

Abstract

The role of designers in developing a sustainable society is not limited to creating sustainable products but also includes envisioning products, processes, and services that promote sustainability and will be accepted by the wider society. Design for sustainable behavior, the literature that has grown in this context, aims to encourage the adoption of desirable sustainable behaviors and discourage undesirable, unsustainable behaviors. In this context, this paper aims to propose a guide for designers to use the data from this study to incorporate into their design process by assessing the behaviors and motivations of users who exhibit waste reduction behavior in designing for sustainable behavior. For this purpose, users' waste reduction behaviors were examined within the framework of the zero-waste approach using the 5Rs (*reject, reduce, reuse, recycle and rot*) proposed by Johnson. The findings were categorized according to the drivers of changing consumer behavior described in the National Academies of Sciences, Engineering, and Medicine (NAS) study to create a data set that designers can use. The study used qualitative analysis to gain insight into user behaviors and motivations related to waste reduction. The participants in the study were selected using a purposive sampling method among consumers who are aware of waste reduction. A total of 50 participants, randomly selected among the followers of 'Zero Waste' themed pages on social media, took part in the research voluntarily.

Keywords: Waste Reduction Behavior, Design for Sustainable Behavior, Zero-Waste.

Evaluation of Consumers' "Waste Reduction" Behavior in the Framework of Design for Sustainable Behavior

Tüketicilerin "Atık Azaltma" Davranışının Sürdürülebilir Davranış İçin Tasarım Çerçevesinde Değerlendirilmesi

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Genişletilmiş Özet

Tasarımcıların sürdürülebilir bir toplum geliştirmedeki rolü, sürdürülebilir ürünler yaratmakla sınırlı olmayıp, sürdürülebilirliği teşvik eden ve toplumun daha geniş bir kesimi tarafından kabul görecektir ürünler, süreçler ve hizmetler öngörme içerir. Bu çerçevede literatürü oluşturan sürdürülebilir davranış için tasarım, arzu edilen sürdürülebilir davranışların benimsenmesini teşvik etmeyi ve istenmeyen, sürdürülemez davranışları caydırmayı amaçlamaktadır. Sürdürülebilir tüketici davranışının teşvik edildiği tasarım stratejilerini anlamak için pazarlamacıların çok sayıda nedeni bulunmaktadır. Sürdürülebilir bir davranış olarak sıfır atık, ürün ve süreçlerin üretilen atık ve kirlilik miktarını en aza indirecek şekilde tasarlanması ve yönetilmesi uygulamasını ifade eder. Bu yaklaşım sadece kaynakları koruyarak ve sera gazı emisyonlarını azaltarak çevrenin korunmasına yardımcı olmakla kalmaz, aynı zamanda atık yönetimi maliyetlerinin azaltılması ve geri dönüşüm ve yeniden kullanım sektöründe yeni işler yaratılması yoluyla ekonomik faydalar sağlama potansiyeline de sahiptir.

Bu bağlamda, bu makalenin amacı tasarımcılar için sürdürülebilir davranış için tasarım atık azaltma davranışı sergileyen kullanıcıların davranışlarını ve motivasyonlarını değerlendirmek tasarımcıların bu çalışmadan elde edilen verileri tasarım süreçlerine dahil etmek için kullanmaları için bir rehber önerisinde bulunmaktadır. Bu amaç ile kullanıcıların atık azaltma davranışları Johnson (2013) tarafından önerilen 5R başlıkları (reddetmek, azaltmak, yeniden kullanmak, geri dönüştürmek ve kompost yapmak) kullanılarak sıfır atık yaklaşımı çerçevesinde incelenmiştir. Bulgular, tasarımcıların kullanabileceği bir veri seti oluşturmak için Ulusal Bilim, Mühendislik ve Tıp Akademileri'nin (2020) (NAS) çalışmasında açıklanan değişen tüketici davranışlarının itici güçlerine göre kategorize edilmiştir.

Çalışmada, atık azaltma ile ilgili kullanıcı davranışları ve motivasyonları hakkında fikir edinmek için nitel analiz kullanılmıştır. Davranışlar ve motivasyonlar 5R yaklaşımı çerçevesinde analiz edilmiştir. Kullanıcıların atık azaltma konusundaki farkındalıkları sorgulanmış ve Reddetme, Azaltma, Yeniden Kullanma, Geri Dönüştürme ve Kompost Yapma kategorileri altında gerçekleştirilen davranış ve eylemleri etkileyen olumlu ve olumsuz motivasyonlar incelenmiştir. Her bir sıfır atık kategorisindeki davranışlar ve motivasyonlar NAS'ın tüketici davranışını değiştiren etmenlerine göre tartışılmıştır.

Araştırmaya örneklem olarak katılan katılımcılar, atık azaltma konusunda farkındalığı olan tüketiciler arasından amaçlı örnekleme yöntemi kullanılarak seçilmiştir. Sosyal medyada 'Sıfır Atık' temalı sayfaların takipçileri arasında rastgele seçilen toplam 50 katılımcı gönüllülük esasına göre çalışmada yer almıştır. Pandemi sonrası gelişen araştırma metodolojileri çerçevesinde katılımcılardan yarı yapılandırılmış ve açık uçlu araştırma sorularına çevrimiçi olarak yanıt vermeleri istenmiştir. Katılımcıların motivasyonları ve davranışlarını bilinçli bir şekilde aktarmalarını sağlamak için, 5R'nin her aşamasında örnek davranış kalıpları üzerinden her aşamayı da kapsayan dört eylemi değerlendirmeleri ve ardından kendi davranışlarını ve motivasyonlarını değerlendirmeleri istenmiştir. Transkripsiyonlar, atık azaltma davranışlarını ve motivasyonlarını belirlemek için tematik kodlama kullanılarak analiz edilmiştir. Kodlama çalışması sonucunda katılımcıların 5R yaklaşımları üç başlık altında kodlanmıştır: "Davranışlar", "Pozitif Motivasyon" ve "Negatif Motivasyon". Her bir kategori belirlenen kodlar çerçevesinde değerlendirilmiştir. Daha sonra sonuçlar tartışılmıştır.

Sürdürülebilir davranış ve sıfır atık çerçevesinde kullanıcılar arasında atık azaltma davranışlarını ve motivasyonlarını incelenenlerden sonra, Johnson (2013) tarafından önerilen 5R yaklaşımı, veri toplamak için faydalı bir çerçeve sağlamıştır. Sonuç olarak, atık azaltma davranışı, sürdürülebilirlik için bütüncül bir yaklaşım gerektiren karmaşık ve çok katmanlı bir konu olarak benimsenmiştir. Sıfır atık gibi yaklaşımlar; atığın değersiz bir yan ürün olarak görüldüğü geleneksel anlayışa meydan okumakta ve atık oluşumunu en aza indirecek çözümler sunmaktadır. Ancak atık azaltma davranışı, atıkların son kullanıcılar dışındaki kuruluşlar tarafından toplanması, ayrıştırılması ve bertaraf edilmesi nedeniyle tüketiciler için büyük ölçüde görünmez kalmaktadır. Bu davranışların sürdürülebilir davranış için tasarım çerçevesinden incelenmesi, tasarımcılara tasarım süreçlerinde kullanabilecekleri değerli veriler sağlamıştır. Alışkanlıkların kullanıcıların davranış kalıpları üzerinde hem olumlu hem de olumsuz etkileri olabileceği görülmüştür. Bir yandan, bir kullanıcı olumlu ilişkilere sahip olduğu ürünleri değiştirme konusunda isteksiz hissedebilir ve bu da sürdürülebilir davranışları benimsenmesini zorlaştırabilir. Diğer taraftan ise, sürdürülebilir davranış alışkanlıklarının geliştirilmesi, kullanıcıların sürdürülebilirlik hedefleriyle çelişebilecek diğer kalıpları benimsenmelerini önlemeye yardımcı olabilir. Buna ek olarak, bir kullanıcının yaşam tarzı ve günlük rutini, alışkanlıkları üzerinde önemli bir etkiye sahiptir.

Değişen tüketici davranışlarının itici güçlerini kategorize eden bu çalışma, tasarımcılara sürdürülebilirliği teşvik eden ve toplumun daha geniş bir kesimi tarafından kabul gören ürün, süreç ve hizmetler geliştirmeleri için bir veri seti sunmaktadır. Bu faktörlerin bağımsız olarak değerlendirilemeyeceğini belirtmek önemlidir. Bu kategorizasyon davranış kalıplarını detaylı olarak incelemek için kullanılabilirken, yapılan çalışmada bu aşamaların birbirini takip eden bir gelişim sisteminden ziyade iç içe geçmiş bir yapıda, bir diğerine geçen yapısız bir bütünlük içerisinde gerçekleştiği gözlemlenmiştir. Bu kategorizasyon, sürdürülebilirlik hedeflerine ulaşmada bireysel davranışın rolünü vurgulayan sürdürülebilir davranış için tasarım literatürüyle de örtüşmektedir.

Anahtar Kelimeler: Atık Azaltma Davranışı, Sürdürülebilir Davranış İçin Tasarım, Sıfır Atık

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Introduction

Since the industrial revolution, humans have significantly increased industrial production and urbanization by using natural resources, leading to problems such as global warming, depletion of natural resources, and uncontrollable waste accumulation (Gardner 2013; Giljum et al. 2008; Chalmin and Gaillochet 2009; Zaman and Lehmann 2011). Waste is a major issue in this context, often being perceived as a worthless and inevitable byproduct at the end of a product's life cycle. Approaches such as zero waste, which aim to eliminate waste, challenge this assumption, and address these byproducts, defined as "waste," as a problem (Zaman and Newman 2021).

When considering waste reduction behavior within the framework of sustainable behaviors, it emerges as a multi-layered behavioral integrity. Waste products, including the resources and byproducts used to create items such as food, clothing, and other possessions, are largely hidden from consumers (Crooker 2012). The collection, separation, or disposal of waste is carried out by entities other than users, which directly affects the interaction of users with products and their consumption habits. The invisibility of waste in the consumption system results in users not paying attention to the waste generated by the objects they consume. However, from an environmental impact perspective, critical decisions directly affect the consumer through a combination of purchasing and product use choices (Princen 2010).

The role of designers in developing a sustainable society is not limited to creating sustainable products but also involves envisioning products, processes, and services that promote sustainability and will be accepted by a wider section of society (Stegall 2006; Buchanan 1989). Design for sustainable behavior (DfSB) aims to encourage the adoption of desirable sustainable behaviors and discourage undesirable, unsustainable behaviors. There are numerous reasons why

understanding facilitators of sustainable consumer behavior should be of interest to marketers (White et al. 2019). In this context, this article aims to evaluate them within the framework of DfSB for designers and to suggest a guide for designers to use the data obtained from this study to incorporate sustainable behavior into design content by evaluating the behaviors and motivations of users who exhibit waste reduction behavior (Medeiros et al. 2018). Additionally, the waste reduction behavior of users will be examined within the framework of the zero-waste approach, using the 5R titles (*refuse, reduce, reuse, recycle, rot*) suggested by Johnson (2013). The positive and negative user motivations identified as a result of this research were categorized according to the drivers of changing consumer behavior described in the National Academies of Sciences, Engineering, and Medicine (2020) (NAS) study to create a data set that designers can use (Oria & Schneeman, 2020).

Conceptual Background

Zero Waste as an Issue for Designers

When a product becomes waste, it means the end of its lifecycle. It is discarded from the environment in which it was used. Zero waste is identified as "a set of principles focused on waste prevention that encourages the redesign of resource life cycles so that all products are reused" (OECD, 2022). Connett (2013) defines zero waste as reducing the amount and damage of waste and materials, protecting resources, and designing and managing products and processes as a system. The term "zero waste" was first used by Dr. Palmer in 1973 to describe the recovery of resources from chemicals (Palmer 2004). Waste is defined as the transformation of resources during the consumption phase, in the context of zero waste from past to present (Zaman 2015). In the mid-1980s, the idea of zero waste seemed impossible in many countries. However, by 1995, the idea of reducing consumption had emerged as a goal for designers and manufacturers in places such as California and Italy. Since then, zero waste has

become an environmental movement and has shown the business community a way to reduce waste in some communities, while others have adopted it as a goal (Connett 2013). The concept combines design and waste management to address the threats of consumption and unsustainable behavior. In the context of zero waste, a product does not follow the traditional consumption cycle because it may be recycled, repaired, or repurposed in its new cycle (Zaman 2013).

Environmental issues have been a concern for the profession of industrial design (Ramirez 2007). Victor Papanek (1985) challenged designers to prioritize social ethics and environmental responsibility over unwarranted resource consumption and disposable products. However, after some years, he observed that designers were still involved in creating useless and wasteful products, becoming slaves to the capricious works of marketers and advertisers and he found that the design profession was deforming and misinforming society rather than being a reformer and informer during those days (Baker 1997).

Despite that, designers have the potential to create solutions and should be viewed as a potential force for change rather than being responsible for current unsustainable conditions (Yang and Giard 2001). In the 2000s, the Industrial Design Society of America (IDSA) (2001), a large organization with many designer members, defined designers as creators of helpful solutions to reduce ecological problems and provide benefits to both the environment and human quality of life. At that time, designers explained that their profession integrates the environment and follows the principles of sustainable development by coordinating the economy, culture, technology, and environment that affect sustainability (ICSID 2001).

According to Margolin (1998), to overcome the problems humankind faces, industrial designers should review their profession individually and collectively. Within this framework, the life cycle of a

product is considered, and sustainable behavior preferences of the user start to gain importance. These preferences are analyzed by the designer and included as a situation in the design process.

In recent years, there has been a growing emphasis on sustainability and zero waste practices across various sectors. The concept of zero waste involves designing and managing products and processes to eliminate waste, conserve resources, and promote recycling and resource recovery (Pasricha & Greeninger, 2018). This approach has been recognized as a key strategy to stimulate sustainable production and consumption, optimize recycling, and enhance resource recovery (Bessette et al., 2020). Implementing zero waste strategies not only benefits the environment but also leads to economic and financial advantages for industries and stakeholders (Saplacan & Márton, 2019).

Furthermore, the utilization of waste as raw materials in processes like biorefinery is gaining interest as it aligns with the principles of a circular economy and zero waste policies (Alfio et al., 2021). This shift towards a circular economy involves incorporating waste back into production processes repeatedly, moving towards the goal of zero waste (Robayo-Salazar et al., 2020). In the construction industry, adopting the zero-waste concept has shown to optimize natural resource usage, reduce environmental impacts, and promote sustainability (Liyanage et al., 2019).

Moreover, the concept of zero waste extends beyond waste management to areas like fashion, food production, and urban planning. For instance, in the fashion industry, adopting zero waste practices can help identify inefficiencies in material usage and promote sustainable fashion (Gupta & Saini, 2020). Similarly, reducing food waste in the agri-food industry is crucial for achieving sustainable development goals such as zero hunger and sustainable consumption patterns (Sánchez-Teba et al., 2021).

Zero Waste as a Sustainable Behavior

Zero waste as a sustainable behavior

refers to the practice of designing and managing products and processes in a way that minimizes the amount of waste and pollution generated (Gibbs 2015). This approach not only helps to protect the environment by conserving resources and reducing greenhouse gas emissions, but it also has the potential to bring economic benefits through the reduction of waste management costs and the creation of new jobs in the recycling and reuse sector (Gibbs 2015, Wiedmann and Minx 2014).

The negative impacts of large amounts of waste on the environment, humanity, and all life in the universe have prompted authorities to develop more sustainable solutions (Shekdar 2009; Cheng and Hu 2010). The management of zero waste sees waste as a source and a symbol of modern society's lack of efficiency (Zaman and Lehmann 2013). On the other hand, users and consumers are becoming more aware of zero waste and are following the news and seeking out new products or actions to support zero waste management. People are shifting towards greater sustainability. In the zero-waste approach, there is no burning of waste or throwaway society, but rather a sustainable society (Connett 2013).

In design fields, the concept of waste has started to be discussed within the framework of sustainability. Green design, one of the first applications of these approaches, initially followed the reduce-reuse-recycle waste hierarchy by focusing on reducing environmental impact and designing the individual characteristics of products (Ceschin and Gaziulusoy 2016). Later, various tools and methods stemming from the concept of eco-design were introduced in the early stages of product development and design to minimize the environmental impact caused by products and resource consumption (Bhamra and Lofthous 2016). Today, this systematic approach has combined eco-design and product design in a holistic and systematic approach within the framework of sustainable design (Kretschmer et al. 2014; Ceschin and Gaziulusoy 2016).

Most studies on sustainable design have focused on the production, assembly, and end-of-life of products (Shu et al. 2017). However, more recent research has examined user behaviors, such as the increasing demand for single-use products and market-led solutions for changing user behaviors (Shin and Bull 2019, Medeiros et al. 2018). One example of sustainable behavior achievements is found in the NAS study's drivers of consumer behaviors (Oria & Schneeman, 2020). The study conducted literature research to gain insights into the drivers of changing consumer behavior, both at home and away from home, with potential relevance for wasted food and made a few general observations. In the context of zero waste, the NAS study referenced by Oria & Schneeman (2020) is likely to provide insights into waste management practices, sustainable solutions, and policy recommendations aimed at reducing waste generation and promoting recycling and reuse. By leveraging expert consensus and research frameworks, the NAS contributes to the development of strategies that can drive progress towards a more sustainable and environmentally friendly approach to waste management. According to NAS, there are 5 drivers that categories user behavior.

The first driver is "Motivation, Opportunity, and Ability to Work Together." Consumers adopt desired behaviors when they feel capable, motivated, and can participate in the targeted behavior. Motivation precedes ability in this behavior. The second driver is "Sociodemographic Variables." These factors can change consumers' motivation, opportunity, and ability to behave according to significant cultural variation at every socioeconomic level, resulting in a wide range of routines, norms, and beliefs.

The third driver is "Motivational Factors," such as altered attitudes toward outcomes, values, agency, perceived control, and social norms. These factors are more effective drivers of behavior. The fourth

driver, "Contextual Factors," indicates factors such as pricing, accessibility, and service quality that are not under the control of the user. Finally, the fifth driver is "Habits," which explains that consumers influence both the breaking of old habits and the establishment and maintenance of new ones.

In this context, research on sustainable user behaviors is just as important as research on production, materials, and life cycle planning. Design for sustainable behavior aims to identify users' motivations and how they adopt or do not adopt consumption behaviors that are compatible with sustainability (Medeiros et al. 2018). In this regard, design professionals have been pushing design beyond consumer culture and exploring new forms of practice (Chick 2011).

Five "R"

When examining waste reduction behavior within the framework of DfSB, it is important to consider user behaviors at various stages. However, it is not possible to examine a user's approach to waste reduction from a single perspective (Seng et al. 2011). In this context, the 5R stages of zero waste (*refuse, reduce, reuse, recycle, rot*) can be useful in categorizing behaviors (Johnson 2013). Instead, in this research, the interaction of products with user behaviors and waste reduction actions at these 5R stages will be examined within the context of the 5R stages of zero waste.

Refuse involves the conscious decision to reject certain items or practices that contribute to waste generation. By refusing unnecessary items, individuals and organizations can significantly reduce the amount of waste produced, leading to a more sustainable approach to consumption (Zacho & Mosgaard, 2016).

Reduction focuses on minimizing the consumption of goods and materials, thereby decreasing the overall waste generated. Studies have shown that reduction is considered one of the most effective methods for managing waste, particularly in industries like construction

and demolition (Lu & Yuan, 2011).

Reuse involves using products again. According to Korst (2012), it requires creativity because the user chooses the next journey for the product. It is up to the user to determine how the product will be used.

Recycling involves returning materials to a new form. This requires a system for collecting and transforming them. When materials are recycled in industry, reusing them can save energy costs and reduce the impact of extraction (Connett 2013).

Rot relates to composting. Organic waste can be collected and turned into fertilizer, which can be used in a garden to grow organic products (Korst 2012). It is important to compost kitchen waste and other organics because if they are mixed with other waste, they can cause a bad odor and release methane gas, which can pollute the air and soil (Connett 2013, Johnson 2013).

Methodology

In the study, qualitative analysis method was used to learn about user behaviors and motivations related to waste reduction. An online survey was used as a data collection method. Participants were asked semi-structured open-ended questions. Through these questions, it was aimed to examine behaviors and motivations of participants in detail. The questions posed in the research were organized within the framework of the perception of the 5R approach by the participants and its implementation in real life and were analyzed separately for each zero-waste stage within the framework of user behaviors and the positive and negative motivations that arise while performing these behaviors (Johnson, 2013; Dumas et al., 2014). In this framework, a total of 15 open-ended questions, consisting of 5 stages covering the zero-waste approach with three questions in each stage, were asked to the participants to define their behavior and motivations. Before each stage, 5 Likert-scale questions were asked to help participants better understand and engage with the open-ended questions

about the zero waste stages, which were not evaluated in the study. And also, for each zero-waste phase, users were given information about the phase at the beginning of that phase.

The participants of the study were selected by purposive sampling method among consumers who are aware of waste reduction. To efficiently reach the conscious user under pandemic conditions, social media accounts that share about environmental, national, international sustainability and zero waste issues were contacted on Instagram application and they sent an open call to their followers to voluntarily participate in the study. While sharing the open call, the link of the survey was shared with followers. A total of 50 participants among the followers of 'Zero Waste' themed pages on social media, answered questions. Participants were asked to answer semi-structured and open-ended research questions in writing online. (Patton, 2014).

For the analysis of the participants' responses, the answers were textualized and content analysis was used as an analyzing method. Within the framework of this analysis, thematic codes were created for each zero-waste stage by researchers. Positive and negative motivations affecting the behaviors and actions performed under the categories of Refuse, Reduce, Reuse, Recycle and Rot were examined. All codes are defined by researchers based on the answers. The positive and negative motivations defined in the framework of participants' statements in each zero-waste stage are discussed according to NAS's consumer behavior change drivers (Oria & Schneeman, 2020).

Results

In this research, the participant's evaluation of the concept of waste was analyzed before examining their waste reduction behaviors and motivations. Waste reduction behaviors and motivations were evaluated using the 5R approach. As a result of the coding study, the participants' 5R approaches were coded

under three headings: "Acted Behaviors," "Positive Motivation," and "Negative Motivation." Each category was evaluated within the framework of the determined codes.

Refuse

Behaviors

In their responses, participants identified the behavior of not using single-use products, implementing a hierarchy of needs, choosing reusable products, and reducing consumption (Table 1). "Not using single-use products" refers to the refusal of single-use plastic or paper products, such as plastic bags, single-use food packaging, and plastic utensils. "Implementing a hierarchy of needs" involves questioning whether a product is truly necessary before purchasing it. However, participants noted that this can be difficult due to changing needs and habits. "Choosing reusable products" involves selecting products that can be washed and used again, such as cloth bags or a thermos, instead of single-use plastic items. "Not consuming" encompasses behaviors such as living a minimalist lifestyle, carefully considering real needs before purchasing, and avoiding unnecessary purchases.

Table 1. Coding the participants' Refuse behaviors and motivations.

Behaviors	Positive Motivations	Negative Motivations
Not to use single-use products	Reducing waste	Habits
Implementing a hierarchy of needs	Lifestyle	Daily life requirements
Choosing reusable products	Concerning the future	Family and social effects
Not consuming	Protecting the nature	No alternatives

Positive Motivations

When the motivations for participating in refuse behavior were evaluated, four positive motivations were identified: reducing waste, lifestyle, concern for the future, and protecting nature. "Reducing waste" refers to actions taken to prevent waste formation, create less waste, and avoid using unnecessary objects.

Participants stated that the financial situation was inversely proportional to this motivation. "Lifestyle" refers to the adoption of refuse behavior as a routine and way of life, with the belief that consuming less leads to happiness and that buying unnecessary products creates extra work and clutter. "Concern for the future" refers to the motivation to leave a livable world for future generations, with a focus on a livable future, accessible nature, and happy future generations. "Protecting nature" referred to a concern for nature and animals, and the belief that refuse behavior is a basic step towards preventing consumption and protecting the earth.

Negative Motivations

When the motivations for participating in refuse behavior were evaluated, four negative motivations were identified: habits, daily life requirements, family and environment effects, and no alternative. "Habits" referred to behaviors that were difficult to change and included actions such as using paper towels, accepting promotional items, and occasionally using plastic disposable products. "Daily life requirements" include the need for certain products in daily life, such as cleaning products and personal hygiene products, as

use certain products, such as plastic plates and forks in food service, toilet paper, cleaning, and health products, or not being able to find a replacement solution when needed.

Reduce Behaviors

As a result of the responses given by participants about their behaviors related to the "reduce" action, six codes were identified: reducing shopping, reducing the use of packaged products, changing transportation habits, not preferring single-use products, simplifying, and sharing (Table 2). "Reducing shopping" refers to considering real needs when shopping, such as not buying products that won't be used later or are only wanted on a whim and reducing the purchase of personal items and clothes. "Reducing the use of packaged products" referred to the effort to use unpackaged products, such as using reusable, refillable, and cleanable products as packaging and reusing them to obtain different products. This behavior included reducing the use of plastic, clothing, and vehicles, and examples included consuming less fast-food making coffee at home, and carrying it in a thermos.

Table 2. Coding the participants' Reduced behaviors and motivations.

Behaviors	Positive Motivations	Negative Motivations
Reducing Shopping	Psychological impact	Habits
Reducing the use of packaged products	Protecting nature	Daily life requirements
Changing transportation habits	Lifestyle	Family and social impact
Not preferring single-use products		
Simplifying		
Sharing		

well as psychological factors like wanting to treat oneself. "Family and environment effect" refers to the influence of people in one's household or social circle on their ability to refuse certain products, such as using disposable products at events with family or friends or using products that a partner or family member does not refuse. "No alternative" referred to the inability to find a sustainable alternative for a product or action, leading to a feeling of having to

"Changing transportation habits" referred to a preference for more sustainable options, particularly in transportation choices, with the most common example being reducing the use of cars. Other examples included using public transportation, bikes, and walking. "Not preferring single-use products" referred to a focus on reducing packaged products, particularly single-use plastic bags, and using reusable products instead

of disposable ones for fast-moving consumer goods such as carrying coffee in a thermos. “Simplifying” referred to a minimalist lifestyle, with a reduction in unused items and a break from material culture, and examples included not buying clothes, riding a bike, and living in a small house. “Sharing” refers to sharing with those in need and sharing products that are needed by others, such as communicating with other parents with older children before buying something for their children and giving unused clothes and items to parents with younger children.

Positive Motivations

After evaluating the motivations of participants for the ‘reduce’ action, three positive motivations were identified: psychological impact, protecting nature, and lifestyle. “Psychological impact” refers to the mental, emotional, and behavioral motivations to reduce, and includes the belief that having too many items or living in a crowded environment can be tiring for the spirit and lead to unnecessary time loss in life, as well as the discomfort that can come with excessive consumption. “Protecting nature” refers to a consciousness of the impact on nature, with behaviors such as reducing gas emissions, protecting the environment, reducing the carbon footprint, and conserving natural resources. The most common motivation for this code, shared by all participants, was the desire to leave a livable world for future generations. “Lifestyle” refers to living a simple, meaningful, sustainable, and good life, saving time, and making fewer decisions. This adopted lifestyle motivated “reduce” behavior, which was described in two stages: defining excess as supporting minimalist living, a healthy and good lifestyle, and mental relaxation, and being a good example for others and children.

Negative Motivations

According to the examination of users’ motivations for “reduce” behavior, three negative motivations were identified: habits, daily life requirements, and family

and social effects. “Habits” referred to behaviors that participants found difficult to change in their daily routines, and included reasons such as time constraints, not being able to give up personal comfort, and not feeling ready. “Family and social effects” refer to the loss of motivation for “reduce” action due to the influence of others, particularly family members living together. While participants may want to exhibit this behavior, not receiving support from their family members or facing negative criticism can have a negative impact on their efforts. “Daily life requirements” referred to obligations that participants have in their daily lives, and included examples such as shopping during busy periods, not having access to alternatives, having to order online, and having to use technology due to work demands.

Reuse

Behaviors

When the behaviors that participants paid attention to were evaluated, five codes emerged: repair, sharing, reusable product usage choice, secondhand product usage, and reusing packages (Table 3). “Repair” refers to the process of repairing and renewing objects to extend their lifespan, and participants generally expressed the belief that if something breaks, they will repair it rather than throw it away. “Sharing” refers to the behavior of sharing products without charge, particularly children’s products, and includes giving unused items to those who cannot afford them. “Reusable product choice” referred to the frequent use of products that can be reused, particularly in the context of food consumption, and included examples such as thermoses, jars, flasks, lunch boxes, cloth bags, and metal straws.

Table 3. Coding the participants' Reuse behaviors and motivations.

Behaviors	Positive Motivations	Negative Motivations
Repairing	Circular economy	Obligation
Sharing	Feeling good	Preference of consumption
Reusable products	Not harming the environment	Convenience
Secondhand use		
Reusing the packages		

"Secondhand product usage" refers to actions such as exchanging, buying unused products, buying an unused item in exchange for its price, and selling unused owned products, with the most common example being clothing. "Reusing packages" referred to the preference for and purchase of products with recyclable or reusable packaging and included examples such as reusing glass jars for various purposes after consumption, cleaning and reusing plastics.

Positive Motivations

When the motivations of participants for the 'Reuse' action were evaluated, three positive motivations were identified: circular economy, feeling good, and not harming the environment. "Circular economy" refers to the reuse of everything available to participants in a way that allows for transfer from those who no longer need an item to those who do, with the belief that this contributes significantly to sustainability. "Feeling good" referred to the motivation to reuse based on positive emotions, and included actions such as transforming something, sharing with those in need, consuming less, and taking creative actions. "Not harming the environment" referred to the desire to prevent harm to nature, including the cutting of trees, the reduction of plastic production, and the prevention of waste. Participants expressed awareness of the impact of their actions on the environment.

Negative Motivations

When the motivations of participants for the 'Reuse' behavior were evaluated, three negative motivations emerged: obligation, consumption preference, and convenience. "Obligation" referred to cases where the "Reuse" behavior was

not performed due to factors such as emergencies, lack of need, lack of a place to share, obsolescence, harmfulness of the purchased product, and preference for other options. "Consumption preference" referred to the approach to "Reuse" within the context of participants' consumption habits and included reasons such as a lack of willingness to use secondhand products, a preference for new products in certain categories (such as electronics and clothing), similar cost between new and reused products, hygiene concerns with products that meet food, and sensory factors such as smell and touch. "Convenience" refers to negative motivations to avoid the "Reuse" behavior, including the perceived hassle of reusable products, eating out, difficulty with dexterity in some cases, and a preference for easier solutions.

Recycle

Behaviors

When the actions that the participants paid attention to in the "Reuse" behavior were evaluated, four codes were created: "Actively Using Recycle Points," "Separating Wastes," "Not Producing Waste," and "Seeing Unnecessary" (Table 4). The behavior of "Actively Using Recycle Points" refers to actively using recycling facilities, such as taking textile products to stores that recycle and using municipal recycling collection points. Materials that can be recycled include textile products, glass, batteries, waste oil, paper, metal, and plastic products. "Separating Wastes" refers to the participants' process of separating recyclable waste by type, with special areas designated for collection and separation at their homes. Batteries, glass bottles, and plastic products are often separated, and separated waste is stored

in bags and taken to recycling points. “Not Producing Waste” is seen by some participants because of recycling actions, and this perception often intersects with the act of reuse. Examples of this include using old items for different purposes, preferring recyclable packaging, and

using such packaging multiple times before recycling. Some participants define recycling as the recovery of material after certain processes, but they also note that recycling is not always a clear solution due to the energy required.

Behaviors	Positive Motivations	Negative Motivations
Using recycling points actively	Protecting nature	Habits
Separating waste	Concerning the future	Inadequacies
Not to create waste	Feeling good	Distrust

Table 4. Coding the participants' recycling behaviors and motivations.

Positive Motivations

Three codes were identified as positive motivations for the act of recycling: “Protecting Nature”, “Concerning the Future”, and “Feeling Good”. “Protecting Nature” refers to an awareness of the impact of consumption and waste reduction on the environment. Examples of this motivation include keeping the environment clean, minimizing harm to and pollution of nature, efficiently using resources, and recycling waste rather than allowing it to decompose in the environment over time. “Concerning for the Future” refers to a concern for the long-term future of the world and the potential for recycling to reduce the need for new raw materials and mitigate future disasters. “Feeling Good” refers to a sense of satisfaction or fulfillment experienced by the participants while performing the act of recycling. Examples of this motivation include feeling useful or virtuous, having inner peace from living without waste, feeling a sense of connection with faith through recycling, and turning recycling into a hobby.

Negative Motivations

When the motivations of the participants for the “Recycle” behavior were evaluated, three codes were identified as negative motivations: “Habits”, “Inadequacies” and “Distrust”. “Habits” refer to behaviors that the participants cannot change due to their daily routines, as mentioned in the “Reduce” action. These behaviors are often motivated by a lack of alternatives, an inability to give up packaged products due to their habits, and a lack of time for

recycling due to other commitments and feeling too tired. “Inadequacies” refers to a lack of infrastructure and resources that prevent the participants from performing the “Recycle” behavior, even if they want to. Examples of this include a lack of recycling facilities, insufficient waste separation and collection systems, and difficulties in complying with local government waste collection systems. “Distrust” refers to a lack of trust in the recycling stakeholders as a negative motivation towards this action. This includes the belief that recycling is not being done at the reflected rates, that it is not being done in a real sense, that local governments and country administrations are not doing enough recycling in society, and that the effort to collect and separate waste will not be effective.

Rot

Behaviors

When the behaviors that the participants paid attention to in the act of composting were evaluated, four codes were created: “Rot”, “Bokashi”, “Reducing Organic Waste” and “Inclusion with Limited Restrictions” (Table 5). “Bokashi” refers to the process of fermenting organic food in the home kitchen using a bokashi bucket. This action is often performed regularly and is seen as a way of participating in the daily food chain. “Reducing Organic Waste” refers to actions taken to reduce organic waste, such as mixing fruit and vegetable waste into the soil or keeping organic waste separate from other waste.

Participants also mentioned behaviors such as collecting organic waste separately and leaving it at collection points and using all vegetables as much as possible. "Inclusion with Limited Restrictions" refers to participants trying to be involved in composting with small actions, such

as making their compost container, using garbage bags, or giving organic waste to someone who composts regularly. Some participants mentioned not composting due to a lack of knowledge and seeking out information to compost.

Table 5. Coding the participants' Rot behaviors and motivations.

Behaviors	Positive Motivations	Negative Motivations
Bokashi	Benefits of organic waste	Location and equipment issue
Reducing organic waste	Not creating waste	Time needs and work
Inclusion with restricted opportunity		Family and environmental impact Ignorance

Positive Motivations

Two codes were identified as motivations for the "Rot" action: "Benefits of Organic Waste" and "Not Creating Waste". "Benefits of Organic Waste" refers to the benefits of composting organic waste rather than causing harm, such as turning organic waste into fertilizer, returning food to the soil, using the resulting fertilizer instead of chemical or synthetic fertilizers, and creating fertile soil for plants and gardens. "Not Creating Waste" is a motivation that is related to waste reduction and was mentioned independently of the act of composting. Examples of this motivation include protecting nature, reducing waste, decreasing carbon footprint, and teaching children to be conscious and respectful towards the environment. ,

Negative Motivations

Four codes were identified as negative motivations for the behavior of composting: "Location and Equipment Issue", "Need of Time and Work", "Family and Environment Effect" and "Ignorance". "Location and Equipment Issue" refers to a lack of space and equipment for composting, particularly among participants who live in apartments and are affected by city living, lack of balconies, and limited financial resources. Other factors mentioned include a lack of appropriate equipment or space for it, a lack of regular life at home, concern about bad smells, and

the high cost of equipment. "Need of Time and Work" refers to the demands of city living and a lack of time and energy for composting due to a fast pace of work limited time at home, frequent travel, and the need to exercise regularly. "Family and Environment Effect" refers to a lack of support for composting from family members or others in the living environment, including a lack of acceptance for composting at home or the use of traditional methods in family gardens, discomfort, or negative reactions from others due to the lack of equipment, and a lack of support for the action. "Ignorance" refers to a lack of knowledge about composting, including how to combine compost with soil in the living environment, and a lack of experience or confidence in composting.

Motivation Categorization According To Drivers

"A National Strategy to Reduce Food Waste at the Consumer Level" focused on food waste through zero waste (Oria & Schneeman, 2020). It has been specifically highlighted that strategies to reduce food waste at the household level are crucial to achieve sustainability goals and minimize environmental impact (Gerda, 2023). Furthermore, the development of new practices associated with reducing food waste in households has been identified as key to achieving the 2030 Sustainable Development Goals (SDGs)

(Angeles-Segoviano & Hernández-Vázquez, 2023). The use of the research to categorize user behaviors and motivations in the research facilitates the opportunity to comment on the overall perception of zero waste as this study is a comprehensive review of food waste behaviors with a focus on understanding consumers' perceptions, attitudes, and knowledge of waste (Ahmed

et al., 2021). In this framework, it was found appropriate to use this categorization in the research. The positive and negative motivations identified by the participants have been categorized in the framework to five NAS drivers according to their zero-waste behaviors (Oria & Schneeman, 2020) (Table 6) (Table 7).

Motivation, Opportunity, and Ability Work Together	Sociodemographic Variables	Motivational Factors	Contextual Factors	Habits
Concern for the futures	-	Psychological impact	Circular economy	Lifestyle
Protecting nature		Not harming the environment		
Feeling good				
Not creating waste				

Table 6. Categorization of users' positive motivations within the framework of drivers according to zero waste behaviors (Oria & Schneeman, 2020).

For positive motivations, under the category of "Motivation, Opportunity, and Ability to Work Together," participants expressed a strong motivation to engage in waste reduction behaviors, driven by a concern for the future and a desire to protect nature. The intrinsic reward of feeling good and the explicit goal of not creating waste further bolstered these motivations. This aligns with the understanding that when individuals feel capable and motivated, they are more likely to engage in the desired behaviors (Oria & Schneeman, 2020).

psychological impacts such as the desire to not harm the environment were key motivational factors. This reinforces the idea that values and attitudes towards outcomes are crucial drivers of sustainable behavior (Oria & Schneeman, 2020). Under "Contextual Factors," the concept of a circular economy was identified as a motivating factor for users to engage in waste reduction. This highlights the importance of systemic factors and broader economic structures in facilitating sustainable behavior. Lastly, "Habits" and lifestyle choices also played a significant role in shaping positive motivations. The establishment of new, sustainable habits is essential for the maintenance of long-term waste reduction behaviors.

While the study does not provide detailed data on sociodemographic variables. "Motivational Factors" emerged, where

Table 7. Categorization of users' negative motivations within the framework of drivers according to zero waste behaviors (Oria & Schneeman, 2020).

Motivation, Opportunity, and Ability Work Together	Sociodemographic Variables	Motivational Factors	Contextual Factors	Habits
Habits	-	Family and social effects	Daily life requirements	Daily life requirements
Convenience		Distrust	No alternatives	Consumption preference
Inadequacies		Ignorance	Environmental adequacy	
Time needs and work			Obligation	
			Location and equipment issue	

For negative motivations, under the category of "Motivation, Opportunity, and Ability to Work Together," barriers included habits, convenience, inadequacies, and the time and effort required to engage in waste reduction

behaviors. These barriers highlight the challenges individuals face in changing entrenched behaviors and routines. Regarding "Sociodemographic Variables," specific details are not provided.

Under "Motivational Factors," psychological impacts such as the perceived effort and inconvenience associated with waste reduction were identified as negative motivations. This underscores the need for strategies that reduce perceived barriers and enhance the appeal of sustainable behaviors. For "Contextual Factors," daily life requirements, lack of alternatives, environmental adequacy, obligations, and location and equipment issues were cited as significant barriers. These contextual factors, which are often beyond individual control, highlight the need for systemic changes to support sustainable practices. Lastly, under "Habits," the preference for convenience and established consumption patterns emerged as major obstacles to adopting sustainable behaviors. This finding emphasizes the importance of targeting habit formation and disruption in sustainability initiatives.

Participants did not specify Sociodemographic Variables for both positive and negative motivations. This may indicate that cultural influences are kept more limited in the zero-waste approach. It is also observed that some motivations are included in more than one driver. Daily life requirements are included in both contextual factors and habits, especially for negative motivations. This may also be a result of the special situations experienced by the participants within the framework of behaviors.

Conclusion

This study provides a comprehensive examination of user behaviors and motivations related to waste reduction, utilizing the 5R approach (*Refuse, Reduce, Reuse, Recycle, Rot*) as a framework. The findings highlight the complex interplay of positive and negative motivations influencing sustainable behaviors.

Participants demonstrated a strong intrinsic motivation to protect the environment, driven by concerns for the future and a desire to feel good about their actions. The concept of a circular economy and the psychological impact

of not harming the environment emerged as significant motivational factors. These findings underscore the importance of systemic factors and the broader economic context in facilitating sustainable behaviors.

However, the study also identified substantial barriers to waste reduction, particularly related to convenience, time constraints, and the perceived effort required for sustainable practices. The lack of appropriate equipment, limited space, and inadequate support from family and the community were notable challenges. These findings highlight the necessity for strategies that reduce perceived barriers and enhance the appeal of sustainable behaviors. These barriers can be a guide for designers to understand unsustainable behavior.

In conclusion, the research emphasizes the need for a multifaceted approach to promote zero waste behaviors. This includes fostering positive motivations through education and awareness, addressing contextual and systemic barriers, and encouraging the formation of sustainable habits. By understanding the drivers and obstacles to waste reduction, policymakers and practitioners can develop more effective strategies to achieve sustainability goals and minimize environmental impact.

The study primarily relies on self-reported data and attitudinal levels rather than actual behavioral data. This limitation may introduce biases due to social desirability and hypothetical bias, potentially deviating from actual behaviors. Also, the study's sample selection method, which involved reaching out to followers of 'Zero Waste' themed pages on social media, may introduce a selection bias towards individuals already interested in waste reduction, potentially overlooking perspectives of those less engaged in sustainable practices.

For future studies, focus on user behaviors and motivations related to waste reduction may not fully capture the broader systemic and contextual factors that influence

sustainable behaviors, such as policy interventions, infrastructure support, and cultural norms. Also, future studies can emphasize on the 5R approach and zero waste stages may overlook other important factors influencing waste reduction behaviors, such as emotional aspects, habits, and contextual influences.

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