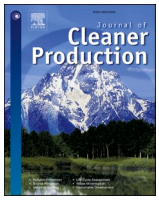
Journal of Cleaner Production 513 (2025) 145749

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro



# Generation Z goes circular: Participation in business models

Sofia Gomes [a,*], José C. Casillas [b]

[a] REMIT - Research on Economics, Management and Information Technologies, Portucalense University, R. Dr. António Bernardino de Almeida 541, 4200-072, Porto, Portugal
[b] Universidad de Sevilla, Avda. Ramón y Cajal, 1, 41018, Seville, Spain

ARTICLE INFO

*Keywords:*
Circular habits
Functional value price and quality
Consumer participation
Circular economy
Signaling theory
Generation Z

ABSTRACT

The transition from linear to circular business models has been accelerated in recent years, valuing the role of companies but underestimating consumers' contribution to this transformation. The objective of this study is to explore the willingness of Portuguese Generation Z consumers to participate in the circular economy (CE), with circular habits and the functional value perceived by these consumers of circular products being considered as drivers of this participation. To this end, this study used a quantitative methodology, having collected, by questionnaire, a sample made up of 578 young Portuguese Generation Z and applying the Partial Least Square (PLS) method to a formulated research model. The results reveal that consumers' circular habits positively influence circular products' functional value-price and functional value-quality. In turn, the perceived functional value positively influences consumers' willingness to participate in CE, contrary to circular habits that were not statically significant in influencing this participation. However, circular habits positively influence consumers' willingness to participate in CE when mediated by the perceived functional value of circular products. This study demonstrates, for the first time, that the participation of Generation Z consumers in CE can be signalled through the functional value perceived by consumers of circular products within the scope of signalling theory. It contributes to narrowing the gap in the literature on effective consumer participation in circular business models and on the circular behavior of Generation Z consumers. Furthermore, it is the first study to use five circular habits simultaneously.

## 1. Introduction

In recent years, the circular economy (CE) has grown in terms of academic interest and practical interest for different societal stakeholders, namely companies and political decision-makers (Korhonen et al., 2018; Vidal-Ayuso et al., 2023). The CE can be defined as a sustainable economic model that seeks to reduce waste and maximize the efficient use of resources (Murray et al., 2017). CE emerges as an alternative to linear and conventional business models, as it is more environmentally sustainable and improves the performance of economic processes (Ghisellini et al., 2016). CE is not only an individual process of reconversion of companies' business models but also of consumption. This implies a change at the company level and in consumer behaviors, attitudes and values (Chizaryfard et al., 2021). The circular economy generates economic and social value, promoting a sustainable model of production and consumption. The economic value of attitudes and behaviors in the circular economy is generated by cost reduction (companies save by reusing materials and reducing waste), new business opportunities (markets for recycled products, repair services and rental of goods emerge), efficiency and innovation (more sustainable production processes reduce dependence on virgin raw materials) and job creation (stimulation of sectors such as recycling, reconditioning and the sharing economy), according to Tapaninaho and Heikkinen (2022). The social value of attitudes and behaviors in the circular economy is generated by the creation of local jobs (sectors such as reverse logistics and repair promote work in communities), reducing inequality (circular models make products more accessible, such as reused clothing and electronics), improving quality of life (reducing pollution and waste improves public health) and by environmental engagement and education (stimulates cultural changes and more conscious consumption), according to Ayaz and Tatoglu (2024). The circular economy strengthens economic sustainability and promotes a fairer, more resilient society.

CE has been studied in different areas, from environmental and social sciences (Machado et al., 2019; Perez-Castillo and Vera-Martinez, 2020). In social sciences, most studies focus on the regeneration of

* Corresponding author.
*E-mail addresses:* sofiag@upt.pt (S. Gomes), casillas@us.es (J.C. Casillas).

https://doi.org/10.1016/j.jclepro.2025.145749
Received 20 March 2024; Received in revised form 10 April 2025; Accepted 17 May 2025
Available online 17 May 2025

companies' business models, and the role of consumers in CE has been neglected, as has been demonstrated in several studies Gomes and Lopes (2023), Lopes et al. (2023), Vidal-Ayuso et al. (2023), Camacho-Otero et al. (2018). Consumers are agents of CE processes and must be aware and motivated to actively participate in CE. In some studies, as Camacho-Otero et al. (2018)mentioned, the approach to the role of consumers in CE focuses on their circular purchasing intention or the extension of the meaning of the CE concept to the demand side. However, few studies still focus on the relationship between CE and the consumer. These studies consider their active role in CE, exploring their availability to participate in this process. To this end, it is necessary to know more about consumer behavior in EC, their attitudes, decision-making and circular habits that can provide important insights into companies' business models and political decision-making within the scope of CE (Stankevich, 2017). Deepening consumer knowledge is vital since greater consumer engagement in CE may involve behaviors that change their daily routines and lifestyle.

Within consumers, a generational cohort has been arousing interest in the most recent research on the circular and sustainable economy: Generation Z (Djafarova and Foots, 2022; Michel et al., 2023; Gomes et al., 2023). These are young people born between 1997 and 2012, representing around 32 % of the world population (WorldBank, 2024) and 20 % of the Portuguese population (Pordata, 2023). There are several motivations for focusing studies on Generation Z on topics of circularity and sustainability: young people from Generation Z are the generation that has more accessible access to information since they are digital natives, and they have demonstrated that they are more aware of environmental problems, they are called green-friendly, those who value money more and are more conscious in their consumption choices when compared to other generations (Gomes et al., 2023; Ham et al., 2022; Kaplan, 2020). They make consumption decisions based on authenticity, sustainability, and purpose, as well as defend values such as diversity, activism, and immediacy. On the contrary, generations X (1965–1980) valued stable work and hierarchy; they were loyal to traditional brands and valued independence, pragmatism and hard work, and Generation Y (1981–1995) sought experiences and personalization in their consumption and defended values such as collaboration, purpose and innovation.

To contribute to narrowing the gap in the relationship between the CE and consumers, two research questions arise: i) What is the influence of the circular habits of Generation Z consumers on their willingness to participate in the CE? and ii) What is the influence of the perceived functional value of consuming circular products on your availability to participate in CE? Therefore, the objective of this study is to explore the willingness of Portuguese Generation Z consumers to participate in the CE, with circular habits and the functional value perceived by these consumers of circular products being considered as drivers of this participation. Five circular habits were considered: recycling, reusing, repairing, reducing and circular shopping. The perceived functional value of circular products was measured by functional value-quality and functional value-price. To this end, a quantitative methodology was applied to a sample of 578 Portuguese Generation Z consumers, and a research model was proposed and estimated using the Partial Least Square (PLS) method.

The results demonstrate that circular habits positively influence the perceived functional value of circular products and that this perceived functional value influences consumers' willingness to participate in CE. It was also found that there is a positive influence of the relationship between circular habits and consumers' willingness to participate in CE, which is mediated by the perceived functional value of circular products.

This study makes several contributions. In theoretical terms, firstly, it contributes to expanding the scope of application of signalling theory by demonstrating that the participation of Generation Z consumers can be used as a signal translated by the perceived functional value of the consumption of circular products, and not just that consumption of products is only flagged if it is expensive or luxury (Gomes et al., 2023). Second, it narrowed the gap regarding the need for more information about consumer behavior and its role in CE (Camacho-Otero et al., 2018). Third, it focuses specifically on the relationship between consumers and CE, with few studies that do so and explores some drivers of consumers' active participation in CE (Lopes et al., 2023; Vidal-Ayuso et al., 2023). Fourth, as far as we know, this is the first study that brings together many circular habits. Most existing studies focus on just one or two circular habits (e.g. Shevchenko et al., 2023; Maitre-Ekern and Dalhammar. 2019). Fifth, this study contributed to a better understanding of Gen Z's circular consumer behavior, contributing to the literature on generational cohorts. Finally, the results of this study can be used strategically in reconfiguring companies' business models and boosting government decision-making within the scope of the CE.

## 2. Theoretical framework

### 2.1. Signalling theory

The framework of this study is the Signalling Theory, which allows behavior to be described in two dimensions (individuals and companies) that have undifferentiated access to information (Connelly et al., 2011). In this relationship, the sender of information chooses how to signal the information, and the receiver decides how to interpret the received signal. Within the scope of social sciences, Signaling Theory has been used in several academic studies, namely in the area of green consumer behavior (e.g. Ki and Kim, 2022; Cao and Xu, 2023; Waites et al., 2020) and circular consumer behavior (e.g. Wang et al., 2020; Gomes et al., 2022; Morais et al., 2021). When this theory is applied to information sent and received about product quality, it becomes interesting to explore product signalling, particularly circular products. In the case of circular products, information on their quality is ambiguous, and there is little consensus among consumers in the pre-purchase phase. It becomes even more important when the products are new, when there is little information about the products because they are not widely consumed, and when consumers are uninformed and have an elastic behavior about the quality of the products (Sun et al., 2021). The ultimate objective is that quality product signalling reduces information asymmetry and uncertainty in consumer behavior and promotes purchase intention (Zhang, 2021). Some studies have associated the Signaling Theory with the behavior of consuming green products, in which consumers can signal that they are willing to buy products with a higher price because they associate quality and health benefits with green products (Berger, 2019; Wang et al., 2020). Especially useful in this study are consumers' perceived functional value of circular products, whether through their functional quality-value or functional price-value, which are signals that, if well received by issuers, can encourage consumer participation in CE. This means that consumer behavior can be changed to support CE and that one of the motivations can be through the information they receive about the perceived functional value of circular products.

## 3. Literature review

### 3.1. Consumer participation in circular business models

The circular business model consists of creating, delivering and capturing value within the scope of CE (Elzinga et al., 2020). In addition to satisfying customer needs and creating economic value for society, organisations create environmental and social value for customers, other stakeholders and future generations (Geissdoerfer et al., 2017). Circular business models mainly focus on protecting and rationalising natural resources and circularising products, materials and waste to capture and preserve the greatest possible value (Reike et al., 2018). On the contrary, in linear business models, the flow of products, materials and waste is unidirectional. The circular business model has changed with the inclusion of consumer participation in different processes due

to their growing demand burdening the environment and compromising future generations (Vidal-Ayuso et al., 2023; Esposito et al., 2018). If in the linear model, consumer participation was summarized in the "disposal" phase, in linear economic models, consumers are involved in different phases from "making" to "discarding". Thus, consumers are engaged in the "make", "distribute", "buy", "reduce", "reuse" and "recycle" phases. In this way, consumers are more aware of the impact of their consumption in environmental terms and feel greater responsibility for their actions about the environment and society in general (Patwa et al., 2021). In response to the appreciation of consumer behavior, companies tend to involve consumers in their circuit in different business models, despite the high demands of consumers in terms of circularity can be an obstacle to circular production (Patti, 2017). To achieve this, production must adapt to the demand of circular consumers to guarantee greater participation, resulting from greater acceptance of CE by consumers (Peronard and Ballantyne, 2019).

### 3.2. Circular habits

Consumers' circular habits refer to sustainable consumption practices aligned with the principles of the circular economy, aiming to reduce waste and extend the life cycle of products. These habits encourage more conscious consumption, minimizing environmental impacts and maximizing the efficient use of resources. Consumer decisions are strongly influenced by the information they collect and assimilate and their education. The information consumers access, particularly regarding products, is a driver of CE (Musova et al., 2021a, b; Ozanne et al., 2021). This information can be transmitted through education and by capturing signals about the quality, availability and access to informative product details (Bigerna et al., 2021). The demand for products will depend on consumers' perceptions of them, whose characteristics were communicated and triggered bonds in the consumer with these products, accepting the market for these products (Confente et al., 2020).

Consumers' pro-sustainable information and environmental concerns positively influence circular habits (Gomes and Lopes, 2023). Circular habits are actions and behaviors that individuals frequently adopt to reduce their environmental impact (Akram et al., 2023). Studies have identified circular habits transforming consumers from conventional to sustainable behavior (Linder et al., 2022). Some examples of circular habits are recycling packaging and products and avoiding disposable or heavily packaged products (Civancik-Uslu et al., 2021), reducing consumption to what is strictly necessary (Maitre-Ekern and Dalhammar, 2019), reusing products such as clothes, bath water, product packaging, and repairing to extend their useful life instead of discarding them (Cooper and Gutowski, 2017) and purchasing circular products (recycled, eco-efficient, repaired, rechargeable and with low carbon emissions). The literature suggests that consumers' adoption of circular habits leads to a greater predisposition to participate in CE (Testa et al., 2020).

### 3.3. Perceived functional value of circular products

The perceived value of products by consumers is a competitive advantage for companies (Zeithaml et al., 2020) and positively influences consumer satisfaction and loyalty (Devi and Ni Nyoman Kerti, 2021). Consumers' perceived value of products becomes a competitive advantage by generating differentiation, justifying higher prices, increasing consumer loyalty, and strengthening the brand image. Companies that understand and meet consumer expectations about quality, functionality and sustainability gain an advantage over their competitors. Perceived value can be defined as the contribution the consumer perceives to achieve their purposes (Prohl and Kleinaltenkamp, 2020). It can encompass several dimensions, such as economic value and functional value (Sweeneya and Soutarb, 2001). In this study, we address the functional value-price and the functional value-quality consumers attribute to the consumption of circular products. Regarding CE, functional value refers to perceptions of circular products' quality, usefulness, price and performance (Majeed et al., 2022). Functional value can influence the implementation of a circularity system (Fehrer and Heiko, 2021). Value creation in CE is diverse and systemic, as it can be shaped by different business models such as recycling, reusing and reducing (Ranta et al., 2021). In this way, circularization is not a closed and unique process for one company but requires the collaboration of other companies to create circular flows of materials, creating functional value (Harala et al., 2023). Thus, the greater the functional value attributed to circular products by consumers, the greater their predisposition to participate in CE (Qasim et al., 2019; Kushwah et al., 2019). In this study, two dimensions were considered in the functional value of circular products: quality and price. The functional value quality of circular products is associated with the perceived utility attributed by consumers to circular products, which is formulated through their physical performance, durability, functionality, serviceability, usefulness, and environmentally friendly and is normally promoted by the attributes of the products (Mohd Suki, 2016; Kianpour et al., 2014). Many consumers of circular products do not only evaluate the price when making a purchase decision but also other functional attributes and their compositions (namely the ingredients). The price functional value of circular products can be described as consumers' perception of the fairness of their price (Alam et al., 2025). According to Diller (1997), there are five dimensions in functional value-price assessed by consumers: relative price (comparison of prices with similar products), reliability (price expectation) and confidence (favorable price) in the price, price transparency (fair view of the prices charged) and price-quality relationship (balance between price and perceived quality). These drivers influence the choice of environmentally friendly products, predispose consumers to pay more (Majeed et al., 2022), and influence consumer behavior (Khan and Mohsin, 2017). In this way, we can conclude that consumers' attitudes will influenced circular consumption choices, values e.g. functional, social, epistemological) and habits, influencing their participation in CE.

### 3.4. Summary of key findings and gaps identified

Table 1 presents the main key findings, authors and gaps identified in the literature review for each topic.

## 4. Formulation of hypotheses

Taking into account the literature review, the following hypotheses were formulated:

**H1**. The circular habits of a) recycling, b) repairing, c) reusing, d) reducing and e) circular purchasing of young Portuguese Generation Z positively influence the functional value and price attributed by these consumers to circular products.

**H2**. The circular habits of a) recycling, b) repairing, c) reusing, d) reducing and e) circular purchasing of young Portuguese Generation Z positively influence the functional value quality attributed by these consumers to circular products.

**H3**. The circular habits of a) recycling, b) repairing, c) reusing, d) reducing and e) circular purchasing of young people from the Portuguese Generation Z positively influence the willingness of these consumers to participate in CE.

**H4**. The circular habits of a) recycling, b) repairing, c) reusing, d) reducing, and e) circular purchasing of young people from the Portuguese generation Z positively influence the willingness of these consumers to participate in CE when mediated by the functional value attributed by these consumers to circular products.

**H5**. The circular habits of a) recycling, b) repairing, c) reusing, d)

**Table 1**
Summary of key findings and gaps.

| Topic | Key Findings | Authors | Gaps Identified |
|---|---|---|---|
| **Consumer Participation in Circular Business Models** | - Consumers are increasingly involved in the entire life cycle of products, not just in the disposal phase.<br>- Participation covers the phases of "making", "distributing", "buying", "reducing", "reusing" and "recycling". - Companies need to adapt to meet the demands of circular consumers and ensure greater participation in CE business model. | Vidal-Ayuso et al. (2023), Esposito et al. (2018), Patwa et al. (2021), Peronard and Ballantyne (2019) | - Lack of detailed understanding of how companies can effectively encourage consumer participation at different stages of the circular cycle.<br>- Need for more studies on the barriers perceived by consumers to engage with circular business models. |
| **Circular Habits** | - Circular habits include recycling, reusing, reducing consumption and purchasing circular products (e.g., recycled, eco-efficient).<br>- Education and access to information are decisive for the adoption of these behaviors.<br>- Pro-sustainability information positively influences the adoption of circular habits. | Musova et al. (2021), Akram et al. (2023), Linder et al. (2022), Civancik-Uslu et al. (2021) | - Lack of studies that empirically analyze consumers' circular habits.<br>- Most studies only address one or two circular habits<br>- The research lacks more data on the impact of awareness campaigns on changing consumer behavior. |
| **Perceived Functional Value of Circular Products** | -Consumers' perceptions of quality and price influence their willingness to participate in CE.<br>- Quality is linked to durability, performance and environmental sustainability.<br>- Price fairness and the price-quality relationship influence consumer choices. | Majeed et al. (2022), Fehrer and Heiko (2021), Qasim et al. (2019), Kushwah et al. (2019) | - Need for more research on how consumers evaluate the cost-benefit ratio of circular products in different cultural and economic contexts.<br>- Lack of clarity about which functional value attributes (quality, price, performance) are most valued by consumers in practice. |

reducing, and e) circular purchasing of young people from the Portuguese Generation Z positively influence the willingness of these consumers to participate in CE when mediated by the functional value quality attributed by these consumers to circular products.

**H6**. The functional value attributed to circular products by young Portuguese Generation Z positively influences their willingness to participate in CE.

**H7**. The functional quality value attributed to circular products by young Portuguese Generation Z positively influences their willingness to participate in CE.

## 5. Methods

### 5.1. Sample

The sample for this study was obtained through an online questionnaire, the link to which was made available by the authors on their social networks (Facebook and Linkedin) and both contact networks. As such, the sample is non-probabilistic and was collected for convenience. Responses were obtained between October and December 2023. The questionnaire was anonymous, informed consent was obtained from all participants, and the purpose of the study was explained. A pre-test was conducted with 15 participants (with different sociodemographic characteristics) to evaluate the average response time and understanding of the questions. This pre-test revealed that, on average, participants took around 4 min to respond, and there were no difficulties in understanding the questions.

The eligibility criterion for participating in the questionnaire is young people from Generation Z over 18 years old, that is, between 18 and 28 years old. To this end, the questionnaire contained the following question: ("I declare that I am between 18 and 28 years old - yes or no"). If respondents did not meet this condition, the questionnaire ended. If they answered affirmatively, they had access to the remaining questions in the questionnaire. We received a total of 598 responses, of which 578 responses met the eligibility criteria. In Portugal, according to data from Pordata (2023) around 1.1 million young people belong to Generation Z. If we consider an error term of 3 % and a confidence level of 95 %, 1067 responses would be needed, with fewer responses obtained.

Regarding sociodemographic characterization of the sample, 50.5 % are male, 47.8 % are female, and 1.7 % are other. The average age of the sample is 23.5 years old, with 19 % between 18 and 20 years old, 74 % between 21 and 24 years old and 7 % between 25 and 28 years old. Regarding education, 45.7 % have a degree, and 46.7 % have completed secondary education. Most participants do not earn any monthly net income (58.8 %), 28.4 % have a maximum monthly net income of €750, and 4.2 % have between €751 and €1000.

### 5.2. Research model

Based on the literature review, Fig. 1 shows the research model and the hypotheses formulated. The five circular habits (recycling, repairing, reusing, reducing and circular purchase) influence consumers' perceived functional value (price and quality) of circular products by consumers and their willingness to participate in the circular economy. A mediating effect of consumers' perceived functional value of circular products between circular habits and willingness to participate in the circular economy was also formulated.

### 5.3. Data measurement

The questionnaire consists of four groups of questions. The first group refers to the sociodemographic characteristics of the participants. The second group refers to five circular habits: i) recycling with five items, ii) repairing with four items; iii) reusing with six items; iv) reducing with five items and v) circular purchases with six items. The circular economy is based on the principle of minimizing waste and maximizing the efficient use of resources, being guided by the 5 R's: Refuse (manifested in circular purchases), Reduce, Reuse, Recover and Recycle. These principles connect directly with the five circular habits, promoting sustainable practices in everyday life. These items were adapted from Lee et al. (2014) and Ratner et al. (2021). The third group referring to perceived value included two dimensions: four functional value-quality items and four functional value-price items. This group of questions was adapted from Mohd Suki (2016) and Mostaghel and Chirumalla (2021). The fourth group of questions relates to the

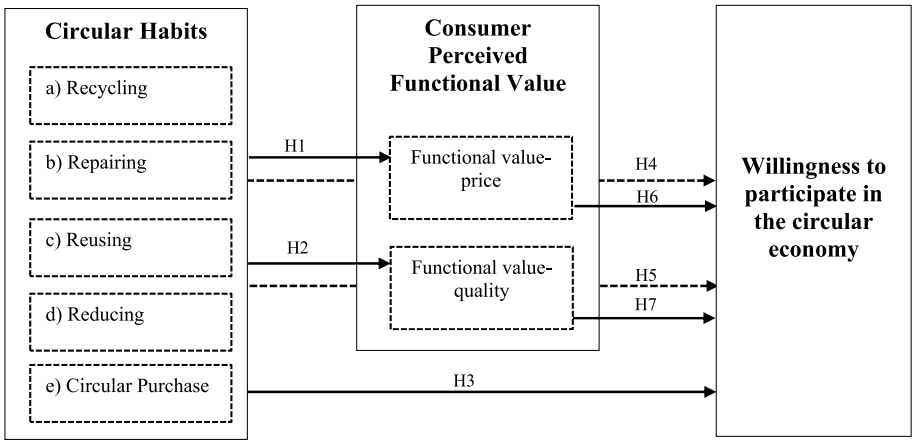



**Fig. 1.** Research model.
Note: Direct effects (→) and mediating effects (→).

willingness of consumers to participate in circular business models and consists of six items, adapted from Hao et al. (2020), Ignacio et al. (2019) and Rezaei and Ghofranfarid (2018). The second group of questions relating to circular habits was measured on a 5-point Likert scale of frequency (1 – never to 5 – very often), and the remaining groups on a 5-point Likert scale of agreement (1 – completely disagree to 5 – I totally agree). The details of the items for each question and scale are described in Appendix A.1.

### 5.4. Data analysis

The data analysis of this study was carried out in five stages. Firstly, a statistical analysis was carried out on the items that measure the constructs included in the research model. Afterwards, a factor analysis was carried out, and an exploratory factor analysis (EFA) was implemented to divide the items by factors and a confirmatory factor analysis (CFA) to evaluate the factor loadings of each construct and the reflective nature of the research model (Watkins, 2021). In the third stage, the Partial Least Square (PLS) method was applied to the research model. This method combines factor analysis with the estimation of linear regressions using the Ordinary Least Square method (Hair et al., 2018). The PLS method stands out for its flexibility, statistical robustness and ability to deal with small samples and non-normal data. Furthermore, its ability to model complex relationships and optimize variance explanation makes it a powerful tool for analyzing research models (Hair et al., 2018). Despite its flexibility and applicability to exploratory models, the PLS method presents limitations in global adjustment, potential bias in estimates and difficulty in confirmatory tests. Furthermore, choosing between reflective and formative indicators can significantly impact the model results. Poorly specified models can lead to wrong conclusions (Hair et al., 2018). It is a method already used by other authors in studies on circular consumer behavior, such as Chao and Tai (2023) and Gomes and Lopes (2023). The model obtained after applying the PLS method was evaluated in terms of convergence, feasibility and discriminant validity using the measures proposed by Hair et al. (2018): (i) Cronbach's Alpha (Cα > 0.70); (ii) Composite reliability (CR > 0.70); (iii) Average Variance Extracted (AVE >0.5) and (iv) discriminant validity tested by the Fornell-Larcker criterion. The fifth stage consisted of implementing a bootstrap analysis to test the relationships between the constructs included in the research model. The implementation of bootstrap analysis is essential for testing the relationships between the constructs of the research model, as it improves the precision of the estimated coefficients, overcomes statistical limitations, reinforces the validity of the results and increases the reliability of inferences about the model (Alfons et al., 2022).

## 6. Results

### 6.1. Descriptive analysis

Table 2 contains a statistical analysis (mean and standard deviation) of the items considered in the research model. The results demonstrate that participants' circular habits do not all occur with the same frequency. Thus, on average, the most frequent circular habit is repairing (M = 3.88), recycling (M = 3.47), reusing (M = 3.38), circular purchasing (M = 3.25) and, finally, reducing (2.98). Regarding perceived value, the items that generated the greatest agreement among participants were those relating to functional value-quality (M = 3.52). In the willingness to participate in the CE construct (M = 3.38), the item that generated the greatest agreement was WP5 – "I will support the development of a circular economy in Portugal".

### 6.2. Data analysis

The sample for this study is adequate according to the statistical value obtained by applying the Kaiser–Meyer–Olkin test (0.842). The results of the implementation of EFA and CFA are included in Appendix A.2. The implementation of EFA resulted in the division of items into eight factors corresponding to the constructs in the research model. No items were deleted. The accumulated variance of the factors is 64.68 %, with no factor individually explaining more than 50 % of the total variance. As such, the responses have no biases according to the common bias method. The implementation of the CFA demonstrates that all items present high confirmatory factor loads (greater than 0.70), and the reflective nature of the model was confirmed.

### 6.3. Measurements of the research model after applying the PLS method

The model obtained after applying the PLS method to the research model was evaluated regarding reliability, convergence and discriminant validity (Table 3) according to reference values by Hair et al. (2018). The results presented for Cronbach Alpha, Composite Reliability and Average Variance Extracted are superior to the reference values (Cα > 0.70; CR > 0.70 and AVE >0.50), and as such, the model is convergent and reliable. Furthermore, the results of applying the Fornell Larcker criterion demonstrate the model has discriminant validity since the square root AVE of each construct (in bold on the diagonal of Table 3) is greater than the correlations between that construct and all other constructs in the model.

The quality of the model fit was also evaluated according to measures of Hair et al. (2018). The model presents a good fit considering the values obtained for the Chi-Square (p = 0.081), Goodness-of-Fit (0.976),

**Table 2**
Descriptive statistics of items.

| Constructs | Mean | Std. Deviation |
|---|---|---|
| **Recycling** | **3.47** | **1.248** |
| REC1 | 3.66 | 1.163 |
| REC2 | 3.67 | 1.184 |
| REC3 | 3.83 | 1.167 |
| REC4 | 3.13 | 1.37 |
| REC5 | 3.04 | 1.358 |
| **Repairing** | **3.88** | **1.032** |
| REPAIR1 | 3.78 | 1.062 |
| REPAIR2 | 4.02 | 0.962 |
| REPAIR3 | 3.89 | 0.991 |
| REPAIR4 | 3.81 | 1.016 |
| **Reusing** | **3.38** | **1.13** |
| REUT1 | 4.06 | 1.092 |
| REUT2 | 3.75 | 1.276 |
| REUT3 | 1.77 | 1.191 |
| REUT4 | 3.00 | 1.189 |
| REUT5 | 3.99 | 1.006 |
| REUT6 | 3.71 | 1.033 |
| **Reducing** | **2.98** | **1.108** |
| REDUCE1 | 3.31 | 1.154 |
| REDUCE2 | 3.05 | 1.034 |
| REDUCE3 | 2.91 | 1.031 |
| REDUCE4 | 2.90 | 1.042 |
| REDUCE5 | 2.75 | 1.280 |
| **Circular Purchase** | **3.25** | **1.050** |
| PURCH1 | 3.04 | 1.116 |
| PURCH2 | 3.17 | 1.037 |
| PURCH3 | 3.33 | 1.056 |
| PURCH4 | 3.11 | 1.079 |
| PURCH5 | 3.57 | 1.031 |
| PURCH6 | 3.27 | 0.982 |
| **Functional value-quality** | **3.52** | **0.834** |
| VF1 | 3.51 | 0.837 |
| VF2 | 3.52 | 0.816 |
| VF3 | 3.55 | 0.819 |
| VF4 | 3.50 | 0.821 |
| **Functional value-price** | **3.29** | **0.879** |
| VPF1 | 3.21 | 0.905 |
| VPF2 | 3.29 | 0.899 |
| VPF3 | 3.28 | 0.820 |
| VPF4 | 3.37 | 0.873 |
| **Willingness to participate in the CE** | **3.38** | **0.897** |
| WP1 | 3.19 | 0.961 |
| WP2 | 3.09 | 1.000 |
| WP3 | 3.08 | 0.948 |
| WP4 | 3.57 | 0.818 |
| WP5 | 3.76 | 0.774 |
| WP6 | 3.57 | 0.879 |

the Comparative Fit Index (0.812), and Standard Root Mean Square Residual (0.090). The Variance Inflation Factor (VIF) coefficients were used to detect collinearity between independent variables. As all VIFs obtained are less than 3, there is low collinearity, that is, a low probability of roundness between the variables (Hair et al., 2018). The endogeneity of the model obtained after applying the PLS algorithm was further evaluated in terms of endogeneity. To this end, the Latent Variable Score Approach was applied, which uses the residuals of the latent variables to check whether there is a correlation with the error and, if necessary, includes a residual latent variable to capture the endogenous effect. The results demonstrate that the residuals of the latent variables are not related to the model error terms (correlation less than 0.30), and as such, endogeneity is not a significant problem (Hair et al., 2018). The model obtained was also evaluated regarding the coefficient of determination ($R^2$) and predictive relevance (Stone-Geisser $Q^2$) based on the cross-validated redundancy approach. The results demonstrate that the model's independent variables referring to circular habits explain 54.9 % of the variance of the dependent variable willingness to participate in the circular economy, 22.9 % of the functional value-quality variable and 22.7 % of the functional price-quality variable (Table 4). Furthermore, the model has predictive relevance since the $Q^2$ coefficients are greater than zero.

### 6.4. Estimation of the relationships contained in the research model

Tables 5 and 6 contain the results of the bootstrap analysis, which allowed for estimating the direct and mediating relationships between constructs established in the research model.

Estimating direct effects (Table 5) between the constructs reveals that all circular habits positively influence the functional price value attributed to circular products, confirming hypotheses H1a to H1e. However, the influence between circular habits and functional value-price is not uniform. The circular shopping habit is what most influences the functional value price ($\beta = 0.210$), followed by recycling ($\beta = 0.147$), reusing ($\beta = 0.092$), reducing ($\beta = 0.009$) and repairing ($\beta = 0.005$). Circular habits also positively influence the functional value-quality of circular products, confirming hypotheses H2a to H2e. Although circular purchasing ($\beta = 0.226$) and recycling ($\beta = 0.155$) are the habits that most influence the functional value-quality of circular products (as has already been seen for the functional value-price), there is a new intensity of influence of the remaining habits: repairing ($\beta = 0.066$), reducing ($\beta = 0.050$) and reuse ($\beta = 0.047$). It should also be noted that circular habits more positively influence the functional value quality attributed by consumers to circular products than their functional value price.

**Table 4**
Coefficient of determination and predictive relevance of the model.

| | $R^2$ | $Q^2$ |
|---|---|---|
| **Willingness to participate in the CE** | 0.549 | 0.290 |
| **Functional value-quality** | 0.229 | 0.100 |
| **Functional value-price** | 0.227 | 0.107 |

**Table 3**
Model evaluation after applying the PLS method.

| Constructs | Cα | CR | AVE | Recycling | Repairing | Reusing | Reducing | Circular Purchase | Functional value-quality | Functional value-price | Willingness to participate in the CE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Recycling** | 0.849 | 0.894 | 0.636 | **0.797** | | | | | | | |
| **Repairing** | 0.825 | 0.881 | 0.650 | 0.312 | **0.806** | | | | | | |
| **Reusing** | 0.717 | 0.808 | 0.514 | 0.528 | 0.570 | **0.717** | | | | | |
| **Reducing** | 0.720 | 0.816 | 0.575 | 0.297 | 0.366 | 0.550 | **0.758** | | | | |
| **Circular Purchase** | 0.874 | 0.905 | 0.615 | 0.411 | 0.423 | 0.543 | 0.480 | **0.785** | | | |
| **Functional value-quality** | 0.925 | 0.947 | 0.816 | 0.279 | 0.218 | 0.262 | 0.155 | 0.319 | **0.893** | | |
| **Functional value-price** | 0.925 | 0.947 | 0.816 | 0.277 | 0.179 | 0.275 | 0.184 | 0.313 | 0.705 | **0.904** | |
| **Willingness to participate in the CE** | 0.836 | 0.877 | 0.548 | 0.275 | 0.247 | 0.284 | 0.218 | 0.361 | 0.700 | 0.636 | **0.740** |

**Table 5**
Results of direct effects between constructs.

| Direct Effects | Coefficient | T Statistics | P Values | Confidence Interval 2.5 % | Confidence Interval 97.5 % | Hypothesis Support |
|---|---|---|---|---|---|---|
| H1a: Recycling - > VPF | 0.147 | 3.301 | 0.001 | 0.055 | 0.229 | Yes |
| H1b: Repairing - > VPF | 0.005 | 0.113 | 0.001 | 0.084 | 0.080 | Yes |
| H1c: Reusing - > VPF | 0.092 | 1.605 | 0.009 | 0.011 | 0.202 | Yes |
| H1d: Reducing - > VPF | 0.009 | 0.189 | 0.005 | 0.092 | 0.083 | Yes |
| H1e: Circular Purchase - > VPF | 0.210 | 4.996 | 0.000 | 0.119 | 0.277 | Yes |
| H2a: Recycling - > VF | 0.155 | 3.745 | 0.000 | 0.076 | 0.237 | Yes |
| H2b: Repairing - > VF | 0.066 | 1.618 | 0.006 | 0.004 | 0.151 | Yes |
| H2c: Reusing - > VF | 0.047 | 0.835 | 0.004 | 0.063 | 0.150 | Yes |
| H2d: Reducing - > VF | 0.050 | 1.096 | 0.004 | 0.130 | 0.041 | Yes |
| H2e: Circular Purchase - > VF | 0.226 | 5.159 | 0.000 | 0.135 | 0.309 | Yes |
| H3a: Recycling - > WP | 0.017 | 0.514 | 0.608 | 0.053 | 0.078 | No |
| H3b: Repairing - > WP | 0.050 | 1.553 | 0.121 | 0.013 | 0.112 | No |
| H3c: Reusing - > WP | 0.021 | 0.576 | 0.565 | 0.097 | 0.048 | No |
| H3d: Reducing - > WP | 0.041 | 1.157 | 0.248 | 0.028 | 0.110 | No |
| H3e: Circular Purchase - > WP | 0.093 | 2.840 | 0.005 | 0.026 | 0.155 | Yes |
| H6: VPF - > WP | 0.259 | 6.021 | 0.000 | 0.176 | 0.338 | Yes |
| H7: VF - > WP | 0.471 | 10.344 | 0.000 | 0.378 | 0.560 | Yes |

Note: WP: Willingness to participate in the CE; VF: Functional value-quality; VPQ – Functional value-price.

**Table 6**
Results of mediating effects between constructs.

| Mediating Effects | Coefficient | T Statistics | P Values | Confidence Interval 2.5 % | Confidence Interval 97.5 % | Hypothesis Support |
|---|---|---|---|---|---|---|
| H4a: Recycling - > VPF > WP | 0.038 | 2.831 | 0.005 | 0.013 | 0.005 | Yes |
| H5a: Recycling - > VF > WP | 0.073 | 3.471 | 0.001 | 0.034 | 0.008 | Yes |
| H4b: Repairing - > VPF > WP | 0.001 | 0.113 | 0.910 | 0.022 | 0.022 | Yes |
| H5b: Repairing - > VF > WP | 0.031 | 1.581 | 0.114 | 0.002 | 0.001 | Yes |
| H4c: Reusing - > VPF > WP | 0.024 | 1.540 | 0.124 | 0.003 | 0.003 | Yes |
| H5c: Reusing - > VF > WP | 0.022 | 0.828 | 0.408 | 0.030 | 0.001 | Yes |
| H4d: Reducing - > VPF > WP | 0.002 | 0.186 | 0.853 | 0.024 | 0.022 | Yes |
| H5d: Reducing - > VF > WP | 0.023 | 1.076 | 0.282 | 0.061 | 0.019 | Yes |
| H4e: Circular Purchase - > VPF > WP | 0.054 | 3.694 | 0.000 | 0.028 | 0.005 | Yes |
| H5e: Circular Purchase - > VF > WP | 0.107 | 4.663 | 0.000 | 0.059 | 0.005 | Yes |

Note: WP: Willingness to participate in the circular economy; VF: Functional value-quality; VPQ: Functional value-price.

Furthermore, the results reveal that circular habits are not statistically significant in affecting consumer participation in CE, rejecting hypotheses H3a to H3e.

Finally, hypotheses H6 and H7 confirmed that the functional value-price ($\beta = 0.259$) and the functional value-quality attributed to circular products ($\beta = 0.471$) positively and significantly influence these consumers' willingness to participate in the CE. This perceived value influence on circular products is more intense regarding functional value-quality.

The results of the mediating effects of the perceived value constructs between circular habits and the willingness of Portuguese consumers of Generation Z to participate in the circular economy are described in Table 6. All circular habits positively influence the willingness of Portuguese consumers of Generation Z to participate in the circular economy when mediated by functional value-price and functional value-quality. Thus, the mediating hypotheses H4a to H4e and H5a to H5e are confirmed. The circular purchase habit most influences the willingness to participate in the CE ($\beta = 0.107$), when mediated by functional value-quality, followed by the recycling habit ($\beta = 0.073$). The same happens when mediated by functional value-price.

## 7. Discussion and implications

### 7.1. Discussion

Literature on the transition from linear to circular business models has grown significantly in recent years, essentially focusing on the role of companies and neglecting the contribution of consumers (Camacho-Otero et al., 2018). In particular, there is still little information about the factors that can drive greater consumer participation in circular business models. This study contributes to this research gap by exploring the influence of circular habits and the perceived functional value of circular products by young Portuguese consumers of Generation Z on their willingness to participate in CE.

The results demonstrate that circular habits, that is, attitudes and behaviors frequently carried out by consumers within the scope of circularity, positively influence the perceived value of circular products in its two dimensions (functional value price and functional value quality). Previous studies have shown that habits can transform consumers' conventional or linear behaviors into sustainable ones with less environmental impact (Linder et al., 2022). Recycling and repairing habits are the most frequent habits among young Portuguese consumers of Generation Z participating in this study, as found by Svensson-Hoglund et al. (2023). Recycling and repair are among the most studied consumer attitudes in various areas of CE, such as electronic products (Islam et al., 2021) and textiles (Paço et al., 2021; McNeill et al., 2020; Musova et al., 2021a,b). However, recycling and circular purchasing habits most positively affect the functional value attributed to circular products by consumers in both dimensions (functional value-price and functional value-quality), creating more value for the consumer of circular products (Prohl and Kleinaltenkamp, 2020). As such, by influencing consumers' perceived value of circular products, these circular

habits can increase their satisfaction and loyalty to products (Devi and Ni Nyoman Kerti, 2021) and generate competitive advantages for companies (Zeithaml et al., 2020). Furthermore, previous studies have already demonstrated that the functional value attributed to circular products can influence the implementation of a circularity system (Fehrer and Heiko, 2021) as in the results obtained in this study. The circularization system is an open and collaborative process with other stakeholders (consumers, suppliers, companies and government) that allows the creation of functional value through circular flows of materials (Harala et al., 2023), which in turn increases consumers' predisposition to participate in CE (Qasim et al., 2019; Kushwah et al., 2019). However, the results demonstrate that circular habits do not directly affect consumers' willingness to participate in CE. However, suppose the relationship between circular habits and consumers' willingness to participate in CE is mediated by the functional value-price and the functional value-quality. In that case, we find a positive relationship between the constructs. These results demonstrate that it is not because consumers have frequent circular attitudes that they are more predisposed to participate in CE, contradicting the results of Testa et al. (2020) and, as such, creating new knowledge about consumer behavior in CE. Consumers must recognize the perceived value of circular products in terms of price and quality and then be available to be active agents in CE business models (Laukkanen and Tura, 2022; Mostaghel and Chirumalla, 2021). Therefore, the consumption of circular products must create value for consumers through functional value to create consumer perceptions of the quality, usefulness, price and performance of circular products (Majeed et al., 2022).

### 7.2. Theoretical implications

Theoretically, this study contributes new knowledge to signalling theory and research on the role of the consumer in CE. First, signalling theory demonstrates that circular products can be signalled through their functional value-price and functional value-quality and that if consumers receive these signals well, they can encourage their participation in the CE. Consumers' perception of the functional value of circular products results from obtaining more information about them, particularly in terms of prices and quality, reducing information asymmetry and positively influencing their acceptance of circularity systems (Fehrer and Heiko, 2021). This information is signals emitted by companies about the perceived usefulness, materialized in the physical performance, durability, functionality, serviceability, usefulness, and environmentally friendly of circular products (Mohd Suki, 2016; Kianpour et al., 2014) as well as the reliability and reliability of prices, relative prices and price transparency (Diller, 1997). Previous studies have shown that green products can have a signalling benefit when consumers are willing to pay more for these types of products (Berger, 2019). Our study demonstrates that the signalling of circular products does not have to be through a higher price but through the functional value attributed to these products. To our knowledge, this is the first study to use the perception of the functional value of circular products as a signal to consumers.

Second, the results of this study contribute to narrowing the existing gap regarding the need to have more information about consumer behavior and their role in CE (Camacho-Otero et al., 2018) for several reasons: i) it demonstrates that habits circulars can be antecedents of the functional value of circular products and that this functional value drives consumer participation in CE; ii) demonstrates that circular habits alone do not increase consumer participation in CE but that this relationship can be positively affected when mediated by functional value price and functional value quality, that is, consumers will only be willing to participate in CE if they recognize that there is functional value created in the consumption of circular products; iii) as far as we know, this is the first empirical study to consider five circular habits of consumers, whereas in other studies one or two circular habits were considered; iv) contributes to the literature on generation Z consumer behavior, which, due to the expressiveness and potential of this generation, can change the most classic paradigms about consumption.

### 7.3. Practical implications

This study provides valuable practical implications for three key audiences: consumers, companies, and policymakers, highlighting how they can collectively drive and benefit from the transition to a CE.

For consumers, adopting circular habits is an environmental choice and a pathway to making more informed and sustainable purchasing decisions. The study suggests that pro-sustainable information and environmental concerns significantly influence consumers' circular behaviours (Gomes and Lopes, 2023). To support this, consumers must be empowered with clear, accessible information about the circularity of products, materials, and processes. This includes knowledge about how their choices impact the environment across various phases, from "making" to "disposing" (Vidal-Ayuso et al., 2023). Enhanced transparency enables consumers to engage more meaningfully in CE, making informed decisions on reducing waste and conserving resources. Additionally, consumers are more likely to adopt circular behaviors when they perceive high functional value in circular products. This includes considerations of the products' durability, reparability, quality, and price—factors that, if communicated effectively, can increase willingness to participate in CE.

For companies, this study underscores the importance of providing accurate and comprehensive information to bridge the information asymmetry gap that often hinders consumer participation in CE. Companies can create value by signaling the circularity of their products, specifically through the communication of functional value, quality, and price transparency. Companies can build consumer trust and loyalty by focusing on authentically circular products—such as reducing plastic in packaging, enhancing product longevity, promoting repair services, and ensuring end-of-life product recovery. Clear labeling with product details on materials, ingredients, circular systems, and quality can improve consumer confidence. Moreover, offering circular products that are both environmentally responsible and economically competitive can position companies as leaders in sustainability, ultimately enhancing their market share. Companies should also invest in consumer education, providing the necessary tools and resources that empower individuals to engage in circular practices.

For political decision-makers, the findings suggest several opportunities to promote circular habits and enhance CE adoption. Policies should encourage the public to engage in more sustainable behaviors through media campaigns, educational programs, and company collaborations. Promoting circular habits through the media, schools, and businesses can increase public awareness and adoption. Furthermore, governments should consider providing financial incentives—such as tax benefits and non-refundable funds—for companies that commit to circular business models. This would incentivise sustainability and support innovation in circular product development. Another key policy recommendation is the mandatory inclusion of clear information on the circularity of products, especially on labels, so that consumers can easily access details on the product's functional value. Furthermore, integrating circular behaviours into educational curricula at all levels—from primary to higher education—can instil sustainable consumption patterns in future generations.

## 8. Conclusion

The objective of this study is to explore the influence of the circular habits of young Portuguese Generation Z on the functional value attributed by them to circular products and on the availability to participate in CE, either directly or when the relationship between circular habits and participation in CE is mediated for the functional value, price and quality of these products. Furthermore, the influence of the functional value of circular products on consumers' willingness to

participate in CE was explored.

The results reveal that consumers' circular habits positively influence the functional value-price and the functional value-quality of circular products. However, the intensity of influence is not uniform among the five circular habits considered. Furthermore, the functional value of these products positively influences consumers' willingness to participate in CE. On the contrary, circular habits do not directly influence consumers' participation in CE, but when this relationship is mediated by consumers' perception of the functional value of products, this relationship is positive.

The authors perceive that consumers' circular habits, such as recycling, reuse, and conscious consumption, positively impact how they evaluate the functional value of circular products, both in terms of price and quality. This suggests that consumers more accustomed to sustainable practices tend to see greater value in these products. However, the authors highlight that this influence is not uniform among the five circular habits analyzed, indicating that not all sustainable behaviors affect value perception in the same way. Some habits may generate a positive view of the product more effectively than others. Another important point is that although perceived functional value increases consumers' willingness to participate in the CE, circular habits alone do not directly lead to participation. In other words, being sustainable in their daily lives is not enough; consumers will only engage in the CE if they perceive that circular products offer fair quality and price. This shows that the perception of functional value acts as an essential mediator between sustainable habits and effective participation in the CE For the authors, this reinforces the importance of companies communicating and delivering real value (both environmental and functional) in their circular products to stimulate consumer engagement.

This study has some limitations. Only Portuguese consumers from Generation Z participated in this study, the sample being non-probabilistic and therefore not representative. To overcome this limitation in future studies, it is suggested that a representative sample of young Portuguese people from generation Z be obtained. In future research, this topic should be further explored, highlighting the points observed in this study, namely the non-uniform influence of different circular habits on the functional value of circular products and the mediating role of perceived functional value in encouraging consumer participation in the Circular Economy. It is important to deepen the understanding of which specific habits most strongly impact value perception and how companies can better communicate both the functional and environmental benefits of their circular offerings. It would also be interesting to replicate the research model to other generations (X and Y), making a comparison of results. As the research was confined only to Portugal, it would still be interesting to replicate this study with young people from Generation Z in other European countries to explore the impact of the sociocultural context on the research model. Furthermore, in this study, only circular habits were considered antecedents to the perceived functional value of circular products. It would be interesting in future studies to consider the impact of personality traits on the adoption of circular habits and on the functional value attributed to circular products, given that certain personality traits can be learned and taught and, as such, drive greater consumer participation in the CE.

## CRediT authorship contribution statement

**Sofia Gomes:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **José C. Casillas:** Writing – review & editing, Writing – original draft, Investigation, Conceptualization.

## Declaration of competing interest

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

## Appendix

A.1. Questionnaire available at: https://drive.google.com/file/d/1GRFBBss01XCut0v2ZvQNPRT-PMqWSVz0/view?usp=sharing.
A.2Results of EFA and CFA.

| | Factor Loading | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Communalities |
|---|---|---|---|---|---|---|---|---|---|---|
| **Recycling** | | | | | | | | | | |
| REC1 | 0.916 | 0.873 | | | | | | | | 0.866 |
| REC2 | 0.892 | 0.874 | | | | | | | | 0.866 |
| REC3 | 0.571 | 0.861 | | | | | | | | 0.836 |
| REC4 | 0.616 | 0.745 | | | | | | | | 0.759 |
| REC5 | 0.916 | 0.786 | | | | | | | | 0.709 |
| **Repairing** | | | | | | | | | | |
| REPAIR1 | 0.830 | | 0.794 | | | | | | | 0.779 |
| REPAIR2 | 0.825 | | 0.734 | | | | | | | 0.793 |
| REPAIR3 | 0.774 | | 0.743 | | | | | | | 0.751 |
| REPAIR4 | 0.795 | | 0.786 | | | | | | | 0.703 |
| **Reusing** | | | | | | | | | | |
| REUT1 | 0.774 | | | 0.798 | | | | | | 0.749 |
| REUT2 | 0.739 | | | 0.789 | | | | | | 0.705 |
| REUT3 | 0.776 | | | 0.784 | | | | | | 0.796 |
| REUT4 | 0.710 | | | 0.702 | | | | | | 0.706 |
| REUT5 | 0.777 | | | 0.744 | | | | | | 0.723 |
| REUT6 | 0.772 | | | 0.791 | | | | | | 0.738 |
| **Reducing** | | | | | | | | | | |
| REDUCE1 | 0.766 | | | | 0.761 | | | | | 0.712 |
| REDUCE2 | 0.703 | | | | 0.733 | | | | | 0.794 |
| REDUCE3 | 0.798 | | | | 0.741 | | | | | 0.707 |
| REDUCE4 | 0.747 | | | | 0.761 | | | | | 0.736 |
| REDUCE5 | 0.794 | | | | 0.744 | | | | | 0.765 |
| **Circular Purchase** | | | | | | | | | | |

(*continued on next page*)

(*continued*)

| | Factor Loading | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Communalities |
|---|---|---|---|---|---|---|---|---|---|---|
| PURCH1 | 0.721 | | | | | 0.724 | | | | 0.715 |
| PURCH2 | 0.794 | | | | | 0.724 | | | | 0.795 |
| PURCH3 | 0.743 | | | | | 0.795 | | | | 0.771 |
| PURCH4 | 0.838 | | | | | 0.771 | | | | 0.729 |
| PURCH5 | 0.771 | | | | | 0.722 | | | | 0.765 |
| PURCH6 | 0.834 | | | | | 0.742 | | | | 0.718 |
| **Functional value-quality** | | | | | | | | | | |
| VF1 | 0.883 | | | | | | 0.818 | | | 0.735 |
| VF2 | 0.923 | | | | | | 0.832 | | | 0.743 |
| VF3 | 0.912 | | | | | | 0.831 | | | 0.747 |
| VF4 | 0.895 | | | | | | 0.831 | | | 0.748 |
| **Functional value-price** | | | | | | | | | | |
| VPF1 | 0.889 | | | | | | | 0.756 | | 0.765 |
| VPF2 | 0.910 | | | | | | | 0.748 | | 0.807 |
| VPF3 | 0.916 | | | | | | | 0.743 | | 0.827 |
| VPF4 | 0.857 | | | | | | | 0.753 | | 0.719 |
| **Willingness to participate in the CE** | | | | | | | | | | |
| WP1 | 0.782 | | | | | | | | 0.778 | 0.726 |
| WP2 | 0.715 | | | | | | | | 0.765 | 0.726 |
| WP3 | 0.780 | | | | | | | | 0.722 | 0.661 |
| WP4 | 0.855 | | | | | | | | 0.715 | 0.647 |
| WP5 | 0.823 | | | | | | | | 0.813 | 0.709 |
| WP6 | 0.835 | | | | | | | | 0.781 | 0.682 |

## Data availability

Data will be made available on request.

## References


Akram, Farheen, Rashid Gill, Abid, Haq, Muhammad Abrar ul, Arshad, Afrasiyab, Malik, Hafiz Abid Mahmood, 2023. Barriers to enduring pro-environmental habits among urban residents. Appl. Sci. 13 (4). https://doi.org/10.3390/app13042497.

Alam, Syed S., Ahsan, Mst Nilufar Kokash, Husam, Ahmad Kokash, Ahmed, Saif, Wu, Di, 2025. Remanufactured consumer goods buying intention in circular economy: insight of value-belief-norm theory, self-identity theory. J. Remanuf. 1–28.

Alfons, Andreas, Ateş, Nüfer Yasin, Groenen, Patrick JF., 2022. A robust bootstrap test for mediation analysis. Organ. Res. Methods 25 (3), 591–617.

Ayaz, Ozlem, Tatoglu, Ekrem, 2024. Unveiling the power of social value: catalyzing circular economy in emerging market SMEs. J. Clean. Prod. 453, 142245.

Berger, Joël, 2019. Signaling can increase consumers' willingness to pay for green products. Theoretical model and experimental evidence. J. Consum. Behav. 18 (3), 233–246. https://doi.org/10.1002/cb.1760.

Bigerna, Simona, Micheli, Silvia, Polinori, Paolo, 2021. New generation acceptability towards durability and repairability of products: circular economy in the era of the 4th industrial revolution. Technol. Forecast. Soc. Change 165 (May 2020), 120558. https://doi.org/10.1016/j.techfore.2020.120558.

Camacho-Otero, Juana, Boks, Casper, Pettersen, Ida Nilstad, 2018. Consumption in the circular economy: a literature review. Sustainability 10 (8). https://doi.org/10.3390/su10082758.

Cao, Cong, Xu, Qianwen, 2023. A new perspective on extra consumer costs for green parcel packaging — an exploration of signal theory and green values. J. Clean. Prod. 382 (October 2022), 135361. https://doi.org/10.1016/j.jclepro.2022.135361.

Chao, Cheng Min, Tai, Kuei Yu, 2023. How emotions and green altruism explain consumer purchase intention toward circular economy products: a multi-group analysis on willingness to be environmentally friendly. Bus. Strat. Environ. (October), 1–14. https://doi.org/10.1002/bse.3632.

Chizaryfard, Armaghan, Trucco, Paolo, Nuur, Cali, 2021. The transformation to a circular economy: framing an evolutionary view. J. Evol. Econ. 31 (2), 475–504. https://doi.org/10.1007/s00191-020-00709-0.

Civancik-Uslu, Didem, Nhu, Thuy Trang, Van, Gorp, Van, Bart, Kresovic, Uros, Larrain, Macarena, Billen, Pieter, Huysveld, Sophie, 2021. Moving from linear to circular household plastic packaging in Belgium: prospective life cycle assessment of mechanical and thermochemical recycling. Resour. Conserv. Recycl. 171, 105633.

Confente, Ilenia, Scarpi, Daniele, Russo, Ivan, 2020. Marketing a new generation of bio-plastics products for a circular economy: the role of green self-identity, self-congruity, and perceived value. J. Bus. Res. 112 (June 2019), 431–439. https://doi.org/10.1016/j.jbusres.2019.10.030.

Connelly, Brian L., Trevis Certo, S., Duane Ireland, R., Reutzel, Christopher R., 2011. Signaling theory: a review and assessment. J. Manag. 37 (1), 39–67. https://doi.org/10.1177/0149206310388419.

Cooper, Daniel R., Gutowski, Timothy G., 2017. The environmental impacts of reuse: a review. J. Ind. Ecol. 21 (1), 38–56.

Devi, Anak Agung Diah Tarama, Ni Nyoman Kerti, Yasa, 2021. Role of customer satisfaction in mediating the influence of service quality and perceived value on brand loyalty. Int. Res. J. Manag. IT Soc. Sci. 8 (3), 315–328. https://doi.org/10.21744/irjmis.v8n3.1786.

Diller, H., 1997. Preis-Management Im Zeichen Des Beziehungsmarketing. Betriebswirtschaft 57 (6), 749–763.

Djafarova, Elmira, Foots, Sophie, 2022. Exploring ethical consumption of generation Z: theory of planned behaviour. Young Consum. 23 (3), 413–431. https://doi.org/10.1108/YC-10-2021-1405.

Elzinga, Remi, Reike, Denise, Negro, Simona O., Boon, Wouter P.C., 2020. Consumer acceptance of circular business models. J. Clean. Prod. 254, 119988. https://doi.org/10.1016/j.jclepro.2020.119988.

Esposito, Mark, Tse, Terence, Soufani, Khaled, 2018. The circular economy: an opportunity for renewal, growth, and stability. Thunderbird Int. Bus. Rev. 82–95.

Fehrer, Julia A., Heiko, Wieland, 2021. A systemic logic for circular business models. J. Bus. Res. 125 (March 2019), 609–620. https://doi.org/10.1016/j.jbusres.2020.02.010.

Geissdoerfer, Martin, Savaget, Paulo, Bocken, Nancy M.P., Hultink, Erik Jan, 2017. The circular economy – a new sustainability paradigm? J. Clean. Prod. 143, 757–768. https://doi.org/10.1016/j.jclepro.2016.12.048.

Ghisellini, Patrizia, Cialani, Catia, Ulgiati, Sergio, 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007.

Gomes, Sofia, Lopes, João M., 2023. Unlocking the potential of circular consumption: the influence of circular habits, environmental concerns and the search for pro-sustainable information on circular consumption. Bus. Strategy Develop. 1–16. https://doi.org/10.1002/bsd2.327 no. November.

Gomes, Giovana M., Moreira, Natalia, Ometto, Aldo R., 2022. Role of consumer mindsets, behaviour, and influencing factors in circular consumption systems: a systematic review. Sustain. Prod. Consum. 32, 1–14. https://doi.org/10.1016/j.spc.2022.04.005.

Gomes, Sofia, Lopes, João M., Nogueira, Sónia, 2023. Willingness to pay more for green products: a critical challenge for gen Z. J. Clean. Prod. 390 (January). https://doi.org/10.1016/j.jclepro.2023.136092.

Hair, J.F.H., Risher, J.J., Sarstedt, M., Ringle, C.M., 2018. The results of PLS-SEM article information. Eur. Bus. Rev. 31 (1), 2–24.

Ham, Chang Dae, Chung, Un Chae, Kim, Woo Jin, Lee, Seo Yoon, Oh, Sang Hwa, 2022. Greener than others? Exploring generational differences in green purchase intent. Int. J. Mark. Res. 64 (3), 376–396. https://doi.org/10.1177/14707853211034108.

Hao, Yu, Wang, Yingting, Wu, Qiuwei, Sun, Shiwei, Wang, Weilu, Cui, Menglin, 2020. What affects residents' participation in the circular economy for sustainable development? Evidence from China. Sustain. Dev. 28 (5), 1251–1268. https://doi.org/10.1002/sd.2074.

Harala, Linnea, Alkki, Lauri, Aarikka-Stenroos, Leena, Al-Najjar, Ahmad, Malmqvist, Tove, 2023. Industrial ecosystem renewal towards circularity to achieve the benefits of reuse - learning from circular construction. J. Clean. Prod. 389 (January), 135885. https://doi.org/10.1016/j.jclepro.2023.135885.

Ignacio, Jonathan Jared, Malenab, Roy Alvin, Mae Pausta, Carla, Beltran, Arnel, Belo, Lawrence, Ma Tanhueco, Renan, Promentilla, Michael Angelo, Orbecido, Aileen, 2019. A perception study of an integrated water system project in a water scarce community in the Philippines. Water (Switzerland) 11 (8). https://doi.org/10.3390/w11081593.

Islam, Md Tasbirul, Huda, Nazmul, Baumber, Alex, Shumon, Rezaul, Zaman, Atiq, Ali, Forkan, Hossain, Rumana, Sahajwalla, Veena, 2021. A global review of

consumer behavior towards E-Waste and implications for the circular economy. J. Clean. Prod. 316 (July), 128297. https://doi.org/10.1016/j.jclepro.2021.128297.
Kaplan, Elaine Bell, 2020. The millennial/gen Z leftists are emerging: are sociologists ready for them? Sociol. Perspect. 63 (3), 408–427. https://doi.org/10.1177/0731121420915868.
Khan, Shamila Nabi, Mohsin, Muhammad, 2017. The power of emotional value: exploring the effects of values on green product consumer choice behavior. J. Clean. Prod. 150, 65–74. https://doi.org/10.1016/j.jclepro.2017.02.187.
Ki, Hyoshin, Kim, Jeong Yoo, 2022. Sell green and buy green: a signaling theory of green products. Resour. Energy Econ. 67, 101266. https://doi.org/10.1016/j.reseneeco.2021.101266.
Kianpour, Kamyar, Ahmad, Jusoh, Asghari, Maryam, 2014. Environmentally friendly as a new dimension of product quality. Int. J. Qual. Reliab. Manag. 31 (5), 547–565. https://doi.org/10.1108/IJQRM-06-2012-0079.
Korhonen, Jouni, Honkasalo, Antero, Seppälä, Jyri, 2018. Circular economy: the concept and its limitations. Ecol. Econ. 143, 37–46. https://doi.org/10.1016/j.ecolecon.2017.06.041.
Kushwah, Shiksha, Dhir, Amandeep, Sagar, M., 2019. Ethical consumption intentions and choice behavior towards organic food. Moderation role of buying and environmental concerns. J. Clean. Prod. 236, 117519. https://doi.org/10.1016/j.jclepro.2019.06.350.
Laukkanen, Minttu, Tura, Nina, 2022. Sustainable value propositions and customer perceived value: clothing library case. J. Clean. Prod. 378 (2022), 134321.
Lee, Y.-k., Kim, S., Kim, M.-s., Choi, J.-g., 2014. Antecedents and interrelationships of three types of pro-environmental behavior. J. Bus. Res. 67 (10), 2097–2105. https://doi.org/10.1016/j.jbusres.2014.04.018.
Linder, Noah, Giusti, Matteo, Samuelsson, Karl, Barthel, Stephan, 2022. Pro-environmental habits: an underexplored research agenda in sustainability science. Ambio 51 (3), 546–556. https://doi.org/10.1007/s13280-021-01619-6.
Lopes, João M., Pinho, Micaela, Gomes, Sofia, 2023. From green hype to green habits: understanding the factors that influence young consumers' green purchasing decisions. Bus. Strat. Environ. (October), 1–13. https://doi.org/10.1002/bse.3602.
Machado, Maria Amália Dutra, Almeida, Stefânia Ordovás de, Bollick, Laura Chiattone, Bragagnolo, Gabriela, 2019. Second-hand fashion market: consumer role in circular economy. J. Fash. Mark. Manag. 23 (3), 382–395. https://doi.org/10.1108/JFMM-07-2018-0099.
Maitre-Ekern, Eléonore, Dalhammar, Carl, 2019. Towards a hierarchy of consumption behaviour in the circular economy. Maastricht J. Eur. Comp. Law 26 (3), 394–420. https://doi.org/10.1177/1023263X19840943.
Majeed, Abdul, Ahmed, Ishfaq, Abdul, Rasheed, 2022. Investigating influencing factors on consumers' choice behavior and their environmental concerns while purchasing green products in Pakistan. J. Environ. Plann. Manag. 65 (6), 1110–1134. https://doi.org/10.1080/09640568.2021.1922995.
McNeill, Lisa S., Hamlin, Robert P., McQueen, Rachel H., Degenstein, Lauren, Garrett, Tony C., Dunn, Linda, Wakes, Sarah, 2020. Fashion sensitive young consumers and fashion garment repair: emotional connections to garments as a sustainability strategy. Int. J. Consum. Stud. 44 (4), 361–368. https://doi.org/10.1111/ijcs.12572.
Michel, Jean Fausner, Mombeuil, Claudel, Diunugala, Hemantha Premakumara, 2023. Antecedents of green consumption intention: a focus on generation Z consumers of a developing country. Environ. Dev. Sustain. 25 (12), 14545–14566. https://doi.org/10.1007/s10668-022-02678-9.
Mohd Suki, Norazah, 2016. Consumer environmental concern and green product purchase in Malaysia: structural effects of consumption values. J. Clean. Prod. 132, 204–214. https://doi.org/10.1016/j.jclepro.2015.09.087.
Morais, Larissa Herminio Lopes de, Pinto, Diego Costa, Cruz-Jesus, Frederico, 2021. Circular economy engagement: altruism, status, and cultural orientation as drivers for sustainable consumption. Sustain. Prod. Consum. 27, 523–533. https://doi.org/10.1016/j.spc.2021.01.019.
Mostaghel, Rana, Chirumalla, Koteshwar, 2021. Role of customers in circular business models. J. Bus. Res. 127 (June 2020), 35–44. https://doi.org/10.1016/j.jbusres.2020.12.053.
Murray, Alan, Skene, Keith, Haynes, Kathryn, 2017. The circular economy: an interdisciplinary exploration of the concept and application in a global context. J. Bus. Ethics 140 (3), 369–380. https://doi.org/10.1007/s10551-015-2693-2.
Musova, Zdenka, Musa, Hussam, Drugdova, Jennifer, George, Lazaroiu, Alayasa, Jehad, 2021a. Percepcion De Los Sentido Del Ser Humano. J. Compet. 13 (3), 111–128.
Musova, Zdenka, Musa, Hussam, Matiova, Veronika, 2021b. Environmentally responsible behaviour of consumers: evidence from Slovakia. Econom. Soc. 14 (1), 178–198. https://doi.org/10.14254/2071-789X.2021/14-1/12.
Ozanne, Lucie K., Stornelli, Jason, Luchs, Michael G., Mick, David Glen, Bayuk, Julia, Birau, Mia, Chugani, Sunaina, et al., 2021. Enabling and cultivating wiser consumption: the roles of marketing and public policy. J. Publ. Pol. Market. 40 (2), 226–244. https://doi.org/10.1177/0743915620975407.
Paço, Arminda, Leal Filho, Walter, Ávila, Lucas V., Dennis, Karen, 2021. Fostering sustainable consumer behavior regarding clothing: assessing trends on purchases, recycling and disposal. Textil. Res. J. 91 (3–4), 373–384. https://doi.org/10.1177/0040517520944524.
Patti, Sebastiano, 2017. Circular economy and sharing consumption: attitudes towards low-carbon tourism. Circular Econom. Shar. Consum.: Attitudes towards Low Carbon Tour. 219–234. https://doi.org/10.3280/EFE2017-001011.
Patwa, Nitin, Sivarajah, Uthayasankar, Seetharaman, Arumugam, Sarkar, Sabyasachi, Maiti, Kausik, Hingorani, Kunal, 2021. Towards a circular economy: an emerging economies context. J. Bus. Res. 122, 725–735. https://doi.org/10.1016/j.jbusres.2020.05.015. September 2019.
Perez-Castillo, David, Vera-Martinez, Jorge, 2020. Green behaviour and switching intention towards remanufactured products in sustainable consumers as potential earlier adopters. Asia Pac. J. Mark. Logist. 33 (8), 1776–1797. https://doi.org/10.1108/APJML-10-2019-0611.
Peronard, Jean Paul, Ballantyne, Anne Gammelgaard, 2019. Broadening the understanding of the role of consumer services in the circular economy: toward a conceptualization of value creation processes. J. Clean. Prod. 239, 118010. https://doi.org/10.1016/j.jclepro.2019.118010.
Pordata, 2023. População Residente: Total E Por Grandes Grupos Etários, 2023.
Prohl, Katharina, Kleinaltenkamp, Michael, 2020. Managing value in use in business markets. Ind. Mark. Manag. 91, 563–580. https://doi.org/10.1016/j.indmarman.2020.03.017. July 2019.
Qasim, Haroon, Yan, Liang, Guo, Rui, Saeed, Amer, Ashraf, Badar Nadeem, 2019. The defining role of environmental self-identity among consumption values and behavioral intention to consume organic food. Int. J. Environ. Res. Publ. Health 16 (7). https://doi.org/10.3390/ijerph16071106.
Ranta, Valtteri, Aarikka-Stenroos, Leena, Väisänen, Juha Matti, 2021. Digital technologies catalyzing business model innovation for circular economy—multiple case study. Resour. Conserv. Recycl. 164 (September 2020), 105155. https://doi.org/10.1016/j.resconrec.2020.105155.
Ratner, S., Lazanyuk, I., Revinova, S., Gomonov, K., 2021. Barriers of consumer behavior for the development economy. Empirical evidence from Russia. Appl. Sci. 11 (1), 46.
Reike, Denise, Vermeulen, Walter J.V., Witjes, Sjors, 2018. The circular economy: new or refurbished as CE 3.0? — exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. Resour. Conserv. Recycl. 135 (February 2017), 246–264. https://doi.org/10.1016/j.resconrec.2017.08.027.
Rezaei, Rohollah, Ghofranfarid, Marjan, 2018. Rural households' renewable energy usage intention in Iran: extending the unified theory of acceptance and use of technology. Renew. Energy 122, 382–391. https://doi.org/10.1016/j.renene.2018.02.011.
Shevchenko, Tetiana, Saidani, Michael, Ranjbari, Meisam, Kronenberg, Jakub, Danko, Yuriy, Laitala, Kirsi, 2023. Consumer behavior in the circular economy: developing a product-centric framework. J. Clean. Prod. 384 (January 2022), 135568. https://doi.org/10.1016/j.jclepro.2022.135568.
Stankevich, Alina, 2017. Explaining the consumer decision-making process: critical literature review. J. Int. Bus. Res. Market. 2 (6), 7–14. https://doi.org/10.18775/jibrm.1849-8558.2015.26.3001.
Sun, Ying, Luo, Biao, Wang, Shanyong, Fang, Wenpei, 2021. What you see is meaningful: does green advertising change the intentions of consumers to purchase eco-labeled products? Bus. Strat. Environ. 30 (1), 694–704. https://doi.org/10.1002/bse.2648.
Svensson-Hoglund, Sahra, Russell, Jennifer D., Richter, Jessik Luth, 2023. A process approach to product repair from the perspective of the individual. Circ. Econ. Sustain. 3 (3), 1327–1359.
Sweeneya, Jillian C., Soutarb, Geoffrey N., 2001. Consumer perceived value: the development of a multiple item scale. J. Retailing 77, 203–220. https://doi.org/10.1108/ITSE-06-2016-0017.
Tapaninaho, Riikka, Heikkinen, Anna, 2022. Value creation in circular economy business for sustainability: a stakeholder relationship perspective. Bus. Strat. Environ. 31 (6), 2728–2740.
Testa, Francesco, Iovino, Roberta, Iraldo, Fabio, 2020. The circular economy and consumer behaviour: the mediating role of information seeking in buying circular packaging. Bus. Strat. Environ. 29 (8), 3435–3448. https://doi.org/10.1002/bse.2587.
Vidal-Ayuso, Fàtima, Akhmedova, Anna, Jaca, Carmen, 2023. The circular economy and consumer behaviour: literature review and research directions. J. Clean. Prod. 418 (April). https://doi.org/10.1016/j.jclepro.2023.137824.
Waites, Stacie F., Stevens, Jennifer L., Hancock, Tyler, 2020. Signaling green: investigating signals of expertise and prosocial orientation to enhance consumer trust. J. Consum. Behav. 19 (6), 632–644. https://doi.org/10.1002/cb.1867.
Wang, Yacan, Zhu, Quan, Krikke, Harold, Hazen, Benjamin, 2020. How product and process knowledge enable consumer switching to remanufactured laptop computers in circular economy. Technol. Forecast. Soc. Change 161 (December 2019), 120275. https://doi.org/10.1016/j.techfore.2020.120275.
Watkins, Marley W., 2021. A step-by-step Guide to Exploratory Factor Analysis with SPSS. Routledge.
WorldBank, 2024. Population estimates and projections, 2024. https://databank.worldbank.org/Population/id/fdaa1724.
Zeithaml, Valarie A., Verleye, Katrien, Hatak, Isabella, Koller, Monika, Zauner, Alexander, 2020. Three decades of customer value research: paradigmatic roots and future research avenues. J. Serv. Res. 23 (4), 409–432. https://doi.org/10.1177/1094670520948134.
Zhang, Chong, 2021. e. HKUST SPD - INSTITUTIONAL REPOSITORY Signaling Quality with Return Insurance: Theory and Empirical Evidenc.