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Research Article

Exploring Consumers' Intention and Behavior in the Circular Economy: Evidence from Vietnam

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Abstract

This study aims to address the key gaps in understanding the factors influencing the intention–behavior relationship of consumers in the context of the circular economy (CE). Grounded in the theory of planned behavior (TPB), this research extends the framework by integrating social pressure, attitudes toward green consumption, and the availability of CE products as crucial components that shape intention and behavior. Data were collected from 603 Vietnamese consumers and analyzed using partial least squares structural equation modeling (PLS-SEM). The results confirm the core TPB constructs, with perceived behavioral control emerging as the most influential factor. Notably, attitude toward green consumption has a greater effect on intention than does attitude toward the CE does, whereas social pressure has a stronger direct effect on behavior than subjective norms do. This research establishes the validity of an extended TPB framework within the CE context of a developing economy, providing new evidence on the psychological and sociocultural factors that shape circular consumption behavior. Finally, this study offers insights for policy makers and businesses to develop strategies for promoting CE not only for Vietnam but also for other developing countries.

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Introduction

Environmental pollution is a major contributor to human diseases, increased morbidity and mortality, and adverse effects on public health and climate change (Ritchie and Roser, 2024). Many countries have shifted to sustainability-oriented models that balance economic growth, environmental protection, and social well-being (Thao et al., 2022). Among these, the circular economy (CE) model is regarded as an approach to achieve this goal (Chen and Kim, 2019). CE maximizes resource value by maintaining the use of products and materials (Nam et al., 2019) while contributing to addressing complex environmental challenges (Marchewka et al., 2025). However, the persistent existence of linear consumption models continues to hinder major CE transitions, posing significant challenges for organizations and nations (Arranz et al., 2023).

With respect to the success of this transition, consumers play an essential role in integrating the CE (Parajuly et al., 2020). However, consumer behavior is often strongly influenced by traditional factors such as product quality, price, and market availability, whereas environmental friendliness is often considered a secondary condition. This has created a substantial gap between environmental awareness and sustainable consumption behavior, preventing environmentally friendly intentions from transforming into actual purchasing decisions (White et al., 2019). Kirchherr et al. (2018) reported that cultural barriers are major obstacles to CE adoption. Therefore, changing consumer behavior through communication, education, and positive social pressure

(SP) is considered a necessary strategy for promoting sustainable development (Steg and Vlek, 2009).

Vietnam currently faces significant environmental challenges. According to World Bank estimates, water pollution could cost Vietnam up to 3.5% of its GDP by 2035, and climate change-related damage could reach 11% of GDP by 2030 (World Bank, 2019). To adapt, Vietnam has initiated a strong transition toward the CE to achieve a net-zero emissions target. However, the country still faces challenges related to institutions and infrastructure, as well as limitations in financial resources, technological capacity, and social awareness (Manh and Huyen, 2023).

Numerous studies have highlighted the gap between consumer perception and behavior in the CE. In some countries, such as China, Saudi Arabia, and Slovakia, consumers have a strong understanding of sustainable development, but awareness of the CE remains limited (Almulhim and Abubakar, 2021; Guo et al., 2017; Musova et al., 2021). These findings clearly reflect the gap between positive environmental attitudes and actual behavior, as evidenced by youth who, despite having positive environmental attitudes, do not frequently practice CE (Krajnc et al., 2022; Voukkali et al., 2023). A study by Silva & Ramos (2024) indicated that the main drivers of circular behavior are often financial benefits and transparency, whereas the greatest barriers lie in poor reputation and product quality. Furthermore, studies also report that social factors, such as group norms and expectations, strongly influence circular consumption behavior. Studies by Wang et al. (2019), Gonella et al. (2024), and Khan et al. (2020) have reported that SPs from communities, governments, and organizations affect the promotion of circular intention and. The impact of SP can be direct or indirect on consumer behavior supporting the CE (Alvarez-Risco et al., 2024; Singh et al., 2018).

However, the gap between intention and behavior often occurs because of various barriers, ranging from economic to psychological–social factors. Economically, high costs and price sensitivity cause consumers to hesitate to participate in a CE (da Silva and Ramos, 2024; Khan et al., 2020; Ungerman and Dědková, 2024; Kongarchapatara and Hanpanit, 2021; Morone et al., 2021; Zhidebekkyzy et al., 2022). Moreover, psychological–cultural factors indicate that entrenched consumption habits, a lack of trust in the quality of recycled products, and other psychological factors impede the transition (Ao et al., 2021; da Silva and Ramos, 2024; Gomes et al., 2022; Gonella et al., 2024; Huyen et al., 2025; Khan et al., 2020; Kirchherr et al., 2018; Tien and Ha, 2025; Wang et al., 2019). Infrastructure and market factors are related to limited access to collection and recycling points and an underdeveloped market for CE products, thus reducing consumption motivation (Ao et al., 2021; da Silva and Ramos, 2024; Gomes et al., 2022; Khan et al., 2020; Nhung and Thuy, 2024; Tuan et al., 2023). Specifically, the accessibility of services and the presence of CE products (PCP) are prerequisites that directly impact the relationship between intention and behavior (Gomes et al., 2022; Sharma et al., 2025; White et al., 2019).

In Vietnam, studies on the CE have shown a notable transition from macrolevel to microlevel approaches to consumer behavior. However, evidence on actual behavior remains limited, while cognitive, social, and institutional barriers continue to hinder this transition (Manh and Huyen, 2023; Trinh, 2022). Current research focuses on two directions: (1) studies based on the theory of planned behavior (TPB) and (2) studies on cognitive–affective processes and social context frameworks, among which TPB-based research still predominates (Thao et al., 2022; Dai, 2023; Ha, 2025; Huyen et al., 2025; My et al., 2023; Nhung and Thuy, 2024; Tien and Ha, 2025; Tuan et al., 2023; Vu and Can, 2024; Yen et al., 2025). However, these studies have shown inconsistencies between intention and behavior. For example, Ha et al. (2025) reported no significant effect of attitude (AT) or subjective norms (SN) on intention (Ha, 2025), whereas Vu and Can (2024) reported that perceived behavioral control (PBC) has no influence. This finding indicates that the traditional TPB model does not fully explain CE behavior in Vietnam. In addition, studies on social cognition also report important findings, confirming the gap between intention and actual CE behavior (Thu, 2024; Thuy et al., 2025). This gap is influenced by various other barriers, such as perceived health risks (Thu, 2024), limited community awareness, and limited financial support (Phuong and Nam, 2025). On the other hand, many studies have shown that attitudes toward green consumption (ATG) influence individuals (Buu and Khanh, 2024; He and Mai, 2021; Hoa, 2021), but it rarely leads to actual behavior in the absence of factors such as SP, institutional support, incentives, and PCP (He and Mai, 2021; Nhung and Thuy, 2024; Phuong and Nam, 2025; Thuy et al., 2025; Tien and Ha, 2025).

In summary, narrowing the consumer CE intention–behavior gap requires a comprehensive approach; although previous studies have addressed the role of sustainability awareness, environmental attitudes, SP, and barriers, they have not deeply explored the role of the PCP or the ATG. Therefore, in the context of the transition from a linear economy to a CE in developing countries, particularly in Vietnam, further in-depth research on PCP and ATG is needed to elucidate the gap between intention and behavior.

On the basis of the above overview, studies in Vietnam primarily rely on the traditional TPB (Hoa, 2021; Thao et al., 2022; Tuan et al., 2023; Vu and Can, 2024), but their actual behavior remains limited because of the influence of personal beliefs, knowledge, group

norms, and organizational support (Chowdhury et al., 2022; He and Mai, 2021). Studies have revealed two existing issues that need to be addressed within the review framework: (1) SP has not been fully researched, and (2) the role of ATG and PCP in circular intention and behavior has not been fully assessed, although these issues are mentioned in the context of sustainable product consumption (Cowan and Kinley, 2014; Esposito De Falco et al., 2021; Montalvo Corral, 2003; Singh et al., 2018).

To fill this gap, this study poses two questions: (1) What factors influence intention and behavior toward circular consumption? (2) How do SP, ATG, and PCP influence the process of transition from intention to actual CE consumption behavior? In terms of contributions, this study extends the TPB by integrating SP, ATG, and PCP while also proposing managerial implications to promote circular consumption.

Materials and methods

1) Theoretical foundation

The TPB model provides a basis for predicting intentional human behavior through the factors of AT, SN, and PBC (Ajzen, 1991; Ajzen and Fishbein, 2005; Thompson et al., 2012). In the context of the CE, the TPB model is considered a reliable theoretical framework (Kongarchapatara and Hanpanit, 2021; Hazen et al., 2017; Singhal et al., 2019); however, the relative influence of these constructs varies across different cultural contexts (Klein et al., 2019; Thao et al., 2022; Wang et al., 2019). In collectivist societies, the TPB framework has been expanded to reflect stronger social influences (Alvarez-Risco et al., 2021; Khan et al., 2020; Singh et al., 2018).

In the TPB model, SN refers to the degree to which a decision-maker is influenced by perceived behavioral norms within the organizational environment (Khan et al., 2020). Additionally, SN denotes an individual's belief that important reference groups—such as family, friends, or colleagues—expect them to approve and support a specific behavior (Ham et al., 2015). Thus, SN reflects interpersonal normative expectations derived from reference groups.

In contrast, SP refers to the perceived pressure to perform or refrain from performing a behavior (Ajzen, 1991) arising from cultural norms, collective expectations, and institutional or market-based signals that encourage individuals to conform to certain behaviors (Conner and Norman, 2005; Ham et al., 2015; Khan et al., 2020). In this study, SP is conceptualized primarily as a form of normative and institutional social pressure, reflecting expectations shaped by social norms and institutional discourses. Unlike SN, which focuses on expectations from proximal reference groups, SP represents a broader form of social influence operating at the societal level.

Here, SP is regarded as a higher-order construct that encompasses SN (Conner and Norman, 2005; Ham et al., 2015) and becomes more critical. SP arises from an individual's belief that referent others approve or disapprove of a specific behavior (Cialdini and Jacobson, 2021). Empirical studies have also demonstrated the influence of SP in specific contexts in India, Belgium, and Peru, revealing its positive impact on consumer behavior (Alvarez-Risco et al., 2021; Khan et al., 2020; Singh et al., 2018).

Therefore, directly integrating SP as an extended construct within the TPB model is necessary for its application in collectivist contexts. This extended approach acknowledges that in collectivist societies, behavioral decisions often reflect conformity to group norms rather than calculations of economic benefits (Cowan and Kinley, 2014; Ham et al., 2015). To fully explain the CE intention–behavior mechanism, recent extensions of the TPB have also incorporated constructs such as ATG and PCP.

2) Hypothesis development and research model

2.1) Hypothesis development

- Attitude toward the CE (AT)

AT shapes decision-making and reflects personal beliefs (Ajzen and Fishbein, 2000; Thao et al., 2022) while also promoting environmentally friendly choices (Kilbourne and Pickett, 2008; Paul et al., 2016). Therefore, a high level of environmental concern increases the likelihood of participation.

Hypothesis 1 (H1): AT positively influences intention (IP).

- Subjective norms (SN)

Unlike subjective norms, which capture expectations from close referent groups, social pressure reflects broader societal expectations and collective norms that encourage behavioral conformity within a community. SNs reflect an individual's perception on the basis of social expectations (Ajzen and Fishbein, 2005; Pastor et al., 2024; Venkatesh et al., 2000). Previous research has demonstrated that SNs tend to be more pronounced in collectivist cultural contexts (Ham et al., 2015; Hofmann and Müller, 2018; Wu and Chen, 2014).

Hypothesis 2 (H2): SN positively influences IP.

- Attitude toward green consumption (ATG)

ATG reflects an individual's attitude toward environmentally friendly products (Varela-Candamio et al., 2018), mediated by their perception of personal environmental responsibility (Karatu et al., 2015; Mostafa, 2009; Wu and Chen, 2014). Consequently, individuals with a more positive ATG are more likely to exhibit stronger intention.

Hypothesis 3 (H3): ATG positively influences IP in CE activities.

- Perceived behavioral control (PBC)

PBC reflects an individual's perceived capability and sense of control (Ajzen, 2002) and facilitates the conversion of intention into behavior in the context of sustainable consumption (Barbu et al., 2022; Thao et al., 2022).

Hypothesis 4 (H4): PBC positively influences IP.

Hypothesis 5 (H5): PBC positively influences CE behavior (IB).

- Social pressure (SP)

SP reflects perceived expectations from relevant social groups (Khan et al., 2020; Ye et al., 2024), with the goal of motivating individuals to undertake environmentally responsible actions (Gupta, 2021; Morone et al., 2021; Singh et al., 2018). Therefore, stronger SP is likely to increase individual participation in IB.

Hypothesis 6 (H6): SP positively influences IB in CE consumption activities.

- Presence of circular products (PCP)

PCP is considered a fundamental condition for promoting sustainable consumption (Weissmann and Hock, 2022). When products are easily accessible and visible, consumers are more likely to engage in behavior (Steinhart et al., 2013; Verma, 2020).

Hypothesis 7 (H7): PCP positively influences IB in circular consumption activities.

- Circular behavior (IB)

IP is a direct and strong predictor of IB (Ajzen, 1991). Individuals with stronger IP toward environmentally responsible actions are more likely to engage in CE-related activities (Khan et al., 2023; Masud et al., 2016).

Hypothesis 8 (H8): IP positively influences IB in CE.

2.2) Research model

The conceptual framework for this study is derived from the TPB model and builds upon the works of Singh et al. (2018), Khan et al. (2020), Alvarez-Risco et al. (2021), and Thao et al. (2022) to analyze consumer cognition and behavior in the CE context (Figure 1).

In this model, AT, SN, and PBC continue to serve as the three core determinants for predicting behavioral intention within the TPB structure. To address the gaps identified in prior studies, the model introduces three extended variables: SP, PCP, and ATG. Among these, SP and PCP are hypothesized to directly influence behavior, whereas ATG affects intention.

Finally, intention to participate (IP) functions as a mediating construct linking attitudinal and contextual factors with integrated behavior (IB), representing the transformation of intention into actual CE-related actions. Overall, the proposed model provides a comprehensive conceptual framework that extends the TPB to better explain and predict consumers' participation in CE behaviors in the Vietnamese context while also offering implications for applied research and policy initiatives aimed at promoting sustainable consumption.

3) Research design and sampling procedure

3.1) Survey population

The target population comprised Vietnamese consumers aged 18 years and older who have awareness of or experience with pro-environmental behaviors such as reusing products, using and purchasing environmentally friendly products, or reducing the use of unsustainable products. Prospective participants were screened using an initial question: Are you interested in the following pro-environmental behaviors: recycling, reusing products, buying eco-friendly products, and reducing the use of unsustainable products? Only respondents who answered "yes" were included in the main survey.

The screening procedure ensured that participants possessed a basic awareness of environmentally friendly circular-economy-related practices. However, it may have excluded consumers with low environmental engagement, which should be considered when the findings are interpreted.

3.2) Research sample

The sample size (n) is calculated as follows: n= N/[1+Ne2], where N is the total population and e^2 is the allowable error (e = 5%) (Yamane, 1973). According to the General Statistics Office of Vietnam in 2023, the average population of Vietnam is approximately 100.3 million people. Thus, the calculation is n=[100.3/(1+ 100.3*$(0.05)^2$] =399,998 ≈ 400. Therefore, a sample size of more than 450 was selected for analysis using the PLS-SEM.

3.3) Sampling method

This study employed a convenience sampling approach, which is a nonprobability sampling technique, owing to practical constraints in accessing participants who were widely dispersed across Vietnam.

To reduce potential sampling bias, respondents were recruited from diverse demographic groups, including those with variations in age, sex, education level, income, and occupation, and from Vietnam's three major geographic regions (North, Central, and South). Data were collected through multiple channels, combining online surveys conducted across all three regions and in-person surveys carried out in the southern region to increase the representativeness and diversity of the sample.

4) Management and instrument development

All the constructs were measured using five-point Likert-type scales ranging from 1 (strongly disagree) to 5 (strongly agree). The measurement items were adapted

from validated instruments used in prior peer-reviewed studies (Daniels, 2022; Gleim et al., 2013; Masud et al., 2016; Thao et al., 2022). The measurement structure was organized as follows: AT, SN, and ATG (Thao et al., 2022); PBC and IP (Masud et al., 2016); SP (Daniels, 2022); PCP (Gleim et al., 2013); and IB (Paço et al., 2019; Thao et al., 2022). These studies report Cronbach's alpha values above 0.70, supporting strong internal reliability and reducing the risk of measurement bias. The questionnaire was further refined through expert review by four academics from different universities and a pretest with eight consumers to ensure clarity and contextual suitability for Vietnam. Feedback confirmed the adequacy of the measurement items and the relevance of the proposed research model and hypotheses.

5) Data collection

Data were collected using a structured questionnaire administered through a dual-mode strategy that combined online distribution with direct, onsite surveys conducted at universities, hospitals, and residential communities. Data collection was carried out from July 2024 to February 2025. In total, 644 responses were obtained from consumers across the northern, central, and southern regions of Vietnam, ensuring geographic representativeness. Following the exclusion of 41 invalid responses due to failed attention checks or unusually short completion times, 603 valid questionnaires were retained for analysis, yielding an effective response rate of 93.63%.

6) Data analysis

The primary data were cleaned and coded using Microsoft Excel, SPSS 27, and SmartPLS 4 (Ringle et al., 2024). Data analysis included assessing reliability (Cronbach's alpha, composite reliability), confirmatory factor analysis (CFA), and structural equation modeling (SEM). Cronbach's alpha values ranging from 0.60–0.90 were considered acceptable to very good, and composite reliability (CR) thresholds of 0.60–0.80 were applied depending on the research purpose (Hair et al., 2022). In the CFA, convergent validity was evaluated using outer loadings (>0.70) and average variance extracted (AVE) (>0.50) (Henseler et al., 2009), whereas discriminant validity was established using heterotrait–monotrait (HTMT) (<0.90) (Guenther et al., 2023). Path coefficient significance was tested by bootstrapping (Henseler et al., 2015).

The PLS–SEM procedure followed that of Hair et al. (2022) and was implemented in five steps. First, multicollinearity was assessed using the VIF, where a VIF≤3.3 indicates no multicollinearity, 3.3–5.0 suggests potential issues, and values >5.0 indicate problematic multicollinearity (Kock, 2016). Second, path coefficients were evaluated, with positive and negative β values reflecting direct and inverse effects, respectively, and significance determined at $p < 0.05$ (Chin, 1998; Hair et al., 2022). Third, explanatory power was assessed using R^2 and adjusted R^2, while effect size (f^2 = 0.02, 0.15, 0.35) (Cohen, 1988) and model fit via SRMR (< 0.08) (Hair et al., 2017; Henseler et al., 2017) were examined. Fourth, the predictive power was tested using Q^2_predict, where values ≤0 denote poor predictive performance (Shmueli et al., 2019). Finally, model comparison employs the BIC and Akaike weights, selecting the model with the lowest BIC and highest weight (Danks et al., 2020; Hair et al., 2022).

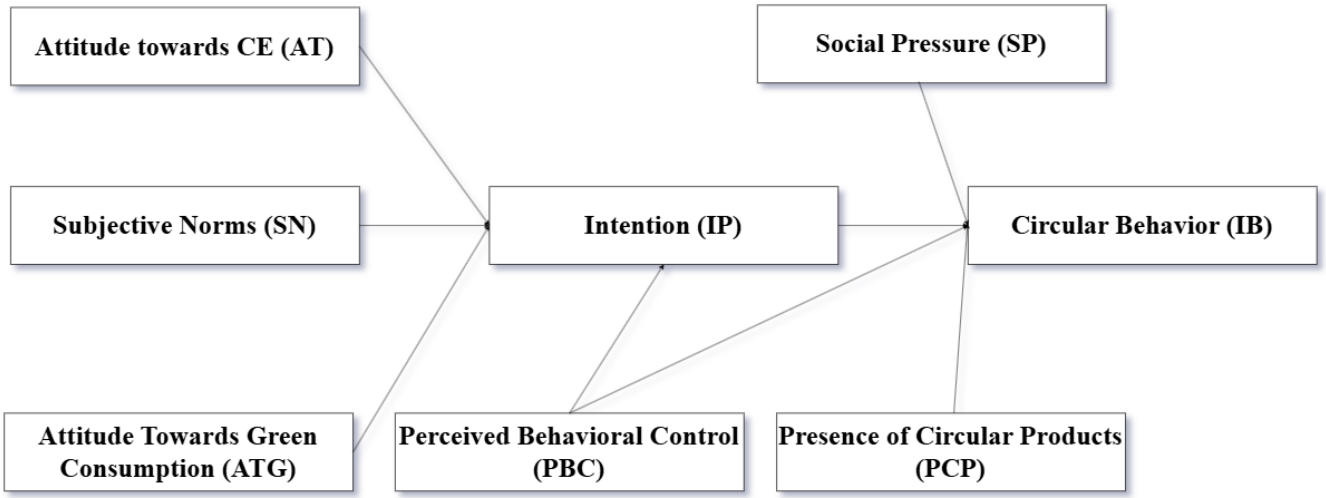


Figure 1 Research model.

Results and discussion

1) Demographic and backgrounds of the participants

A total of 603 individuals participated in the survey, including 375 females (62.2%) and 228 males (37.8%). The participants ranged in age from 18 to 70 years, with 476 (78.9%) aged 18–30 years, 120 (19.9%) aged 31–50 years, and 7 (1.2%) aged 51–70 years. This distribution indicates that the sample is heavily skewed toward younger respondents, which may limit the representativeness of the sample relative to the national population and should be considered when the generalizability of the findings is interpreted. With respect to education, 103 (17.1%) had completed high school, 9 (1.5%) held a college or vocational qualification, 404 (67.0%) had a university degree, and 87 (14.4%) held a postgraduate degree. In terms of geographic distribution, 447 (74.1%) were from the south, 114 (18.9%) were from the north, and 42 (7.0%) were from the central region.

2) Measurement model

With the use of the PLS–SEM technique, the values presented in Table 1 demonstrate high reliability and validity. The results show that all key indices exceeded the established thresholds (Hair et al., 2022; Henseler et al., 2009): all factor loadings (0.765–0.903); Cronbach's alpha (0.701–0.939); CR values (0.834–0.948); AVE > 0.50; and VIF (1.323–3.144). These results confirm the reliability and validity of the measurement model and its suitability for subsequent structural path analyses.

3) Evaluation of discriminant validity accuracy

To assess discriminant validity, the authors applied a threshold ≤ 0.90 for evaluating the pairs of constitutive factors in the model using the HTMT values (Guenther et al., 2023; Henseler et al., 2015). The results presented in Table 2 indicate that the HTMT values for all the factor pairs were lower than the permissible limit (0.345 to 0.893). This analysis provides evidence of satisfactory discriminant validity among all constitutive factors in the model. To assess robustness and ensure greater rigor, a bootstrapping procedure utilizing 5,000 resamples was performed. These results further reinforced the findings, as the upper bounds of all confidence intervals remained below the 0.9 threshold. This two-step analysis demonstrated that discriminant validity is fully established for all latent factors within the research model.

4) Structural model

4.1) Assessment of collinerity

To assess the VIF among the predictive constructs, the VIF was examined. On the basis of the results from the structural model evaluation presented in Table 1, all the VIF values were well below the conservative threshold of 5.0 (Kock, 2016), ranging from 1.323 to 3.144. This finding indicates that the model does not exhibit serious variance inflation factor (VIF) issues, ensuring that the path coefficient estimates are stable and reliable for the research model.

In addition, to examine the potential presence of common method bias (CMB), the study employed Harman's single-factor test. All observed variables were entered into an exploratory factor analysis without rotation. The results indicate that the first factor accounted for less than 50% of the total variance (32.53%), suggesting that common method bias is unlikely to pose a serious concern in this study.

Furthermore, following the full collinearity test proposed by Kock (2016), variance inflation factor (VIF) values were also examined to further assess the potential presence of common method bias. As all the VIF values were below the recommended threshold of 3.3, the results indicate that common method bias does not significantly threaten the validity of the study's findings.

4.2) Path coefficients

Using a bootstrapping procedure with 5,000 resamples, the significance of the path coefficients was assessed, with all hypothesized relationships found to be statistically significant and standardized beta (β) coefficients ranging from 0.079 to 0.440. Specifically, SP was positively associated with IB, whereas SN was significantly associated with IP. PBC remained a strong predictor, showing positive relationships with both IB and IP. ATG was positively related to IP, whereas AT showed a weaker relationship with IP. PCP showed a positive but modest association with IB. Notably, IP emerged as the strongest predictor of IB. These findings highlight the central role of behavioral intention and the varying predictive strengths of the antecedent variables within the CE context.

4.3) Coefficient of determination (R^2, R^2adj) and effective size (f^2)

The results in Table 4 present the R^2 and adjusted R^2 values of the endogenous constructs. The model explains 75.1% of the variance in IB and 56.2% of the variance in IP, indicating substantial explanatory power. The adjusted R^2 values (IB: 0.749; IP: 0.559) are only slightly lower than the corresponding R^2 values, suggesting that the model is not substantially affected by the number of predictors. However, these relatively high explanatory values should be interpreted with caution. The use of convenience sampling and the screening of respondents on the basis of environmental concern may introduce self-selection bias toward environmentally aware consumers. In addition, the sample is heavily skewed toward younger respondents, which may partly strengthen the observed intention–behavior relationship and contribute to the relatively high R^2 values.

Table 1 Reliability and validity statistics for measurement constructs

Item code	α	CR	AVE	VIF	Outer loading
Attitude (AT)					
AT1	0.832	0.899	0.749	2.053	0.879
AT2				1.882	0.865
AT3				1.855	0.852
Subjective norms (SN)					
SN1	0.791	0.877	0.705	1.671	0.842
SN2				1.619	0.769
SN3				2.211	0.903
Perceived behavioral control (PBC)					
PBC1	0.767	0.866	0.683	1.743	0.825
PBC2				1.372	0.787
PBC3				1.851	0.866
Attitude toward green consumption (ATG)					
ATG1	0.791	0.865	0.615	1.553	0.765
ATG2				1.791	0.782
ATG3				1.846	0.810
ATG4				1.533	0.778
Social pressure (SP)					
SP1	0.701	0.834	0.626	1.358	0.780
SP2				1.323	0.793
SP3				1.447	0.800
Presence of CE products (PCP)					
PCP1	0.782	0.873	0.696	1.653	0.828
PCP2				1.801	0.850
PCP3				1.514	0.825
Intention (IP)					
IP1	0.882	0.914	0.681	2.507	0.864
IP2				1.836	0.785
IP3				1.814	0.780
IP4				2.436	0.858
IP5				2.214	0.833
Behavior (IB)					
IB1	0.939	0.948	0.671	2.919	0.820
IB2				2.894	0.813
IB3				2.450	0.825
IB4				2.261	0.789
IB5				2.545	0.815
IB6				3.144	0.855
IB7				2.699	0.825
IB8				2.806	0.831
IB9				2.370	0.799

Table 2 Heterotrait–monotrait ratio (HTMT)–Matrix in PLS–SEM

Indicators	SP	SN	IB	PBC	PCP	AT	ATG	IP
SP								
SN	0.640							
IB	0.849	0.693						
PBC	0.785	0.683	0.863					
PCP	0.547	0.609	0.576	0.578				
AT	0.709	0.483	0.629	0.672	0.345			
ATG	0.893	0.577	0.834	0.805	0.445	0.621		
IP	0.755	0.668	0.877	0.825	0.540	0.591	0.710	

Table 3 Significance testing results of the total effects

Indicators	*β*	*p* values
SP>IB	0.250	0.000
SN>IP	0.224	0.000
PBC>IB	0.254	0.000
PBC>IP	0.376	0.000
PCP>IB	0.079	0.001
AT>IP	0.119	0.001
ATG>IP	0.197	0.000
IP>IB	0.440	0.000

Table 4 Results of R^2 and R^2_{adj}

Indicators	R^2	R^2_{adj}
IB	0.751	0.749
IP	0.562	0.559

Table 5 Results of f^2 effect sizes

Indicators	f^2	Explant
SP>IB	0.145	Low explanatory power
SN>IP	0.077	Low explanatory power
PBC>IB	0.123	Low explanatory power
PBC>IP	0.158	Moderate explanatory power
PCP>IB	0.019	Very low explanatory power
AT>IP	0.021	Low explanatory power
ATG>IP	0.049	Low explanatory power
IP>IB	0.356	High explanatory power

Table 5 presents the effect size values (f^2) for the relationships within the structural model of the proposed research framework. In accordance with widely accepted classification thresholds, 0.02 = small; 0.15 = medium; and 0.35 = large (Cohen, 1988), the effect sizes range from 0.019 to 0.356. The path from IP → IB has a large effect size (f^2 = 0.356), indicating that IP provides the strongest practical contribution in explaining consumers' CE behavior.

The relationship PBC → IP has a medium effect size (f^2 = 0.158), whereas SP → IB and PBC → IB have small effect sizes. In contrast, the relationship PCP → IB has a very small effect size (f^2 = 0.019), suggesting that although this relationship is statistically significant, its practical explanatory contribution is limited within the context of the research data. Overall, these findings underscore the importance of distinguishing between statistical significance and practical significance when structural models are interpreted.

4.4) Assessment of measurement model fit

The fit of the measurement model was assessed using two primary criteria: the communality index and the SRMR. First, the communality index was used to evaluate the degree to which the measurement model fit the structural model and was represented by the AVE (Table 1). In the PLS–SEM framework, an AVE value greater than 0.50 is considered acceptable, indicating that more than 50% of the variance in the indicators is captured by the latent construct. Furthermore, the overall model fit was examined using the SRMR. The SRMR value of 0.059 was below the recommended threshold of 0.08 (Hair et al., 2017), indicating a good fit between the model and the observed data. Overall, these results confirm that the measurement model exhibits satisfactory convergent validity and an acceptable level of fit.

4.5) Out-of-sample predictive power and model comparison

- *Predictive power assessment*

The PLSpredict results show that all the Q^2_predict values are positive, ranging from 0.281 to 0.514, confirming the predictive relevance of the model (Hair et al., 2022). In terms of prediction error, the RMSE values of the PLS-SEM range from 0.569 to 0.695 for the IB group and from 0.433 to 0.615 for the IP group; these values are comparable to those of the linear model (LM), which range from 0.574 to 0.667 (IB) and 0.436 to 0.613 (IP), respectively. Compared with LM, PLS-SEM yields lower RMSE values for several indicators, such as IB1, IB2, and IP1, whereas LM produces more accurate predictions for other indicators, including IB5 and IB8. Overall, the PLS-SEM demonstrates moderate predictive power, whereas the LM model performs better in certain cases.

- *Model comparison*

The model estimation results indicate that Model 1 has the lowest BIC value (-806.519) and the

highest Akaike weight (35.14%). On the basis of both the BIC criterion and the Akaike weights, Model 1 is considered the best-fitting and most parsimonious model among those evaluated and is therefore selected as the optimal model for this study.

5) Results of hypothesis testing and discussion

All the hypotheses in the research model were supported at the 95% confidence level ($p < 0.05$) when the bootstrapping method was used (Table 9).

5.1) The dominance of ATG (H1, H3)

H1: AT→IP: β=0.119, t=3.202, p=0.001, supporting H1.

H3: ATG→IP: β=0.197, t=4.593, p<0.001, supporting H3.

The analysis reveals a clear hierarchy among the factors influencing behavioral intention. Notably, the specific attitude toward the CE (H1) has only a modest effect, which is considerably weaker than that reported in previous studies conducted in other contexts (Khan et al., 2023; Kongarchapatara and Hanpanit, 2021). These findings suggest that in the early implementation stage of the CE in Vietnam, consumers may not yet have a deep understanding or clear evaluation of CE-related concepts. Instead, their primary motivation appears to stem from a general pro-environmental orientation, as reflected in the stronger coefficient of green consumption attitudes (H3). The lower β of H1 and the higher β of H3 together imply that, at this stage, communication messages emphasizing broad, easily comprehensible environmental benefits are likely to be more effective than those focusing on the complex principles of the CE.

5.2) The predominant influence of SN (H2)

H2: SN→IP: β=0.224, t=5.499, p<0.001→ supported.

SN is the strongest predictor of intention, surpassing individual attitudes. These results sharply contrast with those of previous studies (Khan et al., 2023: β = 0.099, p = 0.121; Thao et al., 2022: β = −0.058, p = 0.212), thereby emphasizing the cultural distinctiveness of the Vietnamese context. In a society that values collectivism, social relationships and community harmony play crucial roles. Expectations from family, friends, and CE-practicing groups appear to be strongly associated with behavioral intention, suggesting that social expectations may play an important role in shaping consumers' intentions (Khan et al., 2023; Thao et al., 2022).

5.3) PBC as a foundation construct (H4, H5)

H4: PBC→IP: β=0.376, t =7.199, p<0.00→supported.

H5: PBC →IB: β=0.254, t=7.393, p<0.001→supported.

As hypothesized, PBC emerges as an important predictor within the TPB framework in this study. Its strong influence on both intention (H4) and direct impact on behavior (H5) suggest that consumers may be more likely to participate in a CE when they perceive sufficient capability and resources, are adequately resourced, and face minimal barriers to action. These findings align with those of previous studies by Alvarez-Risco et al. (2021) (H4) and Khan et al. (2023) (H4; H5), reaffirming the importance of strengthening consumers' perceived self-efficacy in terms of CE promotion strategies.

Table 7 Ranges of Q²_predict and RMSE by construct groups

Group	Q²_predict	RMSE_PLS	RMSE_LM
IB (IB1-IB9)	0.417 - 0.514	0.569 - 0.695	0.574 - 0.667
IP (IP1-IP5)	0.281 - 0.446	0.433 - 0.615	0.436 - 0.613
All	0.281 - 0.514	0.433 - 0.695	0.436 - 0.667

Table 8 BIC and Akaike values

	Model 1	Model 2	Model 3	Model 4	Model 5
BIC	-806.519	-806.514	-796.196	-732.117	-806.176
Akaike weights	35.14%	35.05%	0.20%	2.45×10^{-15} %	29.60%

Table 9 Hypothesis testing results

Hypothesis		*β*	*p* values	Results
AT→IP	H1	0.119	0.001	Accepted
SN→IP	H2	0.224	< 0.001	Accepted
ATG→IP	H3	0.197	< 0.001	Accepted
PBC→IP	H4	0.376	< 0.001	Accepted
PBC →IB	H5	0.254	< 0.001	Accepted
PCP → IB	H6	0.079	0.001	Accepted
SP → IB	H7	0.250	< 0.001	Accepted
IP → IB	H8	0.440	< 0.001	Accepted

5.4) The IB bridge and the roil of the SP (H7, H8)

H7: SP → IB: β=0.250, t=7.447, p<0.001→supported.

H8: IP → IB: β=0.440, t=14.177, p<0.001→supported.

The relationship between intention and behavior (H8) in this study is stronger than that reported in some previous works (e.g., Khan et al., 2023), indicating that once Vietnamese consumers report stronger intentions, they also tend to report higher levels of corresponding behavior. The strength of this association may be related to the role of SP within the Vietnamese social context. (H7). The higher β value than that reported by Risco et al. (2021) (β=0.162, p=0.047) in Peru suggests that in Vietnam's tightly knit social environment, community networks and social norms may facilitate the alignment between consumers' intentions and their reported behaviors, reinforcing prevailing social norms (Alvarez-Risco et al., 2021). These findings differ from those of Daniel (2022), who reported no significant influence of SP on consumer behavior. This discrepancy may stem from contextual, cultural, or methodological differences across study settings (Daniels, 2022).

5.5) Implications of the limited effect of PCP (H6)

H6: PCP → IB: β=0.079, t=3.254, p=0.001→supported.

Contrary to common assumptions, product availability shows only a modest association with behavior. These results imply that, at present, supply-side constraints may not represent the most influential factor associated with CE consumption in this sample on CE consumption in Vietnam. Instead, demand-side factors—particularly social and individual motivations discussed earlier—serve as more decisive drivers. This suggests a policy shift: rather than overemphasizing supply expansion, greater attention should be given to stimulating demand and fostering intrinsic consumer motivation. Nevertheless, these results align with the findings of Gleim et al. (2013) regarding product availability, which demonstrated strong reliability.

In addition, Sharma et al. (2025) reported that product availability can enhance consumers' perceived behavioral control and autonomy in decision-making. Thus, the relatively small effect size observed here implies that compared with interventions focusing solely on the supply side of CE products, demand-oriented policies may generate more substantial practical impacts.

Overall, the results of this study provide empirical support for the extended TPB model, with explanatory power values of 56.2% (IP) and 75.1% (IB). This model not only reinforces the robustness of the foundational theoretical framework but also offers insights into context-specific relationships related to the pursuit of sustainable development. Specifically, the research presents two main contributions: (1) it provides empirical evidence for ATG's superiority over AT, and (2) it highlights the pivotal role of sociocultural factors (SP, PCP) in predicting and promoting IB.

The results indicate that in a collectivist environment such as Vietnam, social influence mechanisms play a particularly important role in shaping circular economy consumption intentions and behaviors. From a theoretical perspective, this suggests that collectivist culture may function as a boundary condition of the TPB, amplifying the role of social influence factors relative to individual cognitive evaluations. Furthermore, the study distinguishes between SN and SP as two distinct forms of social influence. While SN reflects expectations from specific reference groups, SP represents broader social pressures stemming from community norms. In the research model, SP is conceptualized as a parallel predictor of behavior, enabling an extended TPB to more comprehensively capture the social influence mechanisms within the CE context.

Conclusions

This study successfully developed and validated an extended TPB framework within the CE context of Vietnam. The model demonstrates strong predictive ability, explaining 56.2% of the variance in behavioral intention and 75.1% of the variance in actual sustainable consumption behavior. These findings provide empirical evidence supporting the relevance of the core TPB construct, while specifically indicating that compared with AT, SP has stronger effects on IB and SN and that SP has a more substantial effect on IB than does PCP.

Theoretically, this research enhances the model's predictive applicability to sustainable consumption and provides empirical evidence from a developing economy, highlighting the mediating role of collectivist culture. The study also provides a validated measurement scale for consumption behavior in the context of the CE. With respect to managerial implications, the findings indicate that policymakers should focus on consumer groups by enhancing communication, education, and community campaigns. Enterprises should leverage social influence through community-based marketing initiatives, collaborate with social organizations, and facilitate the intention–behavior transition by ensuring the PCP.

Although this study makes certain contributions, several limitations should be acknowledged. The use of convenience sampling and the screening of respondents on the basis of their environmental concern may introduce sampling bias toward consumers who already possess ecological awareness. This may increase the reported levels of pro-environmental intentions and behaviors, as well as the explanatory power of the model. Therefore, the findings should be generalized primarily to environmentally aware consumers rather than to the entire population. Future research should employ more representative sampling strategies to test the model across broader consumer groups.

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Data availability statement

Information and data used in the study will be disclosed upon request.

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Conflicts of interest

The authors declare that there are no conflicts of interest in competing financial or personal relationships that could have appeared to influence the work reported in this work.

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