature, our framework proposes that the customer's personal context (individual, values, beliefs, and logics) influences how the customer reacts (sensorial, cognitive, behavioral responses) to each of the touchpoints (stage and nature of customer-provider interactions) that form the customer experience. These elements collectively determine how customers evaluate the overall experience (customer value and satisfaction). The next section describes in detail how this conceptual framework was operationalized to inform the empirical study.

3. Method

Circular economy solutions can be tested and established by large corporations, public institutions, or grassroots and civil society initiatives, the latter being the most common in Europe (Ghisellini et al., 2016). This study empirically investigates the customer experience of circular solutions tested by a nonprofit organization. Case study research is suitable because it enables a robust understanding generated by observing what people actually do, how they feel, and why. It illuminates *why* and *how* decisions are made and implemented, as well as their results, providing in-depth information and thick descriptions on the motivations, processes, and outcomes that people derive from an experience (Eisenhardt and Graebner, 2007; Stake, 2005). Moreover, single-case studies are particularly useful in the early stages of theory building for the purpose of developing new ideas and insights into novel and poorly understood phenomena (Siggelkow, 2007).

3.1. Case description

Because the focal phenomenon of this research is the customer experience of a circular solution, we set out to identify an organization deploying a circular business model, namely, one that involved multiple touchpoints and required customer acceptance to support large-scale deployment. In addition, securing access to customers was a priority. A local nonprofit organization located in Bordeaux (France), LF, met these requirements and was therefore considered an appropriate case study.

LF's mission is to support the deployment of the first urban network for ecological sanitation. This type of sustainable sanitation is a ‘resources-oriented sanitation’ (Hu et al., 2016). It is based on ecosystem approaches and aims for “the closure of material flow cycles, a novel trend of pollution treatment (from sewage disposal to resources reclamation), and a re-conceptualization of sanitation (from a ‘drop-flush-forget’ mode to environment protection at sources by means of ‘drop and reuse’ mode)” (Hu et al., 2016, p. 2). LF's non-collective drainage system is based on the development and installation of dry sanitation (in contrast to “wet sanitation” using water), the provision of necessary resources (sawdust, use and maintenance guidelines, buckets, etc.), the weekly collection of human excreta by bicycle, the storage of the collected material (feces and urine), and its redistribution for transformation into valuable resources (fertilizer, biogas) by partnering with competent organizations. LF's aim is that the outcome of the waste valorization process should ultimately be redistributed to participating households. Not only does this solution drastically reduce water consumption but it also promotes the valorization of waste.

LF began to install ecological sanitation in volunteer households in July 2020. The experimentation phase—testing the solution in a real-life context with customers and stakeholders, exploring options, generating empirical data, and so on (see Bocken et al., 2021)—was planned to last two years. The objective was to test the acceptability of the solution and explore the viability of the business model. In a first step, the research team engaged with LF to establish a robust pre-understanding of the case.¹ Interviews were conducted with the founder and board members, meetings were observed, and internal documents were consulted.

3.2. Research framework

Underlying data collection and analysis is a research framework. Fig. 1 describes the timeline, the type of data collected, and the concepts and dimensions studied. Because the customer experience is a broad, complex, and multifaceted phenomenon, and there is a paucity of research addressing the experience of dry sanitation solutions, it was deemed desirable to gather qualitative and quantitative evidence to pursue the research objective. Thus, we adopted a mixed-methods research design in order to yield a deep and broad understanding of the phenomenon, meaningful and confident answers to the research question, and comprehensive, consistent, and valid findings (Creswell and Plano Clark, 2017). Specifically, among the households experimenting with LF's solution, 46 persons took part in this study: 42 completed a profile survey, 36 participated in keeping regular diaries, and 12 were interviewed. In sum, this mixed-methods study relied on the concurrent collection of quantitative data (profile survey) and qualitative data (semi-structured interviews and diaries) to explore the participants' individual context, touchpoints, responses/reactions, and evaluative outcomes derived from the experience.

3.3. Quantitative data: profile survey

The profile survey aimed to provide insights into the customers'

¹ Visual descriptions of LF's solution, mission, and vision are available as online supplementary material.

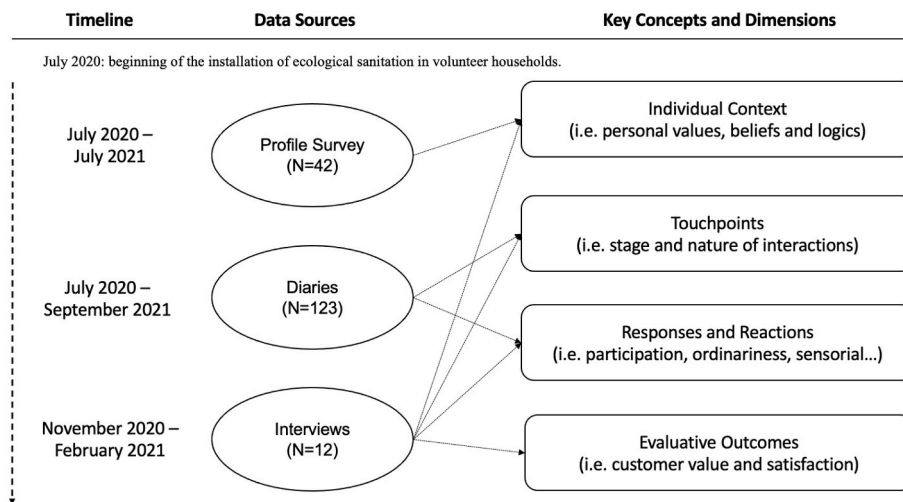


Fig. 1. Research framework.

individual contexts, which involved measuring users' attitudes, motives, and values (see Appendix A). In particular, the respondents' environmental concern was measured with three items taken from Moeller and Wittkowski's (2010) measures of consumers' level of environmentalism; thriftiness (how much having dry sanitation is perceived to enable cost savings) was measured with one item adapted from Hawlitschek et al. (2018); aspiration to a modern lifestyle was measured with three items adapted from Hawlitschek et al. (2018); user values (ecological benefits, societal benefits, pride, status, novelty, and enjoyment) were measured with items based on Leroi-Werelds's (2019) typology of customer values; and 10 basic human values were measured with 21 items from Schwartz's (2003a) Portrait Value Questionnaire (PVQ). Specifically, the PVQ aims to capture what people perceive as important in life (e.g., security, independence, wisdom, success, kindness, pleasure) in order of importance. The 21-item version of the PVQ is employed in the European Social Survey, so that the survey participants' scores could be compared to the general population in France. In addition, the participants were asked to self-report their related environmentally friendly activities (ethically and locally conscious purchase decisions and recycling) through four items adapted from Laroche et al. (2001). All items were measured on a 7-point Likert scale from "totally disagree" (1) to "totally agree" (7), except the PVQ items, which were measured on a 6-point scale from "not like me at all" (1) to "very much like me" (6). Sociodemographic information was also collected from the survey respondents. The questionnaire was translated into French and pretested by scholars who are familiar with survey research and board members of LF. LF distributed the online survey by personal invitation to 62 participants in the experiment, of whom 42 completed it (68% response rate).

As shown in Table 1 of socio-demographics, the survey sample is well distributed in terms of gender, and the average age of respondents is 40.5 years. The sample appears well educated, because all respondents completed high school, and a majority pursued five to six years of higher education. Most are employed at a private company or in the public sector, many are independent entrepreneurs, a few are still studying or seeking a job, and none are retired. The majority earn less than €20,000 per year (before taxes), although the highest incomes are above €90,000.

3.4. Qualitative data: interviews and diaries

The 12 interviews were carried out following an interview guide that was informed by the research framework (see Appendix B). The purpose of the interviews was to obtain in depth information about the participants and their experience. Questions were kept open and flexible to inspire respondents to elaborate on their personal experiences, which

enabled interesting insights to be pursued and new meaning to be generated (Fontana and Frey, 2000). All interviews were conducted by the authors (in French) about two to three months after LF had installed the dry sanitation in the respondents' homes. Interview notes were shared across all the authors to summarize the discussions (generating a total of 14 single-space pages). All interviews were recorded and transcribed verbatim (143 single-space pages). Supplementary material such as pictures was sometimes shared by the interviewees (see Appendix C).

Diaries are seldom used in marketing research despite their ability to capture rich insights into processes, settings, and consumers (Patterson, 2005). Because diaries enable the timely collection of data about a person's most recent experience at regular intervals over a period (Hyers, 2018), they are suitable to explore a repetitive, daily life experience. To complement interview data, a qualitative diary was implemented online to capture perceptions of users' most recent interactions with the sanitation system and collection service. All customers were invited by email to complete the diary every fortnight. As shown in Table 2, 12 diary entries were collected from 36 participants over an 18-month period. These data provide a longitudinal view of the customer experience as it was lived (Bolger et al., 2003) and illuminate how perceptions and judgments about it changed or not over time (Patterson, 2005).

Transcribed interview and diary data were analyzed through thematic content analysis using a combination of deductive coding generated from theoretical concepts from the customer experience literature (De Keyser et al., 2020) and inductive coding generated from an open reading of the material. First, we followed inductive logic procedures, which involved "organizing the data into 1st- and 2nd-order categories to facilitate their later assembly into a more structured form" (Gioia et al., 2013, p. 20), underpinning an insightful conceptual understanding of the phenomenon that was grounded in empirical data. Two researchers independently examined and organized the data into first-order categories representing the key components of the experience. We then compared and contrasted each individual coding and classification decision to achieve a shared and reliable understanding of the phenomenon. Second, we adopted a more deductive approach to collectively examine coded data within all first-order categories and structured them into second-order themes, representing key experience dimensions, as informed by the research framework (De Keyser et al., 2020). Although first-order categories were data-driven, second-order themes represented a more abstract, theoretical level of analysis.

The robustness of the findings was ensured through data triangulation. Obtaining consistent information from multiple sources of evidence from multiple users (e.g., surveys, interviews, diaries) indicated convergent validity and protected against researcher bias and

Table 1
Survey sample demographics (N=42).

Age		
20–30	6	14.3%
31–40	14	33.3%
41–50	16	38.1%
51–60	6	14.3%
Employment		
Employee	25	59.5%
Entrepreneur	10	23.8%
Student	3	7.1%
Job seeking	2	4.8%
Other	2	4.8%
Yearly income		
<20,000€	22	52.4%
20,000–30,000€	11	26.2%
30,000–60,000€	6	14.3%
60,000–90,000€	1	2.4%
>90,000€	2	4.8%
Gender		
Male	18	42.9%
Female	24	57.1%
Family composition		
No child	24	57.1%
1 child	9	21.4%
2 children	6	14.3%
3 children	2	4.8%
Missing	1	2.4%
Highest diploma		
High school	4	9.5%
2 y. Higher Ed.	5	11.9%
3–4 y. Higher Ed.	10	23.8%
5–6 y. Higher Ed.	21	50%
8 y. Higher Ed.	2	4.8%

subjectivity (Goffin et al., 2019). Additionally, emergent categories, themes, and dimensions were reviewed against relevant literature (Dong and Sivakumar, 2017; Leroi-Werelds, 2019) in order to achieve a theoretically sound and robust understanding—a form of abductive logic (Alvesson and Kärreman, 2007).

4. Results

The results section is structured on the concepts and dimensions highlighted in the research framework: (1) the individual context (personal values, beliefs, and motivations); (2) the touchpoints (interactions between users and the organization) and the qualities of the customer experience (visual, sensorial, and emotional attributes of the responses and reactions from users and their level of participation); and (3) evaluative outcomes (customer value and satisfaction).

4.1. Individual context

The respondents' attitudes and motives are described in Fig. 2. They scored high on the environmental concern scale (M = 6.66) but rather average on thriftiness (M = 4.05) and modern lifestyle (M = 4.73) motives. Furthermore, regarding the value derived from having dry sanitation, ecological (M = 6.70) and social (M = 6.00) benefits were the highest, whereas the more self-concerned benefit of achieving status (M = 3.08) was the least shared by respondents. In addition, having dry sanitation enabled survey respondents to gain pride and self-esteem (M = 4.85), enjoyment (M = 4.51), and to satisfy their need for novelty (M = 4.34). Last, survey participants scored high (6.41/7 on average) on environmentally friendly activities related to circular economy consumption.

Responses to the 21 items of the PVQ (see Appendix A) were

Table 2
Qualitative study participants.

ID	Gender	Age	Interview length (min)	Diary entries (N)
ID 01	M	n/a	48:55	4
ID 02	F	38	57:31	9
ID 03	F	n/a	40:55	4
ID 04	F	44	54:18	No entry
ID 05	M	n/a	38:51	No entry
ID 06	F	45	61:47	No entry
ID 07	M	n/a	37:19	5
ID 08	M	43	45:07	1
ID 09	F	33	54:25	5
ID 10	F	50	36:24	2
ID 11	F	26	49:54	6
ID 12	M	34	46:38	5
ID 13	F	43	No interview	5
ID 14	F	51	No interview	1
ID 15	n/a	n/a	No interview	3
ID 16	M	32	No interview	1
ID 17	F	60	No interview	9
ID 18	F	38	No interview	5
ID 19	F	42	No interview	6
ID 20	F	55	No interview	9
ID 21	F	41	No interview	1
ID 22	F	31	No interview	5
ID 23	M	43	No interview	6
ID 24	M	37	No interview	1
ID 25	M	30	No interview	2
ID 26	F	43	No interview	2
ID 27	M	56	No interview	1
ID 28	n/a	n/a	No interview	1
ID 29	n/a	n/a	No interview	1
ID 30	F	44	No interview	6
ID 31	n/a	n/a	No interview	2
ID 32	n/a	n/a	No interview	1
ID 33	M	35	No interview	2
ID 34	F	34	No interview	2
ID 35	M	58	No interview	1
ID 36	F	55	No interview	1
ID 37	F	27	No interview	3
ID 38	M	46	No interview	2
ID 39	M	34	No interview	3

aggregated for the 10 human values and mean-centered according to Schwartz's (2003b, 2012) procedure to reflect value priorities. As shown in Fig. 3, users of dry sanitation scored high on security, tradition, achievement, and stimulation values (above 3) and low on universalism, benevolence, self-direction, conformity, power, and hedonism values (below 3). Furthermore, the survey respondents' values were compared to the European Social Survey Round 9 Data (2018), released in 2021. Independent sample t-tests were performed. The results indicate that the two datasets were significantly different on 6 of the 10 basic values: the dry sanitation sample endorsed the values of tradition, security, power, and benevolence more than, and the values of achievement and conformity less than, the general French population.

The interview data support and enrich the results obtained from the profile survey. There was a broad consensus among study participants about strong environmental and societal convictions, which was reflected in their lifestyles and behaviors. Regarding motivations for participating in LF's solution, they unanimously put forward environmental reasons, such as contributing to saving clean water, reducing pollution, and, more generally, contributing to a better management of natural resources. Interestingly, all interviewees spontaneously stated that they had had previous experience of using dry sanitation, many as early as their childhood and more recently for others; hence, experimenting with a circular solution for human excreta management in an urban context made sense to them.

4.2. Customer experience

Two main themes emerged from the analysis of interview and diary

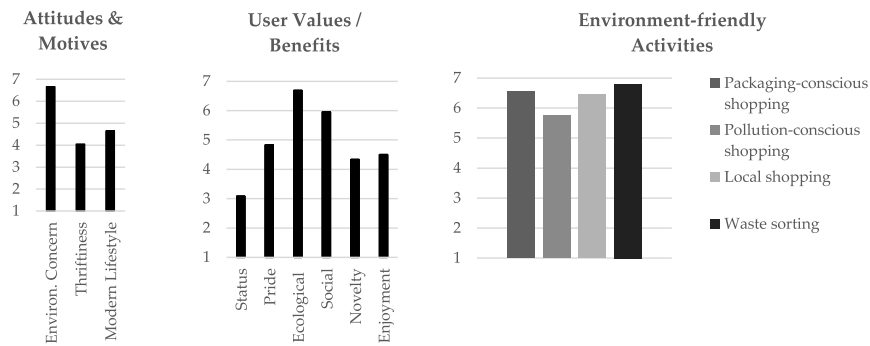


Fig. 2. Descriptive results for user profiles.

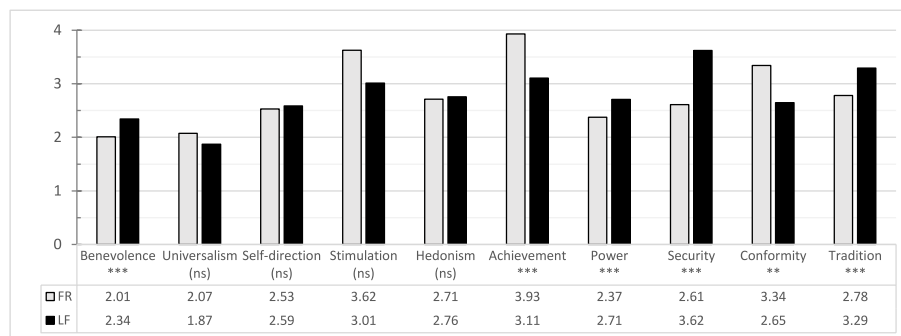


Fig. 3. Human values (PVQ): Comparing survey respondents (N = 42) and French population (N = 1995). Notes: Aggregated value scores on a 6-point scale. t-tests: *** = $p < 0.001$; ** = $p < 0.01$; ns = non-significant.

data; sensorial responses and participation were widely seen as key factors influencing the participants' perceptions of the three touchpoints making up the customer experience: (1) production (using the dry sanitation to urinate and defecate), (2) replacing the collection tanks (emptying the dry sanitation), and (3) planning and handing over full collection tanks to LF.

As shown in Table 3, the first theme relates to the participants' strong reactions and responses to a range of sensory stimuli brought about by the experience of the dry sanitation system. All respondents spontaneously highlighted the olfactory sensations as the main dimension of the user experience. They unanimously emphasized the intensity and nature of the odors they experienced daily. Notably, olfactory responses were stronger in warmer weather. However, many respondents reported that most of the time such odors were acceptable because they were the result of a normal chemical reaction and therefore not necessarily unpleasant. Some households appeared to be more successful than others in fighting odors (e.g., some used white vinegar to remove smells, others used essential oils to hide them).

Next, haptic perceptions were rather positive, because participants noted that the dry sanitation system was comfortable enough and convenient to use. However, three caveats must be noted. First, several participants reported difficulties in finding an adequate and comfortable sitting position to "aim" toward the right box (the system separates excreta). Men also reported having to hold their genitals awkwardly to avoid contact with the toilet. These features of the experience were seen as inconvenient. Second, parents indicated that the design of the toilet was not suitable for children, who found it difficult to sit down properly and thus became increasingly reluctant, and sometimes afraid, to use the

system. Third, those participants who were involved in the weekly draining activity reported that the actual or close contact with excreta resulting from manipulating the boxes was unpleasant. Within most households, we found that typically one person would be permanently assigned to this activity; often, this was the person who had largely been responsible for the decision to take part in the experiment.

Finally, regarding visual responses, several participants pointed to a perceived lack of cleanliness and hygiene. As opposed to traditional sanitation, participants observed that the dry sanitation system was never "virgin" because users see the pile of sawdust, which can make the visual experience unpleasant. For instance, used toilet paper can remain largely visible. In addition, several participants highlighted the recurring appearance of bacterial problems (e.g., mold or fungus) that made the system unattractive and difficult to clean. The awareness of a mediocre visual experience was reported as being particularly negative among guests who used, or refused to use, the sanitation system. In sum, the analysis identified several important pitfalls in the participants' sensorial experience.

The second emergent theme that study participants reported related to their increased level of participation in the experience compared to traditional sanitation systems. Active participation takes two main forms: compulsory and voluntary. On the one hand, the nature of the circular solution requires dry sanitation users to engage in novel, additional weekly activities that were not needed when they used traditional toilets. These activities are mandatory and essential for the realization of the circular solution. Most study participants reported that these activities were neither enjoyable nor satisfying to perform. Specifically, dry sanitation users needed to manipulate and remove the storage boxes of

Table 3
Second order themes identified in interview and diary data.

Themes	Illustrative quotes
Values and beliefs	I really have this awareness, a little embodied, of the link between the health of the earth and the health of humans. (ID 09)
Motivations	It's just an inner coherence. (ID 08) Saving water obviously, because it was an aberration to use drinking water. (ID 10)
Olfactory sensation	My reasons are environmental [...] using our excreta to make fertilizer, that was the main thing. (ID 03) The ammonia smell was problematic. But otherwise, for the rest, no. Then, depending on the quality of the insulation, if it is very hot in the room, it can be a little more problematic; we saw that this summer. (ID 05) Odour problem despite the use of white vinegar. (ID 25) There is still a bit of odour compared to wet toilets. It does not exceed the threshold of the unacceptable; it is a mixture of sawdust and excreta smells. (ID 07) This week, I found the "undergrowth" smell from the toilet to be rather ... unpleasant. (ID 19)
Visual sensation	He admitted that the dry toilet didn't create any particular discomfort, but he asked something like if there couldn't be a way to hide it all? ... we would have to make everything disappear from sight! (ID 09) Apart from the first use after draining and collection, indeed, it is never a neutral place, and therefore, it's considered a space that is no longer virgin and that some see as soiled. (ID 02) He adds double sawdust, to be sure he doesn't see it. (ID 04) There are those stains that set in that I can't seem to remove. I can't keep it clean. (ID 06) The toilet begins to stain, and microporosities (perhaps already there) have appeared in which dirt is getting encrusted. (ID 22) The urine separator needs to be cleaned regularly, and it has not been done for a while. Sawdust and public hair accumulate there, which is not visually attractive. (ID 11)
Haptics	My wife said she had to wiggle back and forth. Either if she needed to pee or to poo. She couldn't explain the actual problem, she just found it inconvenient. Because, often, when she peed, it ended up where the poo was, so ... (ID 08) The design of the sort of funnel that separates pee and poo means that you have to position yourself differently to get the poo to fall neatly in the right place. When going to the bathroom, I don't want to think about how to sit. (ID 12) Regarding the seating comfort, I am not totally convinced by the upper tank for sawdust, which makes the backrest seem like leaning forward. (ID 11) My husband told me that when he goes to the bathroom, he has to hold onto his genitals so that nothing will touch the plastic of the toilet. (ID 06)
Additional mandatory activities	It is true that everything is concentrated in the front of the tank so your regularly need to push the excreta back to the bottom. Otherwise, we used to pull the tank out too early without having completely filled it. It's not prohibitive, but it's complicated. (ID 01) The only thing that is most annoying is when emptying the tanks, when you remove the one where you put the stool. This is the most complicated thing since suddenly, potentially it could tilt over, let's say. (ID 02) If it is very full, there is a risk that it will fall, but hey, it is still a bit tedious in the moment. And that moment happens every week — twice a week for urine. (ID 05) Then, to remove the blue tank, it's a bit complicated. Now, we try not to fill it up too much to be able to carry it more easily. (ID 10) I'm not gonna lie, it's never nice. Comparatively, urine is the most pleasant, but the excrement tank is a little tighter to get out, so we are always afraid of dropping some. (ID 32) The urine tank always has urine on top and the carrying strap is not clean. This is unpleasant. The feces tank is

Table 3 (continued)

Themes	Illustrative quotes
Additional voluntary activities	difficult to get out of the toilet, there are no real handles, and I have to give it a try several times to get it out. This is also not nice. (ID 06) The biggest constraint is more to do with the organization of the waste collection, because I have a job where I am on the move a lot, so it often happens that I am not there at the time of the collection ... So for me the main barrier is that. You don't have that problem when you have wet toilets. (ID 02) I don't know how others clean, if they manage to get by with just white vinegar and a rag. Since that is not enough, I take this cumbersome piece of plastic, I bring it under the shower — I make a move that is not pleasant. I shower the thing with black soap but it makes marks in the small scratches. (ID 06) There are little technical issues that make it so it needs some maintenance, to keep it clean-looking, because otherwise it's disgusting, you know ... (ID 09) It's a bit hard to clean, it's never super clean. These are just little technical things. (ID 10) Can't we fiddle a ventilation system, because we already have an extraction? There, XXX is a DIY tinkerer, so he can bodge something, recycled pipes from somewhere ... (ID 04) I went to the carpentry shop to look for fine sawdust to get rid of the smells. (ID 08) A little complicated to clean in a cramped space, and difficulty being able to lift the dry toilet when you are by yourself (it's too heavy). With a lot of imagination and DIY like MacGyver, I managed to clean it all up and make the place "healthy" again. (ID 02) We correctly use a water + vinegar spray to rinse the separator. We no longer have any odour problems. (ID 11) There's just one improvement to think about, it's about raising the toilet bowl, especially to take out the tank in the back. It lacks a 1-cm space to get it out with ease because you have to tilt it really hard, and therefore it tends to roll in there. (ID 05)
Environmental value	Respecting the environment, saving water, once again fertilizing the soil, for me it's sharing. (ID 04) It's a satisfaction every time I go to the bathroom [...] It's the satisfaction of doing something I believe in. (ID 04) The amount of water we don't use every time we flush, is personally satisfying. (ID 08) Strong ecological values, respect for the environment, in fact happy frugality. (ID 12) While I urinate and/or defecate, I feel good, I feel a satisfaction that my excrement is reused, I feel myself depositing these precious resources in a receptacle, which will be carefully transported and then transformed. (ID 11)

urine and feces (when they were full and/or when collection was due), store them, and then hand over the boxes on the right day and time to the employee responsible for collection and transport. In addition to the time required to perform these novel activities, study participants generally highlighted several problems. For instance, the weekly or biweekly operation of manipulating and removing boxes was described as challenging and carried the risk of spillage. This reaction was exacerbated by the fear of touching excreta (if one mishandled the boxes), which happened to most users. Also, odors and the unappealing sight of excreta made this activity rather unpleasant. Similarly, many participants experienced difficulties in monitoring filling levels, which had resulted in box overflows in many households. Others described the inconvenience of having to "push back" feces toward the back end of the box to reduce the risk of removing a half-full box. Finally, although the waste collection service was broadly described as convenient, effective, and reliable, most interviewees highlighted that it forced them to be available at home on a specific day and time every week, which was seen as a constraint.

The other observed form of increased participation was that study participants admitted taking it onto themselves to reduce their experienced pain points. In other words, they undertook problem-solving, a form of voluntary engagement, to enhance the experience of the dry sanitation system for themselves and fellow users (family members and visitors). We identified a wide range of problem-solving practices across the study sample. There was broad consensus on the idea that cleaning the dry sanitation system involved more time and effort than cleaning traditional toilets and mostly resulted in an inferior visual appearance. In addition, extra cleaning tasks were widely reported due to the occasional overflowing of the urine tank. Several study participants told us about their attempts, sometimes effective and sometimes not, to create their own cleaning products and methods, because traditional ones were largely ineffective in removing stains and concealing odors. An additional voluntary activity by one interviewee (ID 6) was to design a comprehensive training guide (text and pictures), which was then displayed in the toilets to ensure all users adopted good practices when using the toilet (see [Appendix C](#)). Another study participant, who complained about odors, described going to a carpentry shop to source a particular kind of sawdust that was considered most effective in fighting odors. Across the sample studied, we found that participants were happy to make an effort to try and enhance their experience.

4.3. Evaluative outcomes: customer value and satisfaction

Overall, the quality of the experience of using dry sanitation (production, drainage, and collection activities) appeared to be rather mediocre because of the sensory experience, along with a range of the other previously described pitfalls and the increased level of participation and effort required. The dry sanitation experience was generally seen as inferior to the traditional toilet experience. Still, however, most participants emphasized that the sanitation system had quickly become an ordinary, everyday life experience. Importantly, we observed a high level of tolerance in virtually all participants, who were relatively satisfied and accepted the inconvenience associated with this circular solution. As ID 01 put it, “We ignore it because we are sufficiently motivated to contribute”.

Interviewees reported that they derived value not from the experience of using dry sanitation per se, but from other aspects related to the adoption of the circular solution. Consistent with the notion that environmental concern is the highest participation motive (see [Fig. 2](#)), environmental value appeared to be the main outcome that dry sanitation users derived from their experience. During interviews and in their diaries, virtually all participants asserted that they were proud of “doing the right thing” and making a positive contribution to the preservation of the environment. The notion that the shift in behavior induced by the dry sanitation system represented an opportunity to align personal values and actions emerged clearly from the data. Thus, the ability to derive strong and lasting personal benefits from the experience was closely related to its ecological and societal outcomes.

Moreover, participants derived societal value from the fact that they were involved in a local initiative driven by citizens, akin to a grassroots movement, rather than a commercial organization. For instance, one participant described her involvement as “an act of citizenship”, likening it to a fulfilment of civic duties. Another went a step further and expressed her desire to become a board member of LF (see [Appendix C](#)), showing her engagement in LF’s mission and her aim to contribute to transforming the experimentation phase into greater customer acceptance, based on her experience as participant. Respondents also described themselves as pioneers who were happy to take part in this “adventure.” Finally, economic value was an important consideration.

Participating in the experiment was entirely free for households, although they could make a voluntary monetary contribution. We found that study participants were rather reluctant to pay for the real costs of the collection service. This degree of hesitancy raises the important question of willingness to pay for a new solution that provides an inferior experience to replace a free service (or one perceived as such, because water charges are low) and that one does not need.

4.4. Summary

Overall, the findings suggest that the participants (typically, environmentally oriented households with previous dry sanitation experience) derived benefits from factors that were not directly related to the quality of the lived experience. Specifically, participants highlighted the existence of a number of issues with their use experience that required increased participation and effort. All in all, the ecological sanitation experience was perceived and judged to be inferior to the standard sanitation system. However, satisfaction levels were high, and participants were positive in their intention to continue using the solution. This apparent paradox is explained by the value outcomes that participants derived from engaging in a pioneering citizen-driven project that makes a positive and measurable contribution to the preservation of the environment.

5. Discussion

5.1. Theoretical contribution

Previous research on valorizing waste has concentrated on reducing food-waste and recovering nutrients in the hospitality and retail sectors ([Huang et al., 2021](#)) or producing biogas through industrial symbiosis ([Lüdeke-Freund et al., 2018](#)), with only a few studies focusing on customer acceptance issues ([Hu et al., 2016](#); [Pathy et al., 2021](#)). Therefore, this case study on the customer experience with a circular economy solution valorizing human waste and derived contributions to the existing body of knowledge is unique.

This article explores the experience of participants in a novel ecological sanitation system associated with a waste collection service in an urban setting. It identifies key differences between the nature and consequences of the customer experience in a circular economy context and the customer experience in a traditional, linear context. Specifically, the study shows that the customer experience is rather inconvenient, inconsistent and requires significant voluntary customer participation and efforts (e.g., demanding creativity and bricolage skills) to use the circular solution. Nonetheless, participants report a high level of overall satisfaction and a clear willingness to continue using the sanitation system. These insights have important theoretical implications for user-oriented circular economy research because they challenge existing customer experience theory, which has been developed and applied in traditional consumption contexts ([De Keyser et al., 2020](#)). According to this literature, the perceived quality of an experience is the main predictor of customer satisfaction and loyalty behaviors. However, this study demonstrates that in a circular economy context, participants overcome the inconsistency, inconvenience and effortfulness of the experience for the sake of saving environmental resources. In sum, a mediocre experience is counterbalanced by the customer’s personal values, beliefs and logics, as well as the satisfaction of achieving a more responsible and sustainable activity. Ultimately, the relationships between a customer’s individual context, experience, satisfaction and reuse intentions uncovered in this study are conceptually distinct from the relationships established within the traditional, linear economy

(Bekin et al., 2007; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Kirchherr et al., 2017). From a managerial perspective, a key implication is that a relevant approach to support circular solutions lies in seeking close alignment between a provider and customers' worldviews. These insights are discussed further below.

First, this article shows that a mediocre customer experience can be counterbalanced by the customers' personal values and belief systems and that customers create value by engaging in pain-mitigating activities. Negative perceptions about the experience are driven primarily by unpleasant sensorial stimuli. Clearly, the importance of sensory reactions is closely related to the very nature of the experience, although previous research in the fashion rental context has already highlighted the importance of sensorial perceptions of the customer experience in the circular economy (Clube and Tennant, 2020). More interestingly, we observed the conception and enactment of a range of individual practices to cope with negative aspects of the experience, such as sensory perceptions. This resonates with the concept of bricolage when customers improvise and make do with what is available to solve problems — viewing them as opportunities to apply new resource combinations rather than accepting the status quo (Baker and Nelson, 2005; Witell et al., 2017). Moreover, the experience was associated with increased participation and involvement in terms of effort, knowledge, and information. Dong and Sivakumar (2017) observe that the notion of voluntary customer participation, describing activities performed by customers that are not essential for service provision, “is perhaps the least understood [form of participation] but has the greatest potential in value creation” (p. 958). In this study, participants were willing to actively engage in various additional activities in order to enhance their experience and that of other participants as well as to have a positive impact on the environment.

Second, the findings challenge commonly held assumptions regarding the drivers of customer satisfaction, loyalty, and reuse intentions in utilitarian settings. Utilitarian contexts are settings in which customers strive to derive functional and practical benefits from experiences and avoid the occurrence of any possible negative outcomes (Rychalski and Hudson, 2017). In such contexts, customer loyalty depends on the provider's ability to offer a predictable, effortless, and convenient customer experience (Siebert et al., 2010). The sanitation system and associated services under study fit this definition of utilitarian contexts well. The participants' individual values, beliefs and logics helped to overcome the mediocrity of the customer experience. This suggests that in a circular context, customer satisfaction and reuse intentions are driven by the interplay between the customer's personal context and the perceived quality of the experience. Additionally, participants drew on their experience to suggest or implement improvements to the design of the solution. This observation extends previous research (Dong and Sivakumar, 2017) by suggesting that customer participation in a circular economy experience is not always targeted at enhancing one's own experience but also at ensuring the benefit of the wider population and the environment. Circular economy solutions could therefore be regarded as a special type of utilitarian context, which offers a point of departure from existing knowledge regarding the customer experience in utilitarian settings in the linear economy.

5.2. Practical recommendations for managers and policymakers

The profile of the population participating in the urban ecological sanitation experiment raises a number of questions that need to be addressed before wider deployment to the general public could be considered (market adoption of the circular economy solution). Clearly, the environmental orientation and pioneer mindset characterizing the

population of circular economy aficionados played a large part in mitigating negative consequences arising from the customer experience. In addition to demographic information, we emphasized the importance for circular solution providers to capture the personal values and beliefs of customers with a view to ensuring a sufficiently balanced sample of participants in testing such solutions. This approach is critical to obtain customer feedback that can inform more accurately future business model designs and improvement decisions.

Moreover, we identify several levers for organizations seeking to engage regular consumers (not circular economy aficionados) in adopting and accepting these solutions. First, this study suggests that the provider's ability to reduce the pitfalls at *circular touchpoints* (van Boerdonk et al., 2021) and also reducing the level of participation and effort that is required from less environmentally savvy customers is key to driving uptake and ensuring a satisfactory experience. The feedback obtained from early adopters, as well as the bricolage solutions they performed, were useful to identifying various ways to improve the customer experience. In line with this, the second lever involves identifying tactics to encourage such voluntary participation. Providers could support more seasoned users who are more capable of providing voluntary customer activities based on their accumulated experience, for example, by building a “brand community” to share tricks and tips and by rewarding customers who contribute to improving the circular solution. The third lever is that the provider takes on all or part of mandatory activities considered nuisances by the customer (e.g., including a cleaning service for sanitation) to ease the burden on the customers.

Finally, this study suggests two ways in which regional and local policymakers can contribute to the emergence and development of such initiatives. On the one hand, policymakers are encouraged to offer adequate support to circular solution providers, helping them to enhance the design and operation of the products and services that are typically involved in creating the customer experience. Improvements in how customers perceive and evaluate their experience with a circular solution can be seen as a prerequisite to foster wider deployment and adoption by the general public. On the other hand, policymakers can explore the opportunity to effect changes in the population's value and belief systems. Raising the population's environmental consciousness has the potential not only to increase the size of the market for circular economy solutions but also to make customers more tolerant of relatively disappointing user experiences.

6. Conclusions

This study has several limitations that suggest future research directions. Specifically, the findings are highly context-specific, which limits the scope of the contribution and the ability to generalize to other forms of circular solutions. Further research should explore the phenomenon of voluntary customer participation in additional and different types of circular economy contexts, for example, using multiple case studies to compare and contrast the findings of this study. Moreover, because the study participants had experienced dry sanitation in the past and score significantly higher on ecological values and other sustainable consumer behaviors than average citizens, future research should consider the point of view of more regular and novice customers to identify similarities and differences between these populations. In the same vein, future research could explore more closely the role of the customer's cultural context in shaping the dry sanitation experience. Finally, this research is limited by the experimentation phase within which it is situated (Bocken et al., 2021). We encourage circular economy researchers to investigate the entire development process of

circular solutions from experimentation to full market adoption, notably the elements of value capture and monetization of the business model, to provide a more complete and thorough understanding of the phenomenon.

In conclusion, this study explored how the customer experience of a fairly extreme form of resource recovery-based circular solution influenced desired customer outcomes, an area that is under researched in the extant literature. Interestingly, such solutions have a high sustainability potential, but they can also introduce more profound changes to the customer experience, which is assumed to influence the decision to adopt and use the solution, and subsequently ensure the commercial viability of the provider’s business model. The originality of this study is to offer robust evidence that extends the existing understanding of the customer experience in a circular economy context as well as challenges mainstream customer experience research, which asserts that a positive experience plays the key role in influencing customer satisfaction. Contrary to this well-established argument, the study shows that in this specific circular economy context the customer’s individual context (i.e. personal values, beliefs and logics) were more significant contributors to

overall satisfaction than the actual experience itself. We hope that this study provides a platform on which future research can build in order to continue exploring this important and growing phenomenon and extend, fine-tune, or challenge these novel and insightful conclusions.

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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

The authors do not have permission to share data.

Appendix A. Profile survey measures

	Item	N	M	SD	S	K
ATTITUDES AND MOTIVES	Environmental Concern (taken from Moeller and Wittkowski, 2010). CA = 0.618. M = 6.66.					
	Environmental protection is very important for me.	41	6.83	0.44	-2.68	7.13
	In my consumer behavior, I hold environmentally friendly products in high regard.	41	6.71	0.60	-1.96	2.79
	If consumer goods are environmentally friendly, I accept other sacrifices (such as paying more).	40	6.45	0.75	-0.98	-0.48
	Thriftiness (adapted from Hawlitschek et al., 2018).					
	Having dry toilets allows me to save money.	40	4.05	1.83	-0.18	-0.81
	Modern Lifestyle (adapted from Hawlitschek et al., 2018). CA = 0.709. M = 4.73.					
	Having dry toilets is in tune with the times.	39	5.85	1.27	-1.17	1.05
	Having dry toilets is trendy now.	39	3.56	1.31	0.29	-0.12
	Having dry toilets is an expression of a modern lifestyle.	38	4.71	1.63	-0.14	-0.63
USER VALUES (BENEFITS)	Status (based on Leroi-Werelds, 2019). CA = 0.813. M = 3.08.					
	Having dry toilets at home is important for my social status.	39	2.64	1.56	0.46	-0.92
	Having dry toilets gives a good impression.	41	3.44	1.42	0.05	-0.22
	Having dry toilets improves the way I am perceived by others.	40	3.28	1.34	-0.33	-1.11
	Having dry toilets gives me social approval.	41	2.93	1.33	0.01	-1.26
	Pride (based on Leroi-Werelds, 2019). CA = 0.805. M = 4.85.					
	I am proud to have dry toilets.	41	5.93	1.37	-1.59	2.97
	Having dry toilets improves my self-esteem.	40	4.68	1.51	-0.45	0.28
	Having dry toilets is important for my self-worth.	36	3.94	1.71	-0.27	-0.51
	Ecological Benefits (based on Leroi-Werelds, 2019). CA = 0.762. M = 6.70.					
	Having dry toilets is environmentally friendly.	41	6.66	0.62	-1.66	1.70
	Having a dry toilet reduces water consumption.	41	6.73	0.67	-2.75	7.46
	Societal Benefits (based on Leroi-Werelds, 2019)					
	Having dry toilets makes a real difference because of their socially responsible nature.	38	6	1.19	-1.34	2.02
	Novelty (based on Leroi-Werelds, 2019)					
I am experimenting with dry toilets out of curiosity.	41	4.34	1.83	-0.33	-0.71	
Enjoyment (based on Leroi-Werelds, 2019). CA = 0.803. M = 4.51.						
Having dry toilets is fun.	41	4.56	1.42	-0.16	0.15	
Having dry toilets gives me pleasure.	40	4.42	1.53	-0.23	-0.12	
BEHAVIORS	Green Behaviors (adapted from Laroche et al., 2001)					
	I pay attention to the product packaging, avoiding buying products wrapped in excessive plastic packaging or not made of recycled paper.	41	6.51	0.93	-2.23	5.08
	I refuse to buy products from companies considered to be polluters.	39	5.82	0.94	-0.02	-1.22
	I buy local products.	41	6.49	0.87	-1.88	2.97
	I sort out my waste.	41	6.78	0.61	-3.27	11.46
HUMAN VALUES	Benevolence					
	It’s very important to him to help the people around him. He wants to care for other people.	41	2.44	1.05	-0.04	-1.18
	It is important to him to be loyal to his friends. He wants to devote himself to people close to him.	40	2.25	0.90	0.36	-0.48
	Universalism					
	He thinks it is important that every person in the world be treated equally. He wants justice for everybody, even for people he doesn’t know.	40	1.70	0.94	1.04	-0.11
	It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them.	41	2.27	1.12	0.79	0.07
Self-Direction						
He strongly believes that people should care for nature. Looking after the environment is important to him.	40	1.68	0.83	1.26	1.32	

(continued on next page)

(continued)

Item	N	M	SD	S	K
Thinking up new ideas and being creative is important to him. He likes to do things in his own original way.	40	2.08	1.27	1.44	1.79
It is important to him to make his own decisions about what he does. He likes to be free to plan and to choose his activities for himself.	39	3.13	1.44	0.16	-1.15
Stimulation					
He likes surprises and is always looking for new things to do. He thinks it is important to do lots of different things in life.	40	2.60	1.30	0.21	-1.09
He looks for adventures and likes to take risks. He wants to have an exciting life.	41	3.39	1.39	-0.40	-0.80
Hedonism					
Having a good time is important to him. He likes to "spoil" himself.	41	2.51	0.95	0.24	-0.86
He seeks every chance he can to have fun. It is important to him to do things that give him pleasure.	40	2.98	1.19	-0.34	-1.01
Achievement					
It is very important to him to show his abilities. He wants people to admire what he does.	40	3.30	1.30	0.50	-0.31
Being very successful is important to him. He likes to impress other people.	40	2.90	1.10	0.45	-0.71
Power					
It is important to him to be rich. He wants to have a lot of money and expensive things.	40	1.50	0.68	1.03	-0.09
It is important to him to be in charge and tell others what to do. He wants people to do what he says.	41	2.59	1.07	0.15	-0.77
Security					
It is important to him to live in secure surroundings. He avoids anything that might endanger his safety.	41	3.66	1.41	0.20	-0.69
It is very important to him that his country be safe from threats from within and without. He is concerned that social order be protected.	38	3.58	1.22	0.23	-1.00
Conformity					
He believes that people should do what they're told. He thinks people should follow rules at all times, even when no-one is watching.	39	2.23	0.96	0.26	-0.84
It is important to him always to behave properly. He wants to avoid doing anything people would say is wrong.	40	3.10	1.32	0.52	-0.39
Tradition					
He thinks it's important not to ask for more than what you have. He believes that people should be satisfied with what they have.	41	4.05	1.14	0.22	-0.53
Religious belief is important to him. He tries hard to do what his religion requires.	40	2.55	1.26	0.85	0.45

Note: The ten human value items taken from the Portrait Value Questionnaire (Schwartz, 2003a), were gender-adapted (compounded scores are reported) and measured from 1 to 6. Other items were measured from 1 to 7. *N*: number of observations, *M*: mean, *SD*: standard deviation, *S*: skewness, *K*: kurtosis, and *CA*: Cronbach's alpha.

Appendix B. Semi-structured interview guide

1. Participation Motives

- How did you hear about LF and the experiment?
- Why did you decide to participate in the experiment? Could you explain your choice in a few words?
- And more precisely, what do dry toilets represent for you?
- Did you keep wet toilets? Explain to us.

2. User Experience (based on Leroi-Werelds, 2019)

- Description of customer experience/journey and general feelings
 - How has your experience been in general? Can you tell us about your experience of using dry toilets and about the collection process?
 - What is your role in the collection process (repotting chips, emptying, etc.)?
- Experience of the sanitary system (i.e., the good per se).
 - How is your experience going? What are your impressions of the sanitary system, i.e., dry toilets (practical, hygienic, etc.)? Could you explain in a few words?
 - What did you particularly like?
 - What did you particularly dislike?
- Experience of the collection process (i.e., the service).
 - How is your experience going? What are your impressions of the waste collection service?
 - What did you particularly like?
 - What did you particularly dislike?
- Areas for improvement
 - If you had to improve the sanitary system, what would you suggest and/or do?
 - If you had to improve the collection process, what would you suggest and/or do?
- Satisfaction
 - How satisfied are you with the experience?
 - Explain ...
- Continuation
 - Will you continue with the experiment?
 - Why?
- Recommendation

- i. Have you shared your experience with those around you (friends, family, colleagues, etc.)?
 - ii. What do you tell them?
 - iii. Why?
3. **Value** (based on [Leroi-Werelds, 2019](#))
- a. General
 - i. What benefits/advantages do you derive from your participation in the experiment?
 - ii. What are the constraints (monetary and non-monetary)?
 - b. Specific (to guide the respondent if necessary)
 - i. Did this experience change anything in you? (e.g., social status, self-esteem, ecological value, societal value). Describe, explain, and illustrate in your own words.
4. **Interactions**
- a. What about your interactions and exchanges relating to the use of dry toilets within your household?
 - b. What about your interactions and exchanges relating to the use of dry toilets with your friends/family?
 - c. How have those around you reacted?
 - d. How do these interactions impact your opinion of the dry toilets and waste collection system?
 - e. What hinders/encourages these interactions?
5. **Consequences**
- a. “Rebound effect”: Using dry toilets means that you will use less water in everyday life (if other consumption items remain constant).
 - i. Is saving water important to you? (from emotional and economic perspectives). Tell us why (not).
 - ii. Do you think this will have an impact on your annual budget? To what extent?
 - iii. Do you anticipate any effect on your general water use at home? (e.g., motivation to use less water in other activities or, conversely, “to be able to do something else with it”).
 - b. Everyday behaviour
 - i. Has anything changed in your daily life since the start of the experiment?
 - ii. Why? Explain.
 - iii. What about children’s reactions?

Appendix C. Additional empirical material



Note: Pictures of a study participant’s dry sanitation, with wall graffiti indicating a usage guide (e.g., for guests).



Note: Picture of a study participant's "poster application" to become a board member of LF, showing participation motives in the experiment phase of the project, beliefs in ecology and social cooperation, and potential contribution to the organization's mission.

Online supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2022.134495>.

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