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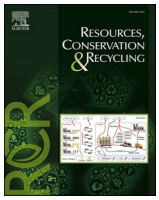

Reducing single-use plastic in everyday social practices: Insights from a living lab experiment

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ABSTRACT

Plastic is ubiquitous in everyday social practices, and few consumer activities do not involve its direct or indirect use. Single-use plastic (SUP) based on fossil fuels is particularly problematic, as it seems virtually unavoidable, especially in everyday products, from plastic wrapping cucumbers to shampoo bottles. Although reducing SUP is crucial, there is little evidence of achieving this in everyday social practices. This paper examines the practicality of reducing SUP and consumer frustration. We studied the social practices of 20 adults using diary records and workshops over the course of two weeks. Our findings suggest that everyday practices shape SUP use, and reducing it disrupts daily life, even for eco-conscious consumers. Packaging-free shops are a popular approach to reducing SUP. However, consumers are hindered from using this alternative by limited availability, convenience and product variety. Future research should explore the seamless integration of alternatives to reduce SUP into everyday social practices.

1. Introduction

The urgent need to decarbonise and defossilise the global systems of production and consumption is widely recognised. However, the prevailing discourse revolves mainly around technical solutions (Huesemann and Huesemann, 2011; Levidow, 2022; Rissman et al., 2020). Although technological advances in waste management, recycling, bio-based or biodegradable alternatives, and fossil-free feedstock play a critical role in reducing greenhouse gas (GHG) emissions and facilitating the transition to cleaner energy sources, these efforts must be complemented by an examination of resource consumption patterns embedded in daily routines and habits (Blatt et al., 2020; Bleischwitz et al., 2022). The pervasive integration of fossil fuel sources within systems of provision and everyday life underscores the importance of considering the broader ecological context of low-carbon technologies and policies (Rissman et al., 2020). Therefore, broadening the discourse to include social science evidence on the evolution of consumption patterns towards sustainability can accelerate progress towards a sustainable future. This study explores the role of single-use plastic (SUP) in consumers' everyday lives, highlighting the importance of social practices and systemic redefinitions of conventions to reduce plastic consumption.

The everyday use of plastic presents complex resource and environmental challenges (Dilkes-Hoffman et al., 2019). Several studies have examined SUP from a green decision-making perspective (Heidbreder et al., 2020; Mundt et al., 2020; Wagner, 2017). These studies view people as thoughtful consumers and recommend interventions to reduce SUPs that focus on behavioural change, economic incentives, regulations, and the availability of sustainable options (Fano et al., 2022; Heidbreder et al., 2023; Kautish et al., 2021; Steinhorst and Beyerl, 2021). Consumer motivation to reduce SUP has thus been linked to both intrinsic and extrinsic factors. Intrinsic motivation is driven by a sense of personal competence, connectedness and autonomy, suggesting that people are more willing to reduce their SUP consumption when they feel empowered and connected to their choice (Nguyen et al., 2022). However, extrinsic motivations have been found to have an impact on reducing the use of SUP bags (Luo and Zhao, 2023). These findings highlight the complexity of reducing SUP and the need for context-specific interventions that incorporate intrinsic and extrinsic motivators as well as systemic factors to address the problem of excessive SUP consumption (Borg et al., 2022). Furthermore, Truelove et al. (2023) found that other people's behaviour, rather than one's own identity, was the most important predictor of change in plastic consumption. Other studies from the perspective of Social Practice Theory

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(SPT), such as Evans et al. (2020) and Hawkins (2019), have explored the social material of SUP to understand the configuration of relational systems that enable SUP.

Existing research on SUP does not explicitly address everyday social practices associated with SUP consumption. Based on the idea that practices, not individuals, are inherently linked to resource consumption (Røpke, 2009; Spurling et al., 2013; Warde, 2005), a promising way to study the use and reduction of single-use plastic (SUP) is to examine the collective symbolic framework of actions that either encourage or discourage SUP. Our study fills this knowledge gap by examining how consumer everyday social practices relate to plastic usage and avoidance. This was achieved by answering an overarching research question: *How is single-use plastic embedded in everyday social practices and under which conditions can the amount of single-use plastic in daily social practices be reduced?* In doing so, our study goes beyond examining consumer attitudes and intentions to offer new insights into the links between SUPs and everyday social practices, leading to solutions that go beyond behavioural or technical fixes.

The remainder of this paper is organised as follows. Section 2 provides the conceptual framework and briefly reviews interventions to overcome plastic problems. Section 3 explains the data collection process, and Section 4 presents the results. Section 5 discusses the implications and limitations of the study. Section 6 concludes the paper and suggests areas for future research.

2. Conceptual framework and related literature

2.1. Conceptual framework

To analyse how SUP and social practices interact in everyday life, this research uses a conceptual framework developed by Rabiu and Jaeger-Erben (2022). The framework is based on a systematic literature review of studies on consumer practices that are relevant for a transition to a circular economy (CE) and draws on the perspective of SPT. The review provides a comprehensive analytical framework for understanding the complexity of circular consumer practices (CCPs) and how different social practices interlock.

Fig. 1 shows the conceptual framework. The framework particularly emphasises the importance of appropriating and routinising circular practices and the challenge of not only trying out ways to reduce SUP consumption, but also routinising these behaviors. Rabiu and Jaeger-Erben (2022) conclude that reducing SUP can have an impact on a network of associated or interlocked practices, their mutual relationship and their association with social meanings like comfort or convenience. With the emergence of social innovations to reduce SUP, such as packaging-free shopping and supermarkets, it is essential to understand how these meanings and the interlocking of social practices act as barriers toward zero-waste consumption.

Studies have found that packaging-free supermarkets can lead to more resource-efficient behaviour amongst vendors and consumers because of their potential to reduce packaging and food waste (Beitzen-Heineke et al., 2017). However, the impact of packaging-free supermarkets and the homogenisation of these options into individual consumption patterns in everyday life is still unknown. Although alternative supply systems such as packaging-free stores perform better than mainstream stores do (Scharpenberg et al., 2021), it is essential to understand how they interact with consumers' everyday social practices. This study highlights the issues at the intersection of sustainable consumption alternatives and social practices related to consumption.

2.2. Related literature on interventions to reduce single-use plastic

Previous literature has often viewed plastics as a valuable component of the modern economy, which has harmful consequences if not properly handled (Thompson et al., 2009). Early consumption research has explored the benefits of using plastics in medical products, renewable energy, and energy efficiency in transportation (Andrady and Neal, 2009). However, the increasing prevalence of SUP, the production, use, and disposal of which are problematic from an environmental perspective, has led to several concerns about reducing plastic (Walker and Xanthos, 2018). This section reviews interventions to reduce SUP based on three levels: material, systems of provision, and consumption-related interventions and their relationship with the three basic principles of CE: reduce, reuse, and recycle (see Table 1.).

2.2.1. Material-based interventions

Plastics are typically produced using fossil fuels. In 2019, approximately 13.8 exajoules (EJ) of fossil fuel consumption was used for plastic production (Singh et al., 2022). Fossil-fuel-based materials raise environmental concerns and, therefore, require sustainable alternatives.

Table 1
Intervention in plastic and associated basic CE principle.

Levels of interventions	Relevant CE principle		
	Reduce	Reuse	Recycle
Material-based: finding alternative materials	Minimising materials and emission	Better materials, longer lasting materials	Recyclable materials
Systems of provision: finding other ways to organise procedures	Providing SUP-free products	Providing services lending containers	Ameliorate recycling
		Product design	Design for and from recycle
Consumption related: other practices	SUP bans	Collaborative consumption	Label and instructions (digital passport)
	Incentives Education		

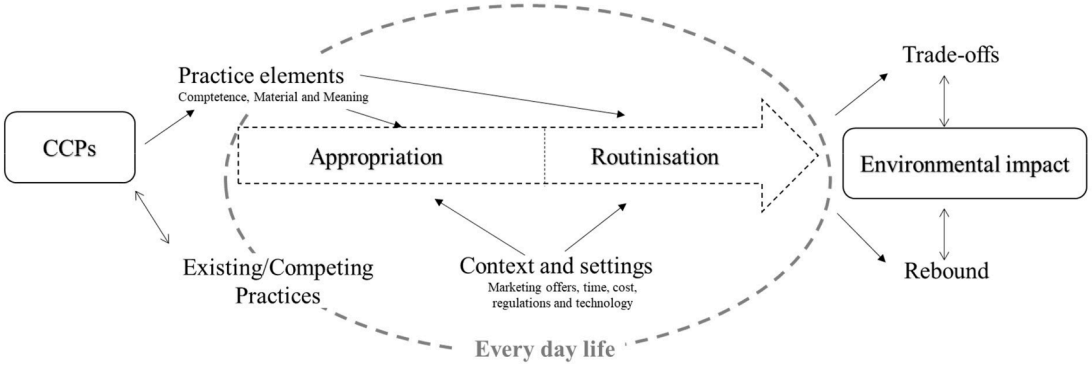

Fig. 1. A framework for studying circular consumer practices adapted from Rabiu and Jaeger-Erben (2022).

Several studies have examined alternative materials to conventional plastics (Fano et al., 2022; Friedrich, 2020). Even though alternative options like biopolymer nanocomposites (Qasim et al., 2021), biodegradable polymers, compostable plastics, and bio-based materials (Singh et al., 2022), are viable options, their widespread adoption depends on meeting specific requirements, including cost-effectiveness and energy efficiency. Bioplastics share some common characteristics with fossil-based plastics, and can serve as alternatives with lower environmental impacts (Zhao et al., 2023) and a reduction of GHG emissions up till 187 % Singh et al. (2022). This reduction in emissions occurs because biomass sources absorb carbon dioxide as they grow (Shen et al., 2022), offsetting the emissions produced during manufacturing. In addition, these materials can help minimise resource consumption and waste management issues, thereby reducing the accumulation of plastic waste in the environment.

Another vital aspect of material intervention is the development of alternative materials that can be recycled. A key advantage of bioplastics is their suitability for mechanical recycling. Unlike conventional plastics, bioplastics are mechanically recyclable, allowing multiple recycle and reuse processes (Kumar et al., 2023). This characteristic enables the creation of a closed-loop system. Life cycle assessments (LCAs) have shown that replacing fossil-based plastics with bio-based alternatives will help to reduce the environmental impact of plastics, although such conclusions are complex (Bishop et al., 2021; Walker and Rothman, 2020). LCAs are limited in their ability to provide a complete picture of the environmental impacts of bioplastic products (Bishop et al., 2021). Walker and Rothman (2020) argued that while replacing conventional plastics with bioplastics may seem reasonable at first glance, it is essential to consider the relative environmental impacts of each material throughout the value chain. Moreover, not all biomass plastics are biodegradable or compostable, particularly if they are mismanaged. This further supports reducing plastic production and consumption, especially for unnecessary and problematic plastics.

2.2.2. *Systems of provision interventions*

Interventions in systems of provision are central to addressing the problem of SUP, as they intersect with both business activities and consumer behaviour. Such interventions enable businesses to improve the design of SUP so that it is less resource intensive, while empowering individuals to rethink processes to reduce and reuse SUP. These include strategies such as packaging-free supermarkets, reusable containers and designing for and from recycling.

Packaging-free supermarkets are innovative measures to reduce SUP consumption (Beitzen-Heineke et al., 2017). These stores eliminate or significantly minimise packaging by offering consumers the option to purchase products in bulk or through alternative packaging (Scharpenberg et al., 2021). Packaging-free supermarkets encourage customers to bring their containers and offer refill stations to reduce the need for SUP. Reusable packaging has gained traction and has been explored in literature as an alternative to SUP for various applications. This has been found to reduce the negative environmental impact of packaging waste (Miao et al., 2023; Tan et al., 2023). Miao et al. (2023) observed that consumers were generally optimistic about reusable packaging. However, concerns regarding safety, product quality, and contamination hinder the adoption of such packaging (Miao et al., 2023). These concerns raise questions regarding the practicality of implementing reusable packaging in consumer everyday social practices. However, the prospect of reusable packaging has led to numerous studies on its potential future use (Ross and Evans, 2003; Song et al., 2023; Tan et al., 2023) and how it can become mainstream (Greenwood et al., 2021).

Other production-level initiatives are intended to improve the product design and facilitate recycling. These include designing SUP products that are easy to recycle and encouraging using materials with high recycling rates (Law and Narayan, 2022). Conversely, design from recycling approaches uses recycled plastics as raw materials to produce new items (Ragaert et al., 2020). These measures help close the loop by reducing dependence on virgin plastics and promoting a circular economy. Law and Narayan (2022) emphasis the need for end-of-life design to improve efficient separation by users and recycling process. As production measures are continuously explored, it is critical to focus on their integration into everyday social practices and the potential disruption of existing social practices to improve their implementation.

2.2.3. *Consumption-related interventions*

Interventions to reduce SUP consumption or usage mainly focus on behavioural changes through awareness, incentives, and SUP bans. A close example of such an intervention is the Plastic-Free July (Heidbreder et al., 2020). However, the literature on behavioural interventions to address plastic problems is mixed. While there is some evidence that behavioural change interventions have some effect (Luo and Zhao, 2023; Martinho et al., 2017; Willis et al., 2018), there is limited evidence that these efforts have been successful in changing individual behaviour in the long run (Borg et al., 2022; Dilkes-Hoffman et al., 2019; Heidbreder et al., 2019). Likewise, Truelove et al. (2023) emphasise the effectiveness of pledges and commitments to technology-based approaches, such as apps that track plastic consumption, to achieve lasting and conscientious reductions in plastic use.

The urgent need to reduce plastics has led the European Union (EU) to take necessary actions by actively pursuing regulations. These efforts include guidelines for packaging and packaging waste that require active end-user engagement (Niero, 2023) and the integration of CE principles into plastic design (Palm et al., 2022). Yalçın et al. (2023) offered a multilevel perspective on the actors involved in European plastics policymaking. The viewpoints of consumers, industry, government actors, and civil society are mutually influenced by the complex material properties of plastics (Yalçın et al., 2023).

The reuse approach focuses on overcoming unsustainable social practices of consumption. Holmberg and Persson (2023) emphasise the need to embrace sharing and lending practices to reduce plastic consumption. Proper labelling and instruction initiatives, such as digital passports, are necessary to improve recycling at the consumer level (Burrows et al., 2022; Yalçın et al., 2023). Nielsen et al. (2020) asserted that policy responses and initiatives must go beyond technical solutions and individual behavioural adjustments. According to Nielsen et al. (2020), a focus on systemic, large-scale economic and political arrangements and prevailing norms and practices that perpetuate unsustainable production and consumption patterns is essential. Therefore, examining the everyday social practices associated with the consumption of SUP is a worthwhile endeavour to gain a deeper understanding of how these practices can be transformed to reduce SUP.

The limitations of existing measures to reduce SUP make it necessary to examine SUP from within the network or pattern of relationships to which it belongs (Evans et al., 2020). Our study differs from previous literature in that, rather than studying behaviour or technology; it takes the configuration of everyday social practices as the site of intervention to understand the relationship between products and practices and to develop an account that links the constraints of current systems of provisions and the material affordances of SUP.

3. Material and methods

Sustainable consumption research regularly emphasised the importance of considering tacit and mundane consumer activities (Jaeger-Erben and Offenberger, 2014; Mylan et al., 2016; Sattlegger et al., 2020). However, when it comes to studying consumers in real-life situations, there are always difficulties. These include the complicated nature of consumer behaviour, ethical concerns and the limitations associated with observing consumers in their everyday environment. Although a definitive consensus on the ideal research method to address this issue has not yet been reached, the diary method has been proposed as a useful approach to gain insight into daily habits in sustainable consumption (Reid et al., 2011; Richter and Bokelmann, 2017). Diaries

offer several advantages over intrusive experiments and traditional surveys (Wild et al., 2010). Diary studies are a form of research in which participants record and possibly reflect on their activities (Reid et al., 2011). In social research on sustainable consumption, diary studies have been used to study household food and packaging waste practices (Leverenz et al., 2019; Müller and Süßbauer, 2022; Richter and Bokelmann, 2017).

This study combines the transdisciplinary perspective of diary methods, workshops and a follow-up questionnaire to understand SUP use and avoidance in everyday social practices. Fig. 2 provides the study procedure. The diary method allows us to delve into consumers' lives without disrupting patterns or imposing artificial constraints. This less intrusive nature encourages participants to provide authentic and unfiltered accounts of their SUP consumption habits. One of the greatest strengths of diary studies is their ability to provide contextual information, which enriches our understanding of consumers' daily experiences (Milligan et al., 2005). Diary-based research often strikes a balance between the number of participants, duration of the study, and depth of information collected. Our study's sample size and duration were consistent with similar social science studies. Recent studies, such as Richter and Bokelmann (2017) and Müller and Süßbauer (2022), serve as relevant examples with comparable sample sizes and study durations.

3.1. Participants

21 adults (12 women and 9 men) participated in the study; however, data from one participant were excluded from the analysis because of incomplete information. The participants were recruited in two rounds. The first round comprised 11 PhD students from the researchers' contacts, who were not offered any incentive. The second round included 2 PhD students, 4 master's students, and 4 people working in other capacities. They were contacted via institutional emails and referrals from their colleagues. In this round, the participants were offered an incentive after completing the experiment. The study was presented to the participants as an experiment with a pre-meeting to explain the purpose and provide instructions on completing the diary.

The age range of the participants was 25–35 years. The household composition of the participants included 13 single adults, 2 living with parents, 2 couples, and 3 living in a shared apartment. All participants provided informed consent, confirming their voluntary participation in the study and were informed of the confidentiality of their personal information. Measures were taken throughout the study to protect the participants' personal information, and the data were stored securely in a cloud folder. To maintain anonymity, no direct reference was made to participants when presenting the study results.

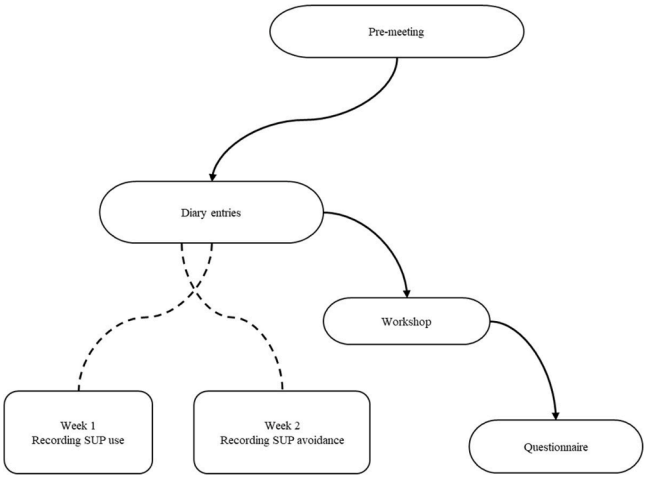

Fig. 2. A graphical representation of the study procedure.

3.2. Diary-based observation

Dairy records were collected during the regular "Plastic Use Week" and "Plastic Avoidance Week". Tables 2 and 3 provide copies of the diaries used. To encourage participants to complete the diary, they were allowed to choose the best week(s) for the experiment. Individual diaries were completed on different occasions between April 2022 and August 2022. Participants were asked to ensure that the experiment did not interfere with their daily use of SUP and to indicate any circumstances or situational interruptions, such as celebrations or parties.

Plastic use week: This week focuses on observing the types of SUP that participants' encounter in their daily lives, the contexts in which they use them, and their disposal routes. This is intended to provide a nuanced understanding of participants' reliance on SUP in their daily lives and the factors influencing their decision-making process. Disposal routes were categorised into three different routes. We assigned the following codes: A stands for disposal via household waste, B stands for return to the retail shop for a deposit, and C stands for individual reuse. In addition, participants were asked to take photos of the moment they used SUP and the amount of SUP they consumed in a day to help us visualise the quantity they used.

Plastic avoidance week: During the plastic avoidance week, we observed the participants' conscious efforts to minimise their dependence on SUP, the alternatives they used, and the challenges they faced. They recorded instances where they avoided SUP and described alternative measures taken. Any challenges faced in these attempts were documented to shed light on the practical difficulties associated with avoiding SUP. Participants were also asked to reflect on their experiences and feelings related to SUP avoidance.

3.3. Workshops

During the workshops, participants engaged in a dynamic and collaborative process to deepen their understanding of SUP consumption while helping the researcher develop potential interventions. The workshop stretched over three days, where session lasted one and a half hours and was attended by 11 diary study participants. Participants reviewed each other's diaries and photos on the first day, encouraging a rich exchange of perspectives and insights. This interactive process allowed for cross-examination of the recorded entries from other participants.

A joint analysis of the diaries and photographs was conducted on the second day of the workshop. Participants shared personal insights and reflections, contributing to a deeper collective understanding of the documented practices and contexts. This shared analysis encouraged participants to examine the data through a multidimensional lens and to discover common patterns and unique peculiarities for designing interventions. On the third day, we focused on developing interventions to reduce the use of SUP in daily life. We did this in two different ways. First, participants took on the role of politicians or decision-makers and designed interventions from that perspective. Second, they were introduced to the three categories of interventions into social practices proposed by Spurling et al. (2013). Participants then approached the design of interventions from the perspective of social scientists, enriching the process with insights from the social practice theory. This allowed us to

Table 2
Diary template for Week 1.

Time (hour)	Description of activities /location	Plastic item used	User needs	Disposal/ reuse routes
08hr	Commuting to the office by train	Plastic coffee cup and spoon	I wanted a coffee to go	B
…	…	…	…	…
13hr	Cycling to the beach	Plastic water bottle	Needed some water	C, for drinking water

Table 3
Diary template Week 2.

Time (hour)	Description of activities /location	Plastic item avoided	Plastic substitute
08hr	Commuting to the office by train	Plastic coffee cup and spoon	Brought coffee from home
…	…	…	…
13hr	Cycling to the beach	Plastic water bottle	Used a refilled water bottle

observe how different roles or standpoints of decision-makers lead to different ideas and proposals for measures to reduce SUP.

3.4. Follow-up questionnaire

A follow-up questionnaire was sent to all participants to collect demographic data and assess their pro-environmental beliefs and practices. By conducting this phase after active participation, we ensured that the information provided was neither influenced nor affected by the course of the study. This questionnaire represented a critical phase in the study that allowed for a more comprehensive understanding of the participants' environmental consciousness, enriching the interpretation of the observed practices.

3.5. Analysis

We imported all recorded diaries into the Atlas.ti software for coding. The coding process followed a selective coding inspired by the theoretical framework developed by Rabiu and Jaeger-Erben (2022). First, we mapped individual quotes and passages from the diaries to relevant components within the framework to identify recurring instances in which participants documented their use of SUP in different aspects of their everyday social practices. For example, the theme "Domains of single-use plastic consumption in everyday life" consists of instances where participants described their use of SUP in everyday life, such as using SUP for takeaway meals and SUP water bottles during their daily commute. We then examined participants' actions to reduce SUP to gain insight into the contextual factors that either facilitated or hindered their efforts. In addition to diary entries, we also integrated data from workshop notes and questionnaires into our analysis. This allowed for the triangulation of the three data sources to gain a holistic view of participants' experiences with SUP. The components were grouped under 6 themes and used as the basis for presenting the study results.

4. Results

4.1. Domains and entanglements of single-use plastic consumption in everyday life

The analysis of the participants' diaries provided valuable insights into the patterns of SUP use in everyday consumption, particularly social practices around food and beverages, commuting, socialising, and personal hygiene.

The diary entries showed that most participants used SUP in the context of food consumption, as a requirement for transport before preparation and eating. This is particularly evident in plastic food packaging, disposable water bottles, and various containers for coffee and juice. Fig. 3 illustrates the range of SUP used by the participants. The first three columns, from left to right, in Fig. 3 show a selection of SUP used by the participants in week 1 of the experiment. The last two columns, however, show the alternatives used by the participants in week 2. We found that the existence of SUP in commuting practices was related to eating and drinking. The diaries show that SUP is widely used

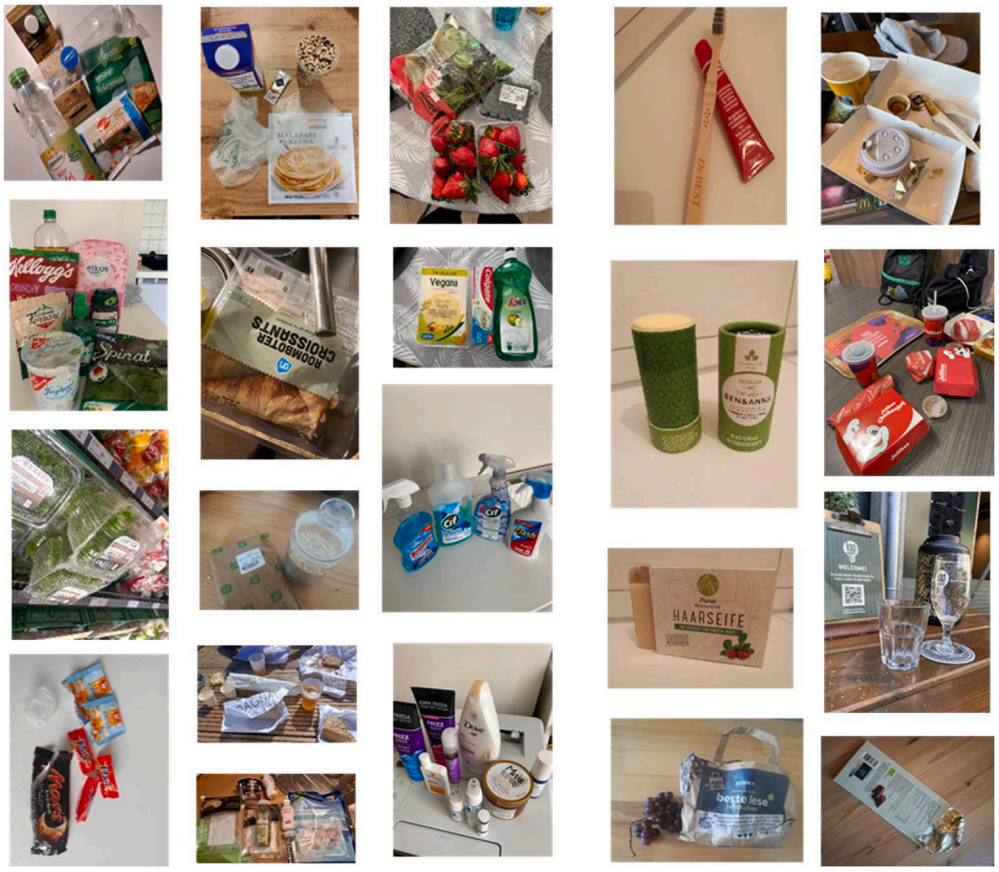

Fig. 3. Diary pictures from participants for Weeks 1 and 2.

in short and long-distance daily commutes. Participants associated using SUP mainly with needing water, coffee, and snacks during the daily commute. These include SUP water bottles for hydration, disposable coffee cups, and SUP-packaged snacks for on-the-go consumption. Participants who had travelled during the experiment reported that their consumption of SUP had increased compared to when they were at home. One participant expressed this as follows:

> "It has been two weeks very busy to travel out of…with a lot of train and outside activities. There is already action that I am taking to substitute plastic in my daily life as using a reusable cup for my coffee. However, it is not always possible to have it with me… Also, I was doing 24hours of train travel, so I bought some single use packaging to have some comfort food during the travel."

Socialising is an everyday activity where SUP use often goes unnoticed due to the communal nature of such gatherings. One participant found it challenging to reduce SUP while attending a birthday party. He narrated:

> "Today we celebrated birthdays for March and April at the office and had cake and tea… it was difficult to avoid the single-use plastic packaging for the cake - it was already delivered that way."

Moreover, participants who reported cooking and eating with others recorded less SUP. This highlights the potential for false compromises in sustainable consumption. Discussions during the workshop revealed that SUP is a 'safe bet' for guests, as it alleviates concerns about the cleanliness of reusable containers and reduces the burden on hosts after the meeting.

Daily hygiene practices are another area where SUP is widely used. Most of the participants relied on SUP-based personal care products, including toothpaste, body wash, and other daily cosmetics. Participants emphasised the seamless integration of SUP into their daily hygiene practices and highlighted the convenience and ease of use of disposable personal care products. As one participant reflected:

> "The disposable bottles just make everything so much more straightforward in my daily routine."

Another notable finding from diary entries was the varying use of SUP in different settings. Participants reported using SUP more often in the office and while travelling than at home. This suggests that consumers mainly use SUPs on the go, indicating a preference for convenience and portability. In addition, SUP was used more frequently on weekdays, emphasising its association with busy daily schedules. Analysis of diaries revealed that SUP use peaks in the early morning and lunchtime. These periods reflect when consumers are more likely to engage in activities such as personal care, breakfast, and lunch practices often associated with using SUP.

4.2. Contexts in which reducing single-use plastic is easier

In a concerted effort to reduce SUP consumption during the avoidance week, participants actively tried to change their everyday social practices. Diary entries showed a remarkable reduction in SUP consumption, particularly food-related SUP consumption. One participant remarked,

> "Making these small changes in my food choices felt encouraging. It was a conscious decision to opt for alternatives to SUP packaging."

This feeling was also reflected in the participants who replaced their plastic-packaged food with sustainable alternatives, such as glass bottles and refillable containers. However, this switch occasionally meant extra effort in preparing their meals or deviating from the usual cooking ingredients. One participant explained this as follows:

> "I took the time to make my own spread instead of resorting to the packaged options. It was just a small change, but it felt like a step towards making more sustainable choices."

In addition, SUP water bottles and coffee cups were replaced with refillable bottles, showing the tangible impact of the plastic reduction week on the use of SUP. One participant reported the following:

> "…to reduce single-use plastic packaging, I take my to-go cup with me so I can drink my espresso anywhere to avoid single-use cups."

This change reflects a reduction in plastic waste and signifies a shift towards more mindful and sustainable consumption practices. Nevertheless, a deep ambivalence to continue the path of reducing SUP in everyday life was noted in the participants' assessments. One participant provided a detailed explanation of why he may not continue to reduce SUP, stating:

> "The second week, I avoided buying snacks, potato chips, or my beloved coconut water, thus reducing single-use plastic consumption as well. However, this is not a long-term option, as I already limit myself in other areas of life to reduce my ecological footprint (vegan, no flights, vacation travel only by train, no car, sharing of living space, mobility in the city only by bike, second-hand purchases whenever possible, higher energy costs due to the purchase of gas and electricity from renewable energy cooperatives)."

While the participant's commitment to sustainable consumption is admirable, it highlights potential trade-offs and the extent of changes people can incorporate in their everyday social practices.

4.3. Contexts in which reducing single-use plastic is a challenge

Complete elimination of SUP is challenging, especially in relation to personal care and hygiene products. One participant noted that:

> "It was difficult to find viable alternatives for certain personal care products packaged in plastic."

This statement resonated with many participants and illustrated how SUP is deeply rooted in the personal care industry. Another participant questioned how to buy toiletries without plastic packaging:

> "Some plastic items are really hard to avoid – e.g. how to buy toilet paper without plastic packaging?"

When participants managed to find an alternative to their SUP personal care products, the performance ratio of the options was relatively low. One participant revealed the following:

> "I used a solid hair shampoo this week, but I am not convinced by the result: it feels like my hair is not really clean afterwards, so I might switch back to the liquid one."

Furthermore, reducing SUP in a social setting was very complex, as participants felt this area goes beyond their consumption. This also applies to eating out. One participant expressed this clearly:

> "I think it feels somehow limited just to calculate with the stuff that I individually use because then I can just go to a restaurant for all meals, and it would count as if I would have been using less plastic."

This observation underscores the nuanced dynamics surrounding SUP reduction in collective contexts. Factors such as the presence of plastic-packaged food and the perceived inefficiency of buying alternatives for only one week prevented some participants from reducing SUP; however, some participants made a conscious effort to invest in sustainable options for their daily SUP products, resulting in a higher cost of daily consumption, longer shopping times at packaging-free shops, the physical burden of carrying heavy loads, and restrictions on shopping on the go.

Nevertheless, the participants described the experiment as an eye-

opener that made them aware of several overlooked alternatives and the amount of plastic they used daily. The following statements from two participants confirmed this:

> "It was interesting to realise how much plastic I am using like every hour of my day."

> "I was particularly surprised to discover so many plastic-free personal care products in the drugstore. However, in most cases they are more expensive than the conventional products."

This shows that consumers have not realised the transition to packaging-free options in conventional shops. As with packaging-free shops, higher costs are a significant barrier to their widespread adoption. This underscores the urgent need for affordable environmentally friendly alternatives.

Participants expressed remorse when they realised the extent of their SUP consumption during the experiment. However, they also expressed frustration when alternatives disrupted their social practices, prompting them to return to SUP. To shed more light on this dynamic, we will examine the account of one participant who self-identified as an expert in plastics.

> "I felt sad for some moments, realising the amount of plastic trash I generate… I must say that despite being a "plastic professional" now, I was quite unconscious of my behaviour in daily activities. I would say that this activity increased my awareness. Sometimes I still consume plastics because of practicality…Some products are a bit time-consuming to prepare, for example, ginger shots or smoothies - I actually tried and is not the same thing."

This inner conflict highlights individuals' complicated relationship with their SUP consumption habits, suggesting that despite conscious efforts, practical considerations and convenience still play a role in decision-making.

4.4. The role of social settings in single-use plastic use

The widespread use of SUP underscores how the current reliance on SUP is structured along the dimensions of time and space. The pattern of SUP use reflects the modern convenience-orientated daily lifestyle, characterised by a lack of time and a preference for easily accessible foods and beverages. This reliance on ready-to-consume items, predominantly packaged in plastic, raises significant concerns about the resource dependency of modern lifestyles, especially given the environmental consciousness of the sample group. One participant reflected:

> "Considering my work, reaching for SUP-packaged options feels like the most convenient choice, even though it's not the most sustainable."

Participants also reported using more SUP outside their usual environment. This observation is in line with the general trend towards the increasing use of SUP in public spaces and at social gatherings. One participant noted:

> "There is limited option to change habit sometimes, for example the water in the train, I had no choice than buying a plastic bottle, even if I have my own refillable bottle with me."

Another participant highlighted the contextual variability of SUP consumption practices, particularly regarding different locations. Stating that:

> …it depends a lot on the places where I spend time (offices, shared household of my partner, shared households of friends, holiday camp)

Participants' recognition that their SUP consumption is contextual suggests that interventions to reduce SUP consumption should consider the different environments in which people live their daily lives.

4.5. The role of systems of provision in single-use plastic use

The diaries reveal how material arrangements and cultural conventions of convenience contribute to the extensive use of SUP. The workshop and individual reflection revealed that, while packaging-free supermarkets represent a departure from traditional supermarkets, integrating their operations and shopping planning into consumer everyday social practices remains complex. This is because of limited access to packaging-free supermarkets and the higher costs associated with packaging-free shopping, which presents significant challenges and transaction barriers for those seeking to reduce SUP consumption. One participant lamented:

> "There is no functional and cost-effective infrastructure that allows shopping without single-use plastic. Of course, there are several individual positive examples that intend to widen the product portfolio to reduce or even avoid single use plastics, such as the unpacked stores or organic food supermarkets, but they can still only be found in certain places in the city. So that the transaction costs to avoid single-use plastic waste are too high."

In addition to accessibility and affordability, participants pointed to a limited variety of products in packaging-free supermarkets. As one participant stated:

> "There are some items (oat milk) which are hard to find differently packed."

This observation underlines the need to diversify offers in packaging-free shops to appeal to a broader range of consumers. It also highlights the importance of retailers and consumers working together to expand the scope of sustainable alternatives and contribute to more inclusive participation in sustainable consumption.

4.6. Co-creating interventions to reduce single-use plastic

To understand how different positions influence the measures people propose to reduce plastic, workshop participants took on the roles of policymakers and scientists to develop measures to reduce SUP in everyday life.

As policymakers, participants proposed interventions that focused mainly on behavioural changes and regulations. These measures include implementing policies that incentivise companies to reduce SUP packaging, rewarding consumers who choose reusable alternatives, and promoting sustainability through educational campaigns. As social scientists, participants advocated for interventions to redefine shopping and eating practices to reduce SUP. At the transformational level, the focus was on modifying or changing components such as packaged foods and challenging the convenience conventions associated with this practice. Participants recommended developing cooking skills, sourcing food from local farmers or packaging-free supermarkets and establishing self-cooking and eating at home as a shared identity. Interventions targeting home eating habits include communal eating arrangements where neighbours come together to eat and break away from individualised consumption patterns.

The interventions described above represent multifaceted approaches from political and social science perspectives. Policy interventions aim to bring about change through policy and regulation, while social practise-based interventions start at the level of everyday social practices. Together, these interventions form a hypothetical representation of participants' thoughts and expectations about how their lives might change, and therefore cannot be considered a concrete real-world behaviour.

The analysis reveals the complex interplay of social practices and contextual factors in shaping consumer behaviour towards SUP. Participants' diaries reveal the far-reaching influence of convenience, lack of time, and accessibility of SUP across various domains of daily life. Furthermore, this study highlights the need for targeted interventions

aimed at social practices and systemic changes in packaging and consumption practices to promote a more sustainable and environmentally conscious society.

5. Discussions

From a social practice theory perspective, we examined the practical implementation of SUP reduction efforts in everyday life. This study uncovered a complex relationship between SUP consumption and social practices. The discussion explores how alternatives interact with everyday social practices to reduce the consumption of SUP, the potential for transforming everyday social practices to minimise the use of SUP, and acknowledges the implications and limitations of the study.

5.1. The interactive dynamics of alternatives and social practices in reducing SUP

Our study supports the notion of the action–behaviour gap paradox; however, we suggest it is insufficient to attribute this gap solely to consumer inaction regarding their environmental concerns. The discrepancy between emerging alternatives and everyday social practices significantly contributes to this gap. Our findings are consistent with previous research, suggesting that changes in sustainability practices are not solely driven by increased self-identity and environmental awareness (Truelove et al., 2023; Zeiss, 2018). However, in line with the observations of Truelove et al. (2023), our study also highlighted that tracking plastic consumption can increase individuals' awareness of their actual plastic consumption. Our findings suggest that SUP is a symptom of a time-intensive modern lifestyle that promotes dependence on convenience food. This is consistent with the assertion by Chakori et al. (2021) that a lack of time in households leads to an increased preference for processed foods. Therefore, initiatives to reduce SUP should be designed to harness consumer efforts and align with everyday social practices.

To overcome the deep-rooted use of SUP in everyday social practices, it is important to look for solutions that go beyond consumer awareness, regulations and technological innovations. These findings are consistent with the assertion of Borrelle et al. (2020) that substantial reductions in plastic pollution can only be achieved through urgent transformative changes in the management of plastics. An essential factor in achieving this includes changes in general societal practices, development of more sustainable social practices, and adequate infrastructure that supports reusable products and packaging-free shopping.

Our study contributes to the literature by providing empirical evidence that supports the assertions of Heidbreder et al. (2019) and Borg et al. (2022) that individual-level behavioural changes must be complemented by other situational contexts and, in this case, consumer everyday social practices when designing interventions to reduce SUP as illustrated in Fig. 4.

Our results show that the use or reduction of SUP is related to consumer knowledge of convenience and everyday social practices, underscoring the importance of understanding the relationship between individual behaviour and broader social practices. In addition, interventions to reduce SUP consumption must challenge prevailing values and habits that prioritise convenience, and should be feasible within existing everyday social practices or work to change them. This is consistent with the finding that stainless-steel cutlery, a better alternative to disposable plastic cutlery (SUP), has limited practicality in the aviation industry (Wei et al., 2022).

5.2. Reconfiguring everyday social practices to reduce single-use plastic

This study sheds light on the intricate dynamics between consumer everyday social practices and the prevalent use of SUPs, highlighting the interplay between convenience and accessibility of alternatives. This finding suggests the need to rethink everyday social practices to facilitate SUP reduction.

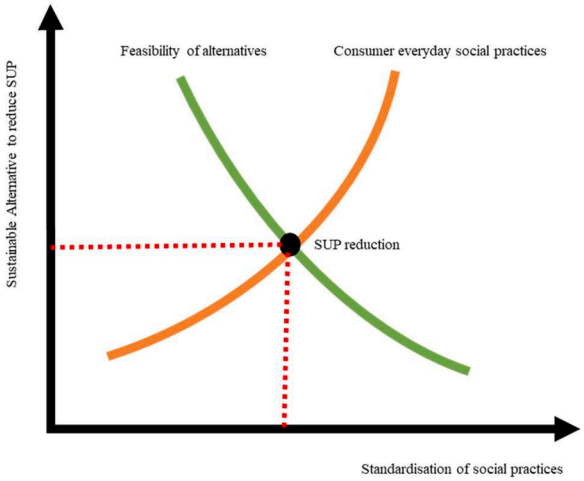

Fig. 4. The interplay between the practicality of alternative options and everyday social practices to reduce single-use plastic.

Reconfiguring everyday social practices can be achieved by developing interventions based on existing frameworks of everyday life. Our study highlights the effectiveness of shared meals as a new approach for reducing SUP consumption. Shared meals promote social interactions and reduce the need for individually packaged meals or take-out containers. This demonstrated why many participants resorted to eating with friends during the week of SUP avoidance. Our study shows that office work and daily commuting are associated with increased consumption of SUP. An effective strategy to mitigate this link with SUP is to work from home. In office environments, SUP items such as disposable cups, bottles and containers are commonly used during daily commuting and office hours, and the increase in remote working is one way to minimise reliance on SUP in this context.

Packaging-free shopping has emerged as a compelling strategy to reduce the pervasive problem of SUP. However, successful integration into daily life requires a change in existing social practices. This involves shifting from the convenience of packaged products and reaching for reusable containers, bags or jars in shops that offer loose products. This change requires new skills, meanings and material arrangements as illustrated in Fig. 5. Integrating packaging-free shopping into everyday social practices is therefore not just a change in shopping behaviour, but a transformation of social practices towards sustainable living and resource conservation.

Our study postulates that in order to successfully transition from using SUP, it is important to understand how everyday social practices are embedded in the use of SUP. Factors such as convenience, product variety, and availability significantly influence consumers' actions. Therefore, Packaging-free stores should consider these factors and strive to offer appealing, accessible, and diverse alternatives to plastic packaging.

5.3. Implication of our findings

Our study sheds light on the challenges of SUP reduction in everyday life, which sits at the intersection of two crucial elements: the availability of viable alternatives and the need to transform everyday social practices towards lower plastic consumption, as illustrated in Fig. 4.

Our results underline the importance of a diverse approach to SUP reduction. It emphasises the need to develop and promote sustainable alternatives to SUP, such as reusable containers and innovative packaging solutions. These alternatives should be environmentally friendly, and at the same time convenient, and economically viable for users. Furthermore, our findings show that significantly reducing SUP consumption requires rethinking and reshaping everyday social practices.

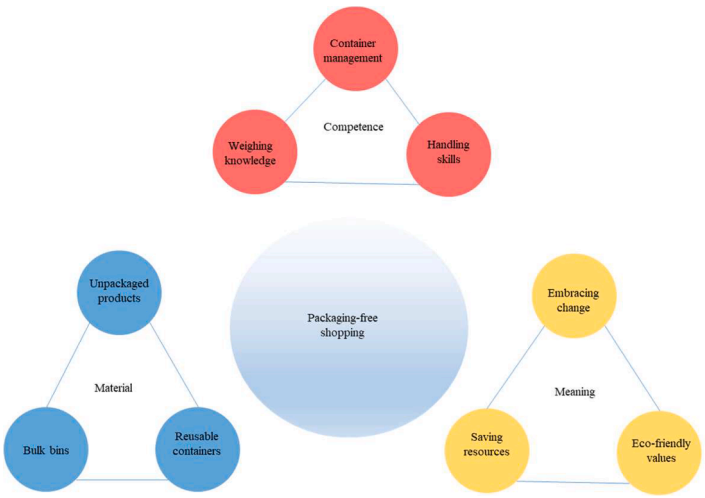

Fig. 5. Key components for integrating packaging-free shopping into everyday social.

This includes adopting new habits, such as carrying reusable bags and containers, avoiding unnecessary plastic items, and actively seeking shops and products that comply with these practices.

A delicate balance must be maintained in the practical application of these constructs. Depending on the specific context and prevailing conditions, redesigning practices or developing viable alternatives should control for rebound effects as much as possible. In a setting where alternatives to SUP are resource-intensive and lead to excessive consumption of other materials or services, redesigning practices may be more relevant. Conversely, in an environment where social practices are less receptive to change and may lead to other unsustainable practices, introducing alternatives to SUP may deliver broader results. This nuanced approach recognises that the two constructs are inextricably linked, but their relative importance depends on the circumstances and support systems.

5.4. Limitations of the study

This study provides insight into the dynamics of SUP reduction, but it has certain limitations. The small sample size of 20 adults limits the generalisability of the results. Moreover, reliance on self-reporting, such as diary entries and workshops, introduces potential recall and social desirability biases. Future research should conduct longitudinal studies to understand the complex relationships amongst alternatives, social practices, and SUP reduction. Moreover, the study focused primarily on the consumer perspective and neglected the role of businesses, policymakers, and other stakeholders in reducing SUP. Furthermore, the quantitative focus of the study was on capturing consumption rather than measuring the types and quantities of SUP used in daily life. Addressing the limitations in future research will improve our understanding of effective strategies to reduce SUP consumption and promote sustainability.

6. Conclusion

Research on SUP has been conducted primarily to understand its use in everyday life or to find ways to reduce it. No study has combined these two aspects in a single investigation. In this study, we sought to fill this gap by examining the use of SUP and efforts to reduce it in everyday life side by side.

Our analyses of consumer diaries of everyday use and avoidance of SUP revealed that the dynamics of everyday social practices significantly influence SUP use and potential reduction. Specifically, we found that SUP facilitate cooking, eating, commuting, working, and socialising, and attempts to reduce SUP often disrupt these social practices. Consequently, the extent to which consumers can disrupt their everyday social practices influence their appropriation of alternatives to minimise SUP, such as packaging-free stores.

These findings highlight the importance of interventions that target everyday social practices. Seamless integration of interventions into consumer everyday social practices can pave the way for a transition to sustainable systems characterised by reduced consumption of SUP. The implications of this research extend to various stakeholders, urging the prioritisation of interventions that align with everyday social practices. By incorporating these findings into decision-making processes and practices, it is possible to reduce the consumption of SUP. Future research should focus on understanding the scenarios that alternatives, such as packaging-free stores, are likely to take in the coming years, as well as strategies for successfully integrating such plastic reduction interventions into consumer everyday social practices.

CRediT authorship contribution statement

Mubarik K. Rabiu: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Melanie Jaeger-Erben:** Conceptualization, Writing – review & editing, Supervision.

Declaration of Competing Interest

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

Data availability

Data will be made available on request.

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