Circular Economy and Sustainability
https://doi.org/10.1007/s43615-024-00429-8

ORIGINAL PAPER

Predicting the Determinants of Generation Z's Readiness to Adopt Circular Economy for Plastics in Vietnam

Hong Thi Thu Nguyen[1]

Received: 12 June 2024 / Accepted: 30 August 2024

Abstract
To address the crisis of plastic waste (PW) pollution, the shift from a linear economy to a circular economy is emerging as a promising alternative. However, applying the circular economy for plastics (CEP) is challenging, especially in developing countries like Vietnam. It requires the effort and consensus of all stakeholders, with consumers playing a crucial role in the success of CEP. Therefore, this research seeks to delve into the three main predictors introduced in the Capability-Opportunity-Motivation-Behaviour model that influence the readiness to adopt CEP practices through PW reuse and recycling among Generation Z (Gen Z), a future generation essential in driving the transition towards CEP. Applying multiple logistic regression to analyze data collected from 632 respondents in Vietnam aged between 18 and 26 years old, the findings reveal that all three components, including capability, opportunity, and motivation, significantly positively influence Gen Z consumers' readiness to reuse and recycle PW. Among these components, opportunity (legislation and economic benefits) emerges as the most influential factor in individuals' preparedness for CEP engagement, surpassing both capability (task knowledge and skills) and motivation (attitude and moral norms). Additionally, the impact of respondents' age was significant, with those aged between 21 and 26 being 90% more ready to engage in CEP practices compared to those aged between 18 and 20. The findings of this research offer guidance for the development of suitable policies, programs, and activities aimed at educating young people to mitigate PW in Vietnam and other countries as well.

Keywords Circular plastic economy · COM-B · Generation Z's readiness · Logistic regression · Plastic waste recycling · Plastic waste reusing

✉ Hong Thi Thu Nguyen
ntthong@ued.udn.vn; hongbkes@gmail.com

[1] The University of Danang - University of Science and Education, No.54 Le Duan Road, Danang 550000, Vietnam

Published online: 06 September 2024

Introduction

Plastics have become essential in all facets of contemporary life, applied in numerous areas ranging from packaging and household goods to construction and the automotive industry [1, 2]. However, the current linear model of plastic production and consumption, known as "take, make, use, and dispose" model, is driving a significant rise in the use of natural resources and the accumulation of plastic waste (PW) globally. This trend poses a serious threat to environmental sustainability, economic growth, and human well-being [3, 4]. On one hand, evidence indicates that greenhouse gas emissions are generated at each phase of the plastic life cycle, from raw material extraction and transportation to plastic manufacturing, waste treatment, and eventual release into the environment [5]. Notably, traditional plastic production relies heavily on virgin materials, primarily natural gas and oil, which are the main sources of the substantial increase in greenhouse gas emissions and the worsening of climate change [4]. On the other hand, annual global plastic production has exploded since 1950s, reaching to an astonishing 400.3 million metric tons in 2022 [6], resulting in an escalation of PW generation. It is predicted that by 2050 there will be about 12 billion tonnes of PW in landfills and the natural environment, significantly impacting global oceans, freshwater systems, terrestrial biodiversity, and public health [7–9].

In deed, plastics are difficult to decompose naturally and can take over a thousand years to degrade compared to other wastes. As a result, they have accumulated on land, in freshwater, and in oceans for many decades [5, 10]. The ocean serves as the final destination for a significant amount of plastic, with plastics being present throughout various parts of the ocean. Most plastic residues in coastal areas, on the surface, in the deep sea, and in polar sea ice carry harmful species such as viruses, algae, and microbial communities, ultimately disrupting ecosystems and altering genetic diversity [11]. Adverse environmental impacts of plastic pollution occur at multiple levels from molecular and biochemical to population and ecosystem. Especially, macro- and microplastic particles have been detected in hundreds of marine species across all major taxa, including those consumed by humans [12]. In the coastal areas of Asia alone, with approximately 14 million tons of plastic enter the ocean each year, it is estimated that 700 species of aquatic life have been affected by the harmful impact of plastic pollution over the years [13]. Focusing on Southeast Asia, the impact of plastic pollution is evident both on land and in the ocean in countries such as Indonesia, Thailand, Vietnam, the Philippines, and Malaysia, which are the top producers of large PW [14, 15]. In Vietnam, for instance, PW can be seen in cities, at sea, in rivers, and in rice fields, and its influx is progressively harming ecosystem life [16]. For example, in the Mekong Delta, known as the rice bowl of Vietnam, significant amounts of toxic PW from bottles, pesticides, herbicides, and chemical fertilizers are contaminating the environment. In marine areas, estimates suggest that by 2050, the weight of PW in the oceans will exceed the mass of fish [17]. Also, plastic ingestion (ranging from macro- to microplastic) has been documented in bivalves [18].

Although PW has caused several numerous negative impacts, only 28% is currently recycled (9%) or incinerated (19%), while the remaining 72% finds its way into landfills or the environment, according to a 2022 report from the Organisation for Economic Cooperation and Development (OECD) [19]. In developing countries, the situation become even more serious, as evidenced by statistics showing 12 out of the top 20 countries with the highest rates of mismanaged PW fall into the categories of low-income or lower-middle-

income economies [20]. Take Vietnam as an example, the total amount of plastics inadequately managed in Vietnam is projected to increase to 3.15 million tonnes by 2030, up from 1.53 million tonnes in 2018 [21]. The nation ranks among the top five contributors to marine plastic pollution and the top twenty generators of PW [22], with merely approximately 10% of the overall PW being recovered through recycling or reuse [21].

In efforts to shift society away from the "take, make, use, and dispose" mindset, the circular economy (CE) approach has arisen as an alternative, which is closely associated with concepts like "cradle-to-cradle", "closed-loop supply chains", "regenerative design", "blue economy", "industrial ecology", "reverse logistics", "performance-based economy", "natural capitalism", and "biomimicry" [23, 24]. It provides a pathway to more sustainable resource management by concentrating on optimizing material and energy cycles [2, 25]. This approach focuses on minimizing the extraction of natural resources and maximizing the use of resources for as long as possible by boosting reusing and recycling efforts, promoting markets for recycled materials to extend the lifecycle of products [3]. When applied to plastic management, CE solutions involve moving to a model that prevents plastics from becoming waste while also fostering economic opportunities [2]. It shows promise as an effective approach for addressing plastic pollution and reducing the costs associated with plastic production [26]. Regarding making plastic consumption and production systems more circular, CE for plastics (CEP) prioritizes using PW as a resource and encouraging reusing and recycling. These efforts play a crucial role in promoting sustainability and aid in achieving multiple Sustainable Development Goals (SDGs), such as SDG 12, which aims to "Ensure sustainable consumption and production patterns" or SDG 14, which aims to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" [4, 7, 25]. In the case of Vietnam, CEP is regarded as crucial in facilitating a shift towards low-carbon green growth, meeting SDGs, and fulfilling international commitments. Expanding upon the initiation of the National Plastic Action Partnership and other actions to reduce plastic pollution, this nation's ambition is implementing the CEP as a solution to the current issue of PW pollution, aims to decrease Vietnam's marine plastic debris by 75% by 2030 [27]. The shift to a CEP reflects the determination of Vietnam and other countries to address the issues of environmental pollution and climate change, while also strengthening the economy's capacity and competitiveness [28].

However, transitioning to a CEP not straightforward and demands effort and consensus from all sectors of society, including government, plastic producers, and especially consumers [7]. While securing commitment from government and industry is crucial for addressing the plastics issue, the public also plays a vital role in promoting circularity because their disposal actions determine the effective reuse and recycling of plastics [26, 29–31]. In other words, the effectiveness of circular initiatives must be economically and technically feasible, alongside social acceptance, which is influenced by consumers' inclinations and willingness to align with the objectives of the CEP [26, 32, 33]. Thus, recent studies have started to emphasize the importance of consumer involvement in advancing circular practices. They have identified that internal factors such as values and personal norms, external factors like the physical environment, and situational factors such as time and cost, can greatly influence recycling behaviour within specific contexts [34–40].

Behavioural theories, such as the theory of planned behaviour [41], the norm activation model [42], and the value-belief-norm theory [43], are most widely employed to investigate the factors influencing consumers' pro-environmental intentions and behaviours

[34]. Nevertheless, these theories predominantly focus on consumers' motivation to act, as reflected in behavioural intentions, while it's equally crucial to consider consumers' ability and opportunity to engage in most behaviours [44]. Therefore, there is a need to investigate the factors influencing sustainable consumer behavioural intentions, considering three key aspects: capability, opportunity, and motivation, as proposed in the Capability-Opportunity-Motivation-Behaviour (COM-B) model [45–47]. In particular, within the context of CEP practices, there are few studies that investigate how capability, opportunity, and motivation influence consumers' readiness for PW reusing and recycling. Moreover, few studies have conducted simultaneous assessments of socio-demographic and other predictors; therefore, comprehensive examination is required to gain a thorough understanding of consumers' perspectives, along with providing adequate explanations for predictor influences [9]. Furthermore, in the extensive review of CE initiatives centered on plastics over the past several years, it is noted that publications in this domain are experiencing rapid growth, with a significant portion of the literature originating from Europe and America [48], while comprehension of involvement with the CEP in developing nations remains unrecorded [7]. For instance, there is a lack of research focused on Vietnam concerning the CEP while it is evident that Vietnam's shift to a CEP cannot thrive without consumers' readiness to engage in CEP activities [9, 27, 28].

To fill the gaps in the literature concerning consumers' perceptions towards CEP, this research seeks to predict the determinants of consumers' readiness to engage in CEP practices in the context of Vietnam by utilizing the COM-B model and employing logistic regression as the analytical method. To be specific, the main objective of the current study is to explore the influence of capability (task knowledge and skills), opportunity (legislation and economic benefits), and motivation (attitude and moral norms) on consumers' readiness for a CE through recycling and reusing PW. As reusing and recycling discarded plastics multiple times for various purposes are important strategies in the CEP, understanding factors influencing consumers' engagement in these practices is crucial. While "personal attitude and moral norms" and "task knowledge and skills" mainly refer to individual variables, the "legislation and economic opportunity" effectively illustrates the impact of situational variables on consumers' readiness for both reuse and recycling practices. Additionally, the effect of consumers' gender and age is also evaluated, in which comprehensive examination is conducted to gain a thorough understanding of Vietnamese consumers' perspectives into CEP. This study provides a theoretical classification of key influential factors related to consumers' readiness for CEP, offering references for empirical investigations in this field and insightful forecasts for future trends in plastic circularity. Moreover, gaining valuable insights into consumers' readiness for a CE through recycling and reusing PW can greatly aid managers in crafting strategies that effectively promote sustainable development and CEP in Vietnam and other countries.

Research Model Development

Introduction of COM-B Model

The COM-B model, developed by Michie et al. [45], is an extensive framework used to explore the factors that impact behavior, which can then be targeted to design effective

behaviour change interventions. This model is considered a guide to understand why a particular behaviour is adopted or reject, and how behavioural targets can be identified and utilized as central points for interventions. The COM-B model also serves as the foundation for a comprehenisve system of behaviours known as the Behaviour Change Wheel [49], which consists of three influential components, namely capability, opportunity, and motivation, being capable of changing behaviour. These components interact with behaviour and influence each other. COM-B model indicates that for an individual to participate in a specific behaviour, they must have the physical and/ or psychological capability to take social and/ or physical opportunities through reflective and/ or automatic motivation.

In the COM-B model, capability refers to an individual's psychological and physical ability to engage in the relevant behaviour, which is associated with behaviour directly and indirectly through the mediator of motivation. Physical capability specifies to whether an individual has the required knowledge and skills needed to implement the desired behaviour. Psychological capability relates an individual's ability to launch the necessary cognitive processes, understanding, and reasoning to carry out the desired behaviour [45]. Opportunity, another component within the COM-B model is defined as all the external factors that enable or trigger a behaviour, including physical and social influences. Its association with behaviour is both direct and indirect, mediated by the influence of motivation [45, 50]. Physical opportunity comes from the built environment, while social opportunity roots from the cultural context, shaping individuals' perceptions and thoughts [45]. Motivation refers to all cognitive processes, both conscious and unconscious, that drive and guide behaviour, extending beyond simply goals and conscious decision-making. It is directly linked to behaviour and is suggested to mediate the connections between capability, opportunity, and behaviour. In COM-B model, a differentiation is drawn between reflective motivational processes, involving evaluations and plans, and automatic motivational processes, relating to emotions and impulses [45]. Past research has shown motivation to be associated with behaviour in a range of contexts [37, 50, 51].

Research Framework Development

The COM-B model has been successfully applied to comprehend impacts on variety of environmentally-relevant behaviours [50, 52, 53] covering plastic disposal and purchase behaviours specifically [37, 47, 51, 54]. Applied within the context of CEP in Vietnam, this present study adopts three broad categories of the COM-B model, including capability, motivation, and opportunity, to predict the consumers' readiness to engage in PW reusing and recycling practices.

Based on a meta-analysis focusing on determinants of PW avoidance and recycling behaviour, cited in Allison et al. [47] and Fogt-Jacobsen et al. [37], it is reported that capability showed a relationship with behaviours associated with PW. Specifically, task knowledge of correct disposal [55] and skills how to sort waste for recycling [56], categorized as physical capability, were proved to be independently correlated with behaviours. This can be explained by the fact that individuals make decisions using a think-absorb-eject mechanism, which involves integrating information particles from their environment [57, 58]. This idea roots from the mindsponge theory, first introduced by Vuong and Napier [59], which is a novel concept related to information processing in the human mind, proposing that the way human minds handle information is closely linked to principles found in nature

[60, 61]. Applying the mindsponge theory to explain environmental behavior, readiness for CEP can be seen as a result of consumers' mental processes, influenced by information gradually absorbed over time. This aligns with a previous study conducted in Vietnam, which suggested that knowledge of the CE can be absorbed and processed in the human mind, leading young adults to be more likely to engage in pro-environmental practices such as waste sorting [57].

Regarding opportunity, it is viewed as both a barrier and a facilitator of behaviours related to PW [37, 47]. Past research indicates that the role of opportunity in directly influencing behaviour varies. For example, it has been recognized that laws and policies, categorized as physical opportunity, play a significant role in shaping plastic recycling, as proper recycling policies have the potential to mitigate substantial waste accumulation and address waste management issues [62, 63]. Another study discovered that the introduction of a ban on disposable plastic bags resulted in a decrease in the overall quantity of disposable bags used [64]. Therefore, the absence of supportive and codified regulations to curb the production, supply, distribution, and waste management of single-use plastics has been identified as a barrier to reducing PW [65]. In contrast, Camacho-Otero et al. [66] reported that issues concerning the legal implications of transactions and agreements can negatively influence the adoption of circular garments. Furthermore, Macintosh et al. [67] investigated the impact of the ban on certain types of plastic bags and found a relatively small net effect or in the research of Van et al. [68], there was an insignificant relationship between laws and regulations and residents' single-use plastic reducing behavioural intention. Physical opportunity supporting circular strategies also includes charges on plastics. Recent studies have proved that plastic taxation positively impacts consumer behaviour, deterring people from purchasing and using plastic bags, thereby reducing PW [69–71]. Similarly, the implementation of a plastic bag charge has proven effective in encouraging consumers to reuse bags and improve their waste separation [72, 73].

In terms of motivation, reflective motivation is perceived to be linked to behaviours related to PW [37, 47]. It consists of a wide range of beliefs, which covers considerations of attitudes and personal moral norms. For example, positive attitudes towards recycling were linked with future recycling behaviours [74–76]. Similarly, favorable attitudes towards PW management behaviours were likewise linked to higher possibility of reusing and reselling plastic items [75] while unfavorable attitudes towards recyclable items and reusable carrier bags were associated to increased consumption of single-use plastic [65]. Moreover, a sense of obligation based on the individual's personal values, so-called moral norms, were indicated to be associated with reducing the use of plastic packaging [77], waste separation [78] and recycling [74]. Nevertheless, moral norms were reported to have an insignificant effect on return or recycling intention in the study of Khan et al. [79]. In addition, findings from research in Vietnam indicated that young adults who are concerned with environmental protection are more likely to engage in pro-environmental practices such as waste sorting [57]. This can be explained by the concept of the mindsponge mechanism, which provides an intriguing perspective on the cognitive processes that underlie the formation of pro-environmental intentions [57, 58].

Along with the three components proposed in the COM-B model, gender and age, being among the important demographic predictors, have been presented to impact consumers' environmentally relevant behaviours [9, 80]. For example, in the project conducted in India, it was reported that the participation of women and youth contributed to the success of waste

collection and the reuse of recycled materials activities [7]. Similarly, literature has found that females tend to have significantly more favorable intentions to reduce the use of plastic compared to males [81, 82]. However, in research on solid waste recycling behaviour, it was discovered that Saudi Arabian men and the older age group exhibited significantly better pro-environmental behaviour compared to women and the younger group [80].

Based on these observations, the current study investigates the impact of capability (task knowledge and skills), opportunity (legislation and economic benefits), and motivation (attitude and moral norms) on consumers' readiness for CEP practices in the context of Vietnam. Additionally, the effect of consumers' gender and age is also evaluated, in which comprehensive examination is conducted to gain a thorough understanding of Vietnamese consumers' perspectives into CEP through PW reusing and recycling, along with providing adequate explanations for predictor influences. Research model of this study is illustrated in Fig. 1.

Methodology

Questionnaire Design and Data Collection

The questionnaire comprises three primary parts designed to examine the key COM factors and demographic predictors influencing consumers' readiness towards a CE for plastics in Vietnam. The first part is a brief warm-up introduction, aiming to engage respondents by outlining the research objectives and offering clarifications on terms used in the survey, such as "readiness" and "circular economy for plastics". This ensures that all participants have a clear understanding of the concepts underlying the questionnaire. In the following part, fifteen observed indicators are presented, representing three latent constructs: Capability to support plastics CE (task knowledge and skills, 3 indicators), Opportunity (legislation and economic benefits, 6 indicators), and Motivation (personal attitude and moral norms, 6 indicators). All indicators are assessed using a five-point Likert scale, ranging from one to five, indicating responses from "strongly disagree" to "strongly agree". These indicators are primarily adapted from previous studies [38–40, 68, 71, 83, 84], with minor modifica-

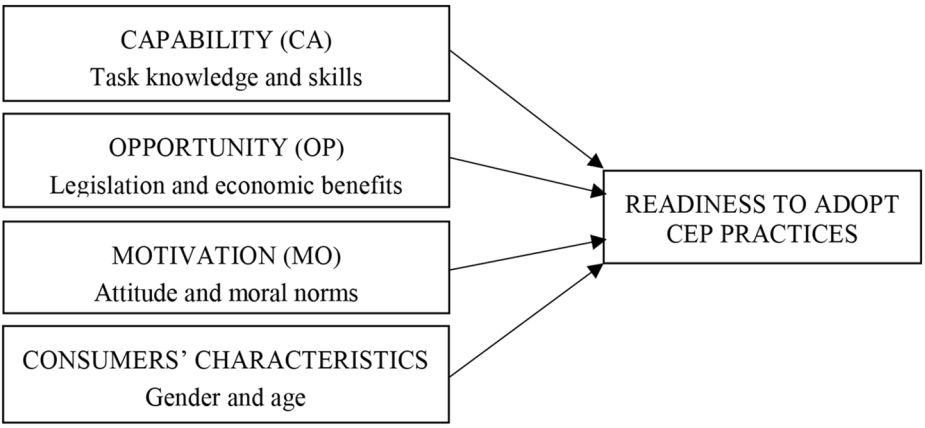

Fig. 1 Research model

tions to suit the specific context of CE for plastics in Vietnam. Furthermore, the second part includes a question assessing the level of readiness of respondents to engage in CE for plastics. This question is presented in binary form, offering two response options, namely "high readiness" and "not yet or low readiness". The survey indicators utilized in part 2 of the questionnaire, along with their sources of reference, are summarized in Table 1. The final part of the questionnaire examines the demographic characteristics of respondents, including gender, age, and current place of residence. A preliminary version of the questionnaire was subsequently distributed to 100 participants, who were assigned the task of answering all questions and offering feedback on the clarity of the questionnaire. No significant adjustments were implemented during this pilot phase. All items were also subjected to reliability testing, and the Cronbach's alpha values fell within the suggested threshold range [85], suggesting the reliability of the scale development.

The final questionnaire for this study was then distributed via self-administered mode, using the Internet-based service Google Forms, targeting Generation Z (Gen Z) respondents. The reason why this study focus on the Gen Z is that this generation is recognized as a pivotal force in advocating for sustainable lifestyles, preserving the environment, and embracing eco-friendly practices, all of which contribute to steering our societies toward a low-carbon and climate-resilient future [86]. In addition, it is stated by the United Nations that the majority of the population in many countries is young people, with approximately

Table 1 Observed indicators in the questionnaire

Observed indicators		Sources of reference
Name	Description	
CA1	I know how to reuse and recycle discarded plastic items	So et al. [40], Soomro et al. [80], and Heidbreder et al. [38].
CA2	I possess the capability to reuse and recycle plastics for various purposes and multiple times	
CA3	It is not challenging for me to reuse and recycle plastic items rather than discarding them	
OP1	The expense of purchasing new plastic items motivates me to reuse and recycle plastic items instead of discarding them	Self-developed, Gulid, Yansomboon [83], Heidbreder et al. [38], Senturk, Dumludag [71], and Van et al. [68].
OP2	The additional cost for plastic items motivates me to reduce my consumption of new plastic items	
OP3	The high cost of plastic items motivates me to generate less PW	
OP4	I will adhere to laws and regulations regarding the responsibility of users to recycle PW	
OP5	The enforcement of regulations can force me to reuse and recycle plastic items rather than discarding them	
OP6	I am influenced by the implementation of government policies on reusing and recycling plastic items	
MO1	I feel a moral obligation to participate in circular economy principles, wherein plastics are reused and recycled rather than discarded	Liao, Yang [84], Senturk, Dumludag [71], Siddiqui et al. [39], So et al. [40], Tonglet et al. (2004), and Van et al. [68].
MO2	It would be right of me to adopt circular economy principles, wherein plastics are reused and recycled rather than discarded	
MO3	I am responsible for lowering the volume of PW generated.	
MO4	Circular economy principles, in which plastics are reused and recycled instead of discarded, is a good approach to safeguarding natural resources	
MO5	Circular economy principles, in which plastics are reused and recycled instead of discarded, are beneficial for both humans and the environment	
MO6	Circular economy principles, in which plastics are reused and recycled instead of discarded, are rewarding	

1.2 billion individuals worldwide and their ages in the range of 15 to 24. In other words, this generation can act as crucial actors in fostering behavioural shifts as they possess the fundamental capacity to make consumption choices and apply logical reasoning [87]. Supporting this notion, recent research has increasingly acknowledged and addressed the significance of cultivating pro-environmental behaviour among young people [88, 89]. To be specific, in Vietnam, an emerging economy in the Southeast Asia region, approximately 13 million individuals belong to Gen Z, comprising about 19% of the country's population, thus significantly influencing consumption patterns. This age cohort is reported to exert significant influence on family purchasing decisions [90], which may show a strong preference for environmentally-friendly products and display a steadfast commitment to PW reduction, thereby contributing to the advancement of the CEP.

To examine Gen Z's preparedness for the CE regarding plastics in Vietnam, this survey targets respondents being in the older segment of GenZ, born between 1997 and 2005. This selection ensures that all respondents from GenZ are of sufficient maturity, being 18 years old or above at the time of the interview. The link to a self-administered questionnaire was randomly distributed to various youth communities via online systems, utilizing common social media platforms such as Gmail, Outlook, Facebook, and Zalo, as well as university channels (Facebook groups) over a span of four months, from August to November 2023. Ultimately, a total of 711 completed questionnaires was received. Following the removal of ineligible responses during the data cleaning stage, the final dataset comprised 632 responses available for further analysis, resulting in a recovery rate of 88.89%. The respondents, whose ages range from 18 to 26 years old, have the majority falling between 18 and 20 years old, accounting for 74.22%. Meanwhile, 25.78% of respondents are between 21 and 26 years old. Consequently, the average age of respondents in this study is 19.35 ± 1.11 years. Most respondents are currently studying, accounting for 94.46%. Of these, 85.59% are pursuing a Bachelor's degree (a 4 to 6-year program), while 14.41% are working towards an associate degree (a three-year college or vocational program). The remaining 5.54% are employed. Out of the 632 respondents, 450 are female, comprising 71.20% of the total, while the remaining 182 participants are male, accounting for 28.80%. The predominance of female respondents can be explained by the fact that, in Vietnam, women are primarily responsible for household consumption and waste management, often serving as the main consumers and disposers [91]. Due to their greater experience with consuming and disposing of plastic products compared to men, women may find the research topic on PW management more familiar and engaging. Evidence suggests that individuals are more likely to respond to questionnaires when the content aligns with their interests. Notably, some researchers argue that women are highly active in online activities involving information exchange, similar to the engagement required by the questionnaires in this study [92].

Data Analysis

This study utilized exploratory factor analysis (EFA) and reliability assessment to evaluate the initial scale of the 15 observed indicators. EFA was performed using the principal component analysis extraction method and varimax with Kaiser normalization rotation to investigate the minimum number of underlying factors from the initial set of observed indicators. It is suggested that the determinant of the correlation matrix should be higher than the threshold of 0.00001 to ensure the exclusion of multicollinearity. Morever, factors in

EFA with Eigenvalues lower than 1.0 or explaining less than 50% of the variance should be excluded and indicators with factor loadings less than 0.5 should be removed [85]. The factorability of the dataset, as presented by the Kaiser-Meyer-Olkin (KMO) values, should be higher than0.7, and the Bartlett's test of sphericity should have a significance level of $p<0.001$ [85]. In terms of reliability analysis, Cronbach's alpha was calculated to assess the internal consistency reliability of the extracted factors, with the desired values typically exceeding 0.7 (0.6 is generally acceptable) [85]. Both EFA and reliability test were conducted with the support of the software of Statistical Packages for Social Sciences (SPSS, version 22, IBM Corp., Armonk, NY).

The next step is conducting logistic regression to identify potential predictors of Gen Z's readiness for a CEP in Vietnam, applying SPSS 22.0 software. Respondents in this study were queried with the question "To what extent are you prepared to engage in the circular economy for plastics?" They expressed their readiness level by selecting from two options: "high readiness" (coded as "1") or "not yet or low readiness" (coded as "0"). As the dependent variable follows a binary format (0–1), this study uses multiple logistic regression to predict the significant factors influencing Gen Z's preparedness for CEP practices. Logistic regression analysis is a statistical method used to check the association between predictor variables (both categorical and continuous) and a binary (dichotomous) outcome [93]. The explanatory variables incorporated into the logistic model for this study comprise age, gender, and three elements of COM-B model.

To evaluate the model's fit, three goodness-of-fit (GOF) assessment methods were employed: (1) Hosmer-Lemeshow test, (2) Classification table, (3) Area under receiver operating characteristics (ROC) curve (AUC). Generally, GOF tests evaluate the null hypothesis that the structure of the fitted model is correct. The Hosmer-Lemeshow test employs a Pearson statistic to compare observed and expected event counts across population subgroups [94]. The decision criterion for the test involves comparing the test statistic with a Chi-squared distribution, with degrees of freedom, which is based on the number of groups utilized to construct the test statistic [95]. The result provides a Chi-square value (referred to as Hosmer-Lemeshow Chi-squared) and a p-value (Pr>ChiSq). A low p-value indicates that the model is not a good fit [94]. In terms of the classification table, higher sensitivity and specificity suggest a superior fit of the model. In simpler terms, a higher percentage of correctly classified instances is predicted for a well-fitted model. Expanding on the concept of the two-by-two table, creating a scatter plot of pairs of sensitivity and specificity (or more commonly, sensitivity versus 1-specificity) yields an ROC curve. The better classification is indicated by higher true positive rates and lower false positive rates for each threshold (ranging from 0 to 1). Therefore, classifiers with curves positioned more towards the top-left side are considered better. AUC, or the area under the curve, is among the most crucial performance measures for classifiers. It offers a comprehensive assessment of how effectively the model accurately classifies both 0s and 1s across all potential cutoff values. Larger AUC values signify enhanced discriminatory ability [96]. The AUC value falls within the range from 0.5 to 1.0, with the minimum value indicating the performance of a random classifier and the maximum value representing a perfect fit. AUC values exceeding 0.70 are typically considered acceptable fit [97]. In addition, the pseudo-R^2 value, such as the Nagelkerke R^2, is evaluated during model fit assessment.

Results and Discussion

Constructs Extracted from EFA and Internal Consistency of these Constructs

The EFA is essential in identifying the correlation between each shared item and its corresponding constructs. Table 2 presents the results of an EFA conducted utilizing the principal component analysis extraction model, with a varimax rotation method and Kaiser normalization. To assess the strength of the correlation and multicollineratiy issue, the correlation matrix, KMO, and Bartlett's test of sphericity are examined. The determinant of the correlation matrix is less than 0.0001, which is significantly greater than 0.00001, indicating the absence of multicollinearity potential. From the finding obtained in this study, KMO value of 0.928 indicates that the degree of information among the indicators overlap greatly/the presence of a strong partial correlation; hence, it is good for factor analysis to commence. In addition, a significant statistical test (sig. < 0.0001) from the Bartlett test of sphericity ($\chi^2 = 5727$, df = 105) shows that the correlation matrix is indeed not an identity matrix, indicating adequate relationships between variables for conducting the factor analysis [85].

Communalities, which show the amount of original information contained in each indicator extracted from a common construct, range from 0.565 to 0.758. The minimum amount of information is 56.5% by OP1 ("The expense of purchasing new plastic items motivates me to reuse and recycle plastic items instead of discarding them"), indicating 43.5% loss of information. In the EFA, three constructs were extracted with an Eigenvalue of 1.048, as indicated by the scree plot (depicted in Fig. 2), and the percentage of variance explained reached 67.472%, meeting the threshold value [85]. Since all the factor loadings of the fifteen indicators exceed 0.5, they are all retained for further analysis to commence. Consequently, the newly established constructs are labeled as follows: Construct 1 - "Capability",

Table 2 Results of EFA and reliability test

Observed indicators	Communalities	Extracted factors' loadings[a]			Cronbach's alpha	Latent constructs
		1	2	3		
CA1	0.707	0.781			0.821	
CA2	0.743	0.821				Capability
CA3	0.704	0.711				
OP1	0.565		0.706		0.879	
OP2	0.650		0.757			
OP3	0.655		0.761			
OP4	0.709		0.764			Opportunity
OP5	0.667		0.720			
OP6	0.600		0.678			
MO1	0.663			0.581	0.896	
MO2	0.614			0.515		
MO3	0.668			0.561		
MO4	0.718			0.794		Motivation
MO5	0.702			0.794		
MO6	0.758			0.824		

[a]Factor loadings from rotated component matrix is reported; Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization; KMO = 0.928; Bartlett's test of sphericity ($\chi^2 = 5727$, df = 105, sig. < 0.0001)

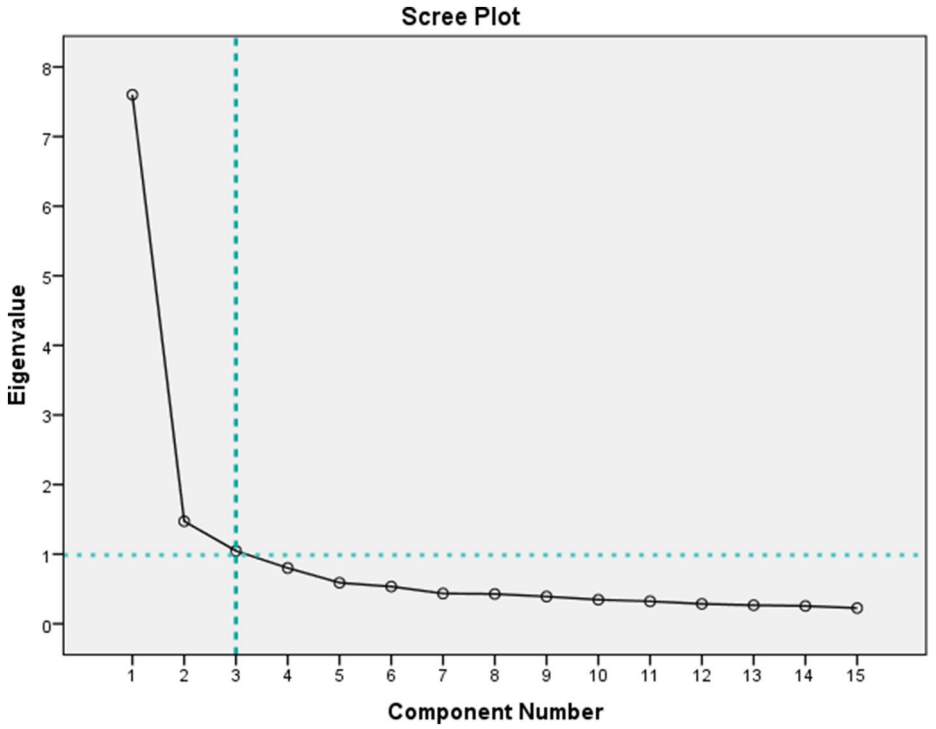

Fig. 2 Scree plot

Construct 2 - "Opportunity", and Construct 3 - "Motivation" whose Cronbach's values are 0.821, 0.879, and 0.896, respectively. The results of the reliability test, as evidenced by the Cronbach's alpha values, confirm that all three derived factors are reliable, indicating the achievement of internal consistency within these constructs. The first construct represents to task knowledge and skills to implement CEP strategy (PW reusing and recycling). The second construct covers legislation compliance and economic benefits gained through applying CEP strategy. The last one is a set of respondents' attitude and moral norms toward CEP strategy.

Factors Affecting Gen Z's Readiness Towards a Circular Economy for Plastics

The logistic regression model includes five predictors: "Capability", "Opportunity", "Motivation", "Gender", and "Age". The dependent variable in this study is the readiness of Gen Z towards a CE for plastics, which is coded as "1 = high readiness" and "0 = no/ low readiness". Further details are presented in Table 3.

Maximum likelihood estimation is employed to compute logistic model estimates. The omnibus test, a likelihood-ratio chi-square test comparing the current model (with five predictors) to the null model (without any predictors), demonstrates a significance value of less than 0.05 (-2 Log likelihood = 462.309, $\chi^2 = 250.671$, df = 5, $p < 0.0001$), indicating that the current model outperforms the null model. Furthermore, achieving a Nagelkerke R^2 value of 0.484 indicates that the current model explains approximately 48.4% of the variance.

Table 3 Variables entering the analysis

Variable	Description	Data type
Dependent variable		
Readiness to adopt CEP practices	0 = "no/ low readiness", 1 = "high readiness"	Discrete (Binary)
Independent variables		
Capability	Mean value of (CA1, CA2, CA3)	Continuous
Opportunity	Mean value of (OP1, OP2, OP3, OP4, OP5, OP6)	Continuous
Motivation	Mean value of (MO1, MO2, MO3, MO4, MO5, MO6)	Continuous
Gender	0 = "female", 1 = "male"	Nominal
Age	0 = "18–20", 1 = "21–26"	Nominal

Next, the Hosmer and Lemeshow test for goodness of fit indicates that the model fits the data well, with a p-value of 0.066 ($\chi^2 = 14.652$, df = 8), which exceeds the threshold of 0.05. Additionally, the classification table reveals that the percentage of correctly classified cases in the current model significantly increases to 84.3%, compared to 74.8% in the null model, indicating a well-fitted model. Referring to the ROC curve depicted in Fig. 3, the curve is positioned closer to the top-left corner, suggesting a good performance. The AUC value serves as an indicator of the model's ability to distinguish between "high readiness" and "no/low readiness". The results indicate an AUC value of 0.876, surpassing the suggested threshold of 0.7, with an asymptotic 95% confidence interval ranging from 0.844 to 0.908, indicating the high power of the current model to classify the samples (high discriminatory ability), implying a good model fit to the data [96].

Next, examining the results of the multiple logistic model, the relationship between explanatory variables and the outcome is demonstrated in Table 4. The findings indicate that all three explanatory components, including capability, opportunity, and motivation, have a statistically significant positive impact on consumers' readiness for PW reusing and recycling. Opportunity, with a coefficient of 1.725 (p-value < 0.0001), is found to be more explanatory of individuals' preparedness for CEP engagement than capability ($\beta = 0.850$, p-value < 0.0001) and motivation ($\beta = 0.471$, p-value = 0.031).

In particular, the positive impact of opportunity confirms the significance of legislation and economic benefits in encouraging young consumers to participate in circular activities for plastics. The finding of the odds ratio indicates that a one-point increase in the five-point opportunity scale raises the odds of CEP engagement by a factor of 5.614, or 461.4%. In other words, it highlights the significant importance of laws and regulations in supporting a plastics CE transition. This aligns with previous statements in the literature, which concluded that consumers' recycling practices are influenced by policies and legislation [3, 98]. In Vietnam, the government has focused its efforts on addressing plastic issues by updating legal documents and environmental protection policies in recent years. Notably, Directive No. 33/CT-TTg, issued by the Prime Minister on August 20, 2020, focuses on strengthening the management, reuse, recycling, disposal, and reduction of PW. This was followed by Decision 1316/QD-TTg, which approved the scheme for strengthening PW management in Vietnam, dated July 22, 2021. Additionally, to fulfill Vietnam's international commitments to addressing PW, the Prime Minister approved the National Action Plan for Management of Marine Litter by 2030 (Decision 1746/QD-TTg) in 2019. The 2020 Law on Environmental

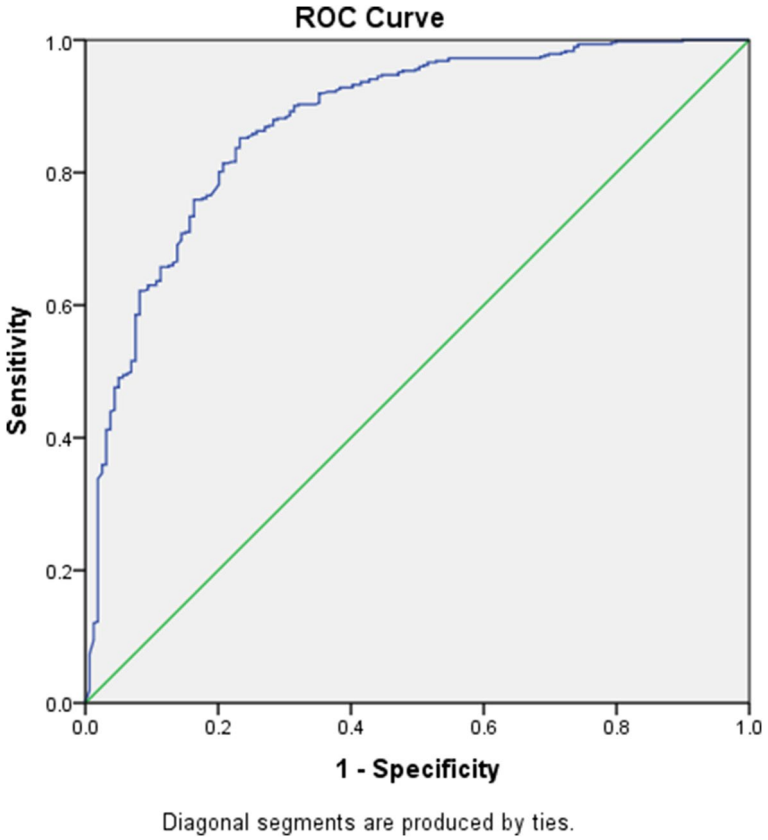

Fig. 3 ROC curve and AUC

Table 4 Results of the multiple logistic model

Predictors	β	S.E.	Wald	*p*-value	Exp(β)	95% C.I.for Exp(β)	
						Lower	Upper
Capability	0.850	0.201	17.932	0.000	2.339	1.578	3.465
Opportunity	1.725	0.215	64.514	0.000	5.614	3.685	8.552
Motivation	0.471	0.218	4.673	0.031	1.601	1.045	2.454
Gender _"female"	0.154	0.269	0.326	0.568	1.166	0.688	1.977
Age_"(18–20) years old"	0.642	0.291	4.861	0.027	1.900	1.074	3.363
Constant	-11.003	1.125	95.734	0.000	0.000		
-2 Log likelihood	462.309, χ^2 =250.671, df=5, $p<0.0001$						
Nagelkerke R^2	48.4%						
Hosmer & Lemeshow test	$p=0.066$ (χ^2 =14.652, df=8)						
Classification accuracy	84.3%						

Note S.E. stands for standard error; C.I stands for confidence interval

Protection, which includes regulations on PW and the prevention of marine PW pollution (in Article 73), was officially implemented in 2022. However, due to a lack of specific and clear guidelines for implementation and the absence of sanctions for administrative violations, PW classification at the source and recycling have not been officially implemented [99, 100]. Therefore, to deal with numerous enforcement gaps in the government's specific laws and regulations on the development of a CEP; the Vietnamese government, along with the Ministry of Natural Resources and Environment, should develop enforceable directives and circulars with clear targets and responsibilities to help facilitate increased recovery and recycling. It should clearly outline consumers' responsibilities for plastic reusing and recycling, provide detailed instructions on how to comply, and specify the sanctions for violations or non-compliance with the regulations. Lessons can be learnt from other countries. For instance, the punitive legislation in Belgium, known as the "garbage fine," which penalizes consumers for failing to sort PW into the blue bag, has proven effective in deterring incorrect or non-sorting behaviors at the consumer level.

Moreover, the current research findings suggest that economic incentives can encourage young consumers to engage in circular activities for plastics. If customers are required to pay for grocery bags rather than receiving them for free, they will be more likely to reuse their old bags to save money. In agreement with this point, Luís et al. [72] suggested that government interventions, such as charges on plastic products, have also garnered support from consumers. Research indicates that implementing a plastic bag charge has proven effective in encouraging consumers to reuse bags in Portugal [101] and Wales [73]. In fact, financial incentives are one of the best ways to help discourage the use of plastics [102]. It is suggested that reducing consumption could be affected by economic instruments, such as taxes imposed on producers and importers of plastic products, or fees paid by consumers for single-use plastics, instead of providing them for free [103].

For example, Vietnam has currently implemented the former option where an environmental protection tax has been applied to non-degradable plastic bags sold on the market since 2010, with producers and importers responsible for the payment while consumers pay no fee for single-use plastics. However, this policy seems to be ineffective in reducing plastic bag consumption. Evidence from World Bank field surveys conducted in 2020 and 2021 indicates that plastic bags remain one of the leading pollutants in Vietnam's environment [103]. This ineffective implementation may be attributed to the following reasons. Firstly, the tax rate of 50,000 VND per kilogram (approximately USD 2 per kilogram) (Law on Environmental Protection Tax No. 57/2010/QH12, dated November 15, 2010) remains relatively low, which has not significantly impacted the production and use of plastic bags [99]. Secondly, taxes paid by producers have less effect on consumption because the tax amount can be included in the product's price. As a result, consumers may not be aware of the charge, and therefore, consumer preferences may not shift towards more sustainable alternatives. Thus, it is evident that the tax has not been as effective as expected, emphasizing the need for additional policies to reduce the consumption of plastic bags. Therefore, with the current framework conditions in Vietnam, applying fees to consumers, the latter option as suggested, would help achieve the ambitious plastic bag reduction targets outlined in Vietnam's national strategies and legal documents. Charging a fee for plastic items at the point of sale might be preferable, as it encourages consumers to reduce their use of plastic products [103]. Hence, it becomes evident that implementing a charge or fee on plastic products enables consumers to save money by reusing items instead of purchasing

new ones, thereby allowing them to simultaneously benefit from both legal compliance and economic advantages.

Another notable finding from this study is that the potential engagement of the Gen Z consumers in CEP practices is significantly influenced by capability. To be more specific, for each one-point interval increase, individuals with a stronger capability component are 2.339 times more likely to be prepared for PW reusing and recycling. This emphasizes the positive power of task knowledge and skills related to CEP in motivating individuals to engage in PW reduction and recycling, which is also noted in existing literature [38, 87, 104]. This indicates that consumers who are well-informed about how to reuse and recycle PW are more prepared to participate in CEP activities compared to those who are not informed. It is evident in the research of Taufik et al. [105], which found that the ability of disposal accuracy of bio-based plastics among German consumers improves in correlation with their understanding of these products. In fact, Ertz et al. [3] and Khatami et al. [26] confirmed that specific knowledge about what, how, where, and when to recycle is crucial for facilitating proper sorting, and recycling PW. Hence, equipping consumers with knowledge and subsequently improving their skills in practicing reuse and recycling will effectively encourage public participation in CEP strategies. It is suggested that educating consumers about reusing and recycling is essential for achieving an effective goal for plastic circularity. In the current context of Vietnam, the majority of people have limited knowledge regarding the sorting and treatment of municipal solid waste, particularly PW, which is reflected in the low collection rate for PW [106]. Although the implementation of regulations on the segregation of domestic solid waste at the source, set to begin on January 1, 2025, under the Revisions to Vietnam's Law on Environmental Protection, aims to improve the quality of domestic PW and ensure more stable sources of raw materials for recycling businesses, it is crucial to provide consumers with clear guidelines and instructions for sorting PW. Additionally, training consumers on proper methods for reusing and recycling PW is necessary. To accomplish this, it is essential to launch communication campaigns that emphasize the simplicity of PW reuse and recycling, thereby encouraging active participation in CEP initiatives.

Furthermore, from the findings of this study, a positive effect of motivation confirms that the importance of attitude and moral norms in motivating the consumers to be involved in circular activities for plastics. The odds ratio indicates that with a one-point increase on the five-point opportunity, there is an increase the odds of CEP engagement by a factor of 1.601. Hence, it can be concluded that the attitudes of young consumers towards CEP significantly influence their readiness to reuse and recycle PW, aligning with findings from earlier research [68, 76]. In fact, individuals with a positive attitude towards circular behaviours, who view these actions as important and beneficial for the environment, are more likely to engage in such behaviours [24]. This finding aligns with the mindsponge mechanism, which suggests that an individual's perceptions of a particular issue are shaped by their subjective cost-benefit assessment of that issue [61]. Additionally, the importance of personal norms is also observed in our study, which have the positive impact on readiness to reuse and recycle PW among Gen Z consumers. In agreement with our findings, White et al. [36] also reported that personal norms are a crucial factor affecting the shift in consumer behaviour towards more sustainable practices. Drawing from these investigations and applied in Vietnam's context, it is crucial to emphasize further actions to enhance positive attitudes among Gen Z

consumers towards achieving a CEP and to encourage the development of personal norms. These efforts will help stimulate practices such as reusing and recycling PW in daily life.

The significant influence of respondents' demographic variables in explaining the readiness involved in CEP practices has also been scrutinized in this study and the findings show that only age is a significantly influential factor in predicting consumers' readiness to cooperate with PW reusing and recycling. To be precise, results in Table 4 demonstrates a positive correlation between age and CEP readiness with the coefficient of 0.642 and significant at 5% level. As the (18–20) years old group is set as a reference category, the positive coefficient implies that increasing average age is associated with increased odds of preparedness in PW reusing and recycling. Meanwhile, those whose age being (21–26) years old are 90% more ready to join in CEP practices than those whose age being (18–20) years old. It is consistent with the previous research, that indicates that older people tend to be more likely to undertake reusing, reducing, and recycling behaviours related to plastic consumption, and to support campaigns for reducing single-use plastic bags [107]. In our study, since the sample focuses on older Gen Z individuals aged 18 to 26, the higher level of readiness among those aged (21–26) towards plastics circular strategies compared to those aged (18–20) may be explained by the differing perceptions of each age group regarding the issue of PW and the need for a CEP. The reason may come from the expose environmental education in general education system. In Vietnam, education about PW, its impacts, and its management is not primarily focused on high schools and is only sporadically integrated into high school curricula through environmental education activities or inclusion in related subjects [108]. Consequently, the knowledge and understanding related to PW among recent high school graduates are relatively limited compared to those in higher education or entering the workforce.

Obviously, education is essential in cultivating a shift in mindset regarding environmental issues. According to the mindsponge theory, individuals are initially exposed to CE-related information, which is then filtered and internally processed by the mind. The process entails either accepting or rejecting values to reshape perceptions, depending on how well they align with the intrinsic values within an individual's information processing system [61]. This highlights the importance of information dissemination in influencing and altering an individual's perceptions and behavior. As demonstrated by Japan, Taiwan, and Singapore, it requires many years of communication, education, and policy implementation to instill environmental values across various segments of the population and future generations. Hence, while education may have an indirect impact on the readiness of Gen Z to embrace CEP, enhancing educational efforts on the issue of PW from the early stages of education is crucial. This will aid in improving youngsters' perceptions and understanding of the critical problem of PW and the urgent need to take action in a CEP.

Conclusions and Recommendations

The transition from a linear economy to a CE is challenging for many countries, particularly regarding specific materials such as PW, which is one of the most severe environmental problems in developing countries like Vietnam. To reduce PW for sustainable development, it is crucial to better understand consumers, especially Gen Z, a future generation with the potential to advance the CEP. This begins with gaining a deeper insight into the factors

influencing their readiness to adopt CEP practices. Considering the urgent need to enhance consumer engagement with plastic circular strategies, this study employed multiple logistic regression to predict the influence of COM factors on Vietnamese Gen Z consumers' preparedness to reuse and recycle PW. The findings reveal that all three explanatory components of the COM-B model, including capability, opportunity, and motivation, have a statistically significant positive impact on consumers' readiness to reuse and recycle PW. Opportunity, represented by legislation and economic benefits, is found to be more explanatory of individuals' preparedness for CEP engagement than capability (task knowledge and skills) and motivation (attitude and moral norms). In other words, all three components play significant roles in determining Gen Z consumers' readiness to reuse and recycle plastics. Moreover, the impact of respondents' age was significant, with those aged between 21 and 26 being 90% more ready to engage in CEP practices compared to those aged between 18 and 20.

Based on these findings, the necessity for consumers to receive political support, technical expertise, and knowledge concerning PW is emphasized; thereby, various practical implications can be derived from these insights. The establishment and enhancement of governmental laws and regulations focusing on plastic disposal can strengthen consumers' commitment to better implement responsibilities regarding plastic circular strategies. For instance, laws focusing sorting at the source for reuse and recycling purposes, bans on certain plastic products, or charges on purchasing new plastic products could help enhance the rates of PW reuse and recycling. Additionally, strengthening consumers' knowledge and understanding of reusing and recycling through educational and training programs is vital to encourage their engagement in these practices, particularly among the younger generation. These measures could be integrating lessons on PW management into relevant subjects within the general education system and organizing hands-on activities or field trips targeted the proper disposal of PW in schools. Moreover, developing and distributing informative materials on PW management, and conducting awareness campaigns on the adverse effects of PW and the importance of reducing plastic usage. Besides propaganda activities, training and educating young people on plastic reuse and recycling methods is a practical way to support the circularity of plastics. Furthermore, the development of suitable policies to foster a sense of dedication among the populace, thereby incentivizing individuals to uphold their obligations and responsibilities in environmental protection awareness, is essential. This can be achieved through diverse channels including families, schools, communities, and various social media platforms such as television, TikTok, Zalo, Instagram, Facebook, and the Internet. This approach effectively exposes consumers to PW issues, educates them, and encourages deeper participation in the CE, thereby enhancing recycling practices among the public.

From a theoretical perspective, this study contributes to enriching theories related to human behaviour regarding CEP, particularly focusing on three key factors: capability, opportunity, and motivation, which influence PW reuse and recycling among Gen Z consumers. Applied within the current Vietnamese context, this study furnishes valuable insights for the government, educational management agencies, and educators in Vietnam. It offers guidance for the development of suitable policies, programs, and activities aimed at educating young people to mitigate PW. Apart from the attained results, this study has various limitations. Firstly, the study focused on the Gen Z generation, primarily comprising students, which could potentially introduce sample bias. Secondly, given the diverse

nature of the factors within the three pillars of capability, opportunity, and motivation introduced in the COM-B model, further exploration is required to identify additional predictors of consumers' readiness for PW reuse and recycling. In addition, although the COM-B model effectively predicts factors influencing sustainable consumer behavioral intentions, it falls short in explaining the dynamic relationship between information and values that shapes human mental processes and behaviors, particularly in the digital age. Therefore, it is essential to consider developing an extended COM-B model, for example, integrating the mindsponge framework with Bayesian multi-level modeling. This approach offers a more systematic and hierarchical method, providing fertile ground for future research. Thirdly, the concept of the circular economy of plastics (CEP) in this study is limited to the practices of reusing and recycling PW. These limitations highlight the necessity for follow-up research to expand the scale, scope, and subjects of the study.

Acknowledgements The author would like to thank all participants who took part in the survey, for their time and cooperation.

Funding This work belongs to the project grant No T2024-PGS-19 funded by The University of Danang - University of Science and Education.

Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing Interests The author has no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Jang Y-C, Lee G, Kwon Y et al (2020) Recycling and management practices of plastic packaging waste towards a circular economy in South Korea. Resources, Conservation and Recycling 158:104798
2. Bucknall DG (2020) Plastics as a materials system in a circular economy. Philosophical Trans Royal Soc A: Math Phys Eng Sci 378:20190268
3. Ertz M, Addar W, Ouerghemmi C et al (2023) Overview of factors influencing consumer engagement with plastic recycling. WIRE Energy Environ 12:e493
4. EEA (2021) Plastics, the circular economy and Europe′s environment - A priority for action. In:European Environment Agency. Publications Ofce of the European Union, Luxembourg
5. Shen M, Huang W, Chen M et al (2020) (Micro) plastic crisis: un-ignorable contribution to global greenhouse gas emissions and climate change. J Clean Prod 254:120138
6. Statista (2024) Annual production of plastics worldwide from 1950 to 2021. In
7. UNDP (2019) Plastics and Circular Economy: Community solutions. In:United Nations Development Programme, New York
8. Ritchie H, Roser M (2018) Plastic pollution. In:Our World in Data
9. Makarchev N, Xiao C, Yao B et al (2022) Plastic consumption in urban municipalities: characteristics and policy implications of Vietnamese consumers' plastic bag use. Environ Sci Policy 136:665–674
10. Babaremu KO, Okoya SA, Hughes E et al (2022) Sustainable plastic waste management in a circular economy. Heliyon 8:e09984
11. Villarrubia-Gómez P, Cornell SE, Fabres J (2018) Marine plastic pollution as a planetary boundary threat–the drifting piece in the sustainability puzzle. Mar Policy 96:213–220
12. Landrigan PJ, Raps H, Cropper M et al (2023) The Minderoo-Monaco Commission on Plastics and Human Health. Annals of Global Health
13. Schmaltz E, Melvin EC, Diana Z et al (2020) Plastic pollution solutions: emerging technologies to prevent and collect marine plastic pollution. Environ Int 144:106067

14. Arumdani IS, Puspita AS, Budihardjo MA (2021) MSW handling of top 5 leading waste-producing countries in Southeast Asia. IOP Conference Series: Earth and Environmental Science 896:012003
15. Ng CH, Mistoh MA, Teo SH et al (2023) Plastic waste and microplastic issues in Southeast Asia. Front Environ Sci 11
16. Omeyer LCM, Duncan EM, Aiemsomboon K et al (2022) Priorities to inform research on marine plastic pollution in Southeast Asia. Sci Total Environ 841:156704
17. Danh NT, Hoi HT (2019) Effects of plastic waste to sea environment in Vietnam. IOP Conference Series: Earth and Environmental Science 351:012023
18. Ngoc Nam P, Pham Q, Duong TT et al (2019) Contamination of microplastics in bivalve: first evaluation in Vietnam. VIETNAM J EARTH Sci 41:252–258
19. OECD (2022) Global Plastics Outlook
20. Godfrey L (2019) Waste Plastic, the challenge facing developing Countries—Ban it, change it. Collect It? Recycling 4:3
21. Monre (2020) National Environmental Status Report 2019. Ministry of the Natural resources and the Environment. Ministry of the Natural resources and the Environment, Hanoi
22. WB (2022) Vietnam: Plastic Pollution Diagnostics. East Asia and Pacific Region. MARINE PLASTICS SERIES
23. Geisendorf S, Pietrulla F (2018) The circular economy and circular economic concepts—a literature analysis and redefinition. Thunderbird Int Bus Rev 60:771–782
24. Gomes GM, Moreira N, Ometto AR (2022) Role of consumer mindsets, behaviour, and influencing factors in circular consumption systems: a systematic review. Sustainable Prod Consum 32:1–14
25. Kumar R, Verma A, Shome A et al (2021) Impacts of plastic pollution on ecosystem services, sustainable development goals, and need to focus on circular economy and policy interventions. Sustainability 13:9963
26. Khatami F, Vilamová Š, Cagno E et al (2023) Efficiency of consumer behaviour and digital ecosystem in the generation of the plastic waste toward the circular economy. J Environ Manage 325:116555
27. Trần TV, Phan TH, Lê ATT et al (2022) Evaluation of factors affecting the transition to a circular economy (CE) in Vietnam by Structural equation modeling (SEM). Sustainability 14:613
28. Nguyen TTA, Ta YT, Dey PK (2022) Developing a plastic cycle toward circular economy practice. Green Process Synthesis 11:526–535
29. Borrello M, Pascucci S, Caracciolo F et al (2020) Consumers are willing to participate in circular business models: a practice theory perspective to food provisioning. J Clean Prod 259:121013
30. Hunka AD, Linder M, Habibi S (2021) Determinants of consumer demand for circular economy products. A case for reuse and remanufacturing for sustainable development. Bus Strategy Environ 30:535–550
31. Deloitte (2019) Economic study of the Canadian plastic industry, markets, and waste. In:Government of Canada
32. Dilkes-Hoffman LS, Pratt S, Laycock B et al (2019) Public attitudes towards plastics. Resources, Conservation and Recycling 147:227–235
33. Daae J, Chamberlin L, Boks C (2018) Dimensions of Behaviour Change in the context of Designing for a Circular Economy. Des J 21:521–541
34. Linder N, Rosenthal S, Sörqvist P et al (2021) Internal and External Factors' Influence on Recycling: Insights From a Laboratory Experiment With Observed Behavior. Frontiers in Psychology 12
35. Mylan J, Holmes H, Paddock J (2016) Re-introducing consumption to the 'Circular economy': a socio-technical analysis of domestic food provisioning. Sustainability 8:794
36. White K, Habib R, Hardisty DJ (2019) How to SHIFT consumer behaviors to be more sustainable: a Literature Review and Guiding Framework. J Mark 83:22–49
37. Fogt-Jacobsen L, Pedersen S, Thøgersen J (2022) Drivers of and barriers to consumers' plastic packaging waste avoidance and recycling– a systematic literature review. Waste Manage 141:63–78
38. Heidbreder LM, Tröger J, Schmitt M (2023) Exploring the psychological antecedents of private and public sphere behaviours to reduce household plastic consumption. Environ Dev Sustain 25:3405–3428
39. Siddiqui SA, Profeta A, Decker T et al. (2023) Influencing Factors for Consumers’ Intention to Reduce Plastic Packaging in Different Groups of Fast-Moving Consumer Goods in Germany. Sustainability 15:7625
40. So WWM, Cheng INY, Cheung LTO et al (2021) Extending the theory of planned behaviour to explore the plastic waste minimisation intention of Hong Kong citizens. Australian J Environ Educ 37:266–284
41. Ajzen I (1991) The theory of planned behavior. Organ Behav Hum Decis Process 50:179–211
42. Schwartz SH (1977) Normative influences on altruism. Advances in experimental social psychology. Elsevier, pp 221–279
43. Stern PC, Dietz T, Abel TD et al (1999) A value-belief-norm theory of support for Social movements: the Case of Environmentalism. Hum Ecol Rev 6:81–97

44. Verplanken B (2018) Promoting sustainability: towards a Segmentation Model of Individual and Household Behaviour and Behaviour Change. Sustain Dev 26:193–205
45. Michie S, Van Stralen MM, West R (2011) The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci 6:42
46. Soma T, Li B, Maclaren V (2021) An evaluation of a consumer food waste awareness campaign using the motivation opportunity ability framework. Resources, Conservation and Recycling 168:105313
47. Allison AL, Baird HM, Lorencatto F et al (2022) Reducing plastic waste: a meta-analysis of influences on behaviour and interventions. J Clean Prod 380:134860
48. King S, Locock KES (2022) A circular economy framework for plastics: a semi-systematic review. J Clean Prod 364:132503
49. Michie S, Atkins L, West R (2014) The behaviour change wheel. A guide to designing interventions. 1st ed. Great Britain: Silverback Publishing 1003:1010
50. Li D, Xu X, Chen C-F et al (2019) Understanding energy-saving behaviors in the American workplace: a unified theory of motivation, opportunity, and ability. Energy Res Social Sci 51:198–209
51. Allison A, Lorencatto F, Michie S et al (2021) Influences on single-use and reusable cup use: a multidisciplinary mixed-methods approach to designing interventions reducing plastic waste
52. Allison AL, Lorencatto F, Michie S et al (2022) Barriers and enablers to Food Waste Recycling: a mixed methods study amongst UK citizens. Int J Env Res Public Health 19:2729
53. Perros T, Allison AL, Tomei J et al (2022) Behavioural factors that drive stacking with traditional cooking fuels using the COM-B model. Nat Energy 7:886–898
54. Allison A, Purkiss D, Lorencatto F et al (2022) Improving compostable plastic disposal: an application of the Behaviour Change Wheel intervention development method. Front Sustain 3:968152
55. Dilkes-Hoffman L, Ashworth P, Laycock B et al (2019) Public attitudes towards bioplastics– knowledge, perception and end-of-life management. Resour Conserv Recycl 151:104479
56. Dhokhikah Y, Trihadiningrum Y, Sunaryo S (2015) Community participation in household solid waste reduction in Surabaya, Indonesia. Resour Conserv Recycl 102:153–162
57. Tran PM, Nguyen T, Nguyen H-D et al (2024) Improving Green Literacy and Environmental Culture Associated with Youth participation in the Circular Economy: a case study of Vietnam. Urban Sci 8:63
58. Nguyen M-H, La V-P, Le T-T et al (2022) Introduction to bayesian Mindsponge Framework analytics: an innovative method for social and psychological research. MethodsX 9:101808
59. Vuong QH, Napier NK (2015) Acculturation and global mindsponge: an emerging market perspective. Int J Intercultural Relations 49:354–367
60. Vuong Q-H (2022) Mindsponge Theory. Sciendo
61. Vuong Q-H, Le T-T, Nguyen M-H (2022) Mindsponge mechanism: an information processing conceptual framework. The mindsponge and BMF analytics for innovative thinking in social sciences and humanities. De Gruyter Berlin, Germany, pp 21–46
62. Calisto-Friant M, Vermeulen WJV, Salomone R (2021) Analysing European Union circular economy policies: words versus actions. Sustainable Prod Consum 27:337–353
63. Roosen M, Mys N, Kleinhans K et al (2022) Expanding the collection portfolio of plastic packaging: impact on quantity and quality of sorted plastic waste fractions. Resour Conserv Recycl 178:106025
64. Taylor RL, Villas-Boas SB (2016) Bans vs. fees: Disposable Carryout bag policies and bag usage. Appl Economic Perspect Policy 38:351–372
65. Jahani A, Dehdari T, Farzadkia M et al (2019) Iranian experiences in terms of consumption of disposable single- use plastics: introduction to theoretical variables for developing environmental health promotion efforts. Environ Toxicol Pharmacol 65:18–22
66. Camacho-Otero J, Boks C, Pettersen IN (2019) User acceptance and adoption of circular offerings in the fashion sector: insights from user-generated online reviews. J Clean Prod 231:928–939
67. Macintosh A, Simpson A, Neeman T et al (2020) Plastic bag bans: lessons from the Australian Capital Territory. Resour Conserv Recycl 154:104638
68. Van L, Hamid NA, Ahmad F et al (2021) Factors of single use plastic reduction behavioral intention. Emerg Sci J 5:269–278
69. Jakovcevic A, Steg L, Mazzeo N et al (2014) Charges for plastic bags: motivational and behavioral effects. J Environ Psychol 40:372–380
70. Homonoff TA (2018) Can small incentives have large effects? The impact of taxes versus bonuses on Disposable Bag Use. Am Economic Journal: Economic Policy 10:177–210
71. Senturk G, Dumludag D (2022) The relationship between consumption of single-use plastic bags, environmental awareness, and socio-demographic factors. J Mater Cycles Waste Manage 24:1494–1507
72. Luís S, Roseta-Palma C, Matos M et al (2020) Psychosocial and economic impacts of a charge in lightweight plastic carrier bags in Portugal: keep calm and carry on? Resources. Conserv Recycling 161:104962

73. Thomas GO, Sautkina E, Poortinga W et al (2019) The English Plastic Bag Charge Changed Behavior and Increased Support for Other Charges to Reduce Plastic Waste. Frontiers in Psychology 10
74. Ofstad SP, Tobolova M, Nayum A et al (2017) Understanding the mechanisms behind changing people's recycling behavior at work by applying a comprehensive action determination model. Sustainability 9:204
75. Khan F, Ahmed W, Najmi A et al (2019) Managing plastic waste disposal by assessing consumers' recycling behavior: the case of a densely populated developing country. Environ Sci Pollut Res Int 26:33054–33066
76. Hameed I, Khan K, Waris I et al (2022) Factors influencing the sustainable consumer behavior concerning the recycling of plastic waste. Environ Qual Manage 32:197–207
77. Heidbreder LM, Schmitt M (2020) Fasting plastic: an intervention study to break habits of plastic consumption (Ayuno De plástico: una intervención para cambiar Los hábitos de consumo de plásticos). PsyEcology 11:170–192
78. Aprile MC, Fiorillo D (2019) Intrinsic incentives in household waste recycling: the case of Italy in the year 1998. J Clean Prod 227:98–110
79. Khan F, Ahmed W, Najmi A (2019) Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. Resources, Conservation and Recycling 142:49–58
80. Soomro YA, Hameed I, Bhutto MY et al (2022) What influences consumers to recycle Solid Waste? An application of the Extended Theory of Planned Behavior in the Kingdom of Saudi Arabia. Sustainability 14:998
81. Hasan SNMS, Harun R, Hock LK (2015) Application of theory of Planned Behavior in measuring the Behavior to reduce Plastic Consumption among students at Universiti Putra Malaysia, Malaysia. Procedia Environ Sci 30:195–200
82. Aruta JJBR (2022) An extension of the theory of planned behaviour in predicting intention to reduce plastic use in the Philippines: cross-sectional and experimental evidence. Asian J Social Psych 25:406–420
83. Gulid N, Yansomboon S (2022) Consumer behavior with single-use Plastic bags in a government campaign. J Posit School Psychol:6134-6148-6134–6148
84. Liao Y, Yang W (2022) The determinants of different types of private-sphere pro-environmental behaviour: an integrating framework. Environ Dev Sustain 24:8566–8592
85. Hair JF, Black WC, Babin BJ et al (2019) Multivariate data analysis. Cengage Andover, Hampshire, United Kingdom, Andover, Hampshire, United Kingdom
86. UN (2022) YouthStats: Environment and Climate Change. In:Office of the Secretary-General's Envoy on Youth
87. Chun T, Moorthy L, Yoon Mei K et al (2020) C. Determinants of 3Rs behaviour in plastic usage: A study among Malaysians. Heliyon 6
88. Herabadi AG, Bella ES, Adishesa S et al (2023) Keep your litter in the Loop: Predicting Generation Z's intention to recycle single-use Plastic Waste. Psychol Res Urban Soc 6:7
89. Aikowe LD, Mazancová J (2021) Plastic Waste sorting intentions among University students. Sustainability 13:7526
90. Nguyen L, Nguyen H (2020) Generation Z in Vietnam: The Quest for Authenticity. In, p 135–148
91. Ga-Circular (2019) The role of gender in Waste Management: gender perspectives on Waste in India. Indonesia, the Philippines and Vietnam. In, Singapore
92. Eysenbach G, Wyatt J (2002) Using the internet for surveys and health research. J Med Internet Res 4:E13
93. Ranganathan P, Pramesh CS, Aggarwal R (2017) Common pitfalls in statistical analysis: logistic regression. Perspect Clin Res 8:148–151
94. Hosmer J, W D, Lemeshow S et al (2013) Applied logistic regression. Wiley
95. Surjanovic N, Loughin TM (2023) Improving the Hosmer-Lemeshow goodness-of-fit test in large models with replicated Bernoulli trials. J Appl Statist:1–13
96. Wendler T, Gröttrup S (2021) Data Mining with SPSS Modeler: Theory, Exercises and Solutions
97. Melo F (2013) Area under the ROC curve. In: Dubitzky W, Wolkenhauer O, Cho K-H, Yokota H (eds) Encyclopedia of systems Biology. Springer New York, New York, NY, pp 38–39
98. Hahladakis JN, Iacovidou E (2019) An overview of the challenges and trade-offs in closing the loop of post-consumer plastic waste (PCPW): focus on recycling. J Hazard Mater 380:120887
99. Nham T (2024) Plastic Waste and difficulties in Management in Vietnam. Eng Technol J 9
100. Liu C, Thang Nguyen T, Ishimura Y (2021) Current situation and key challenges on the use of single-use plastic in Hanoi. Waste Manage 121:422–431
101. Martinho G, Balaia N, Pires A (2017) The Portuguese plastic carrier bag tax: the effects on consumers' behavior. Waste Manage 61:3–12

102. WWF (2021) Assessment of extended producer responsibility (EPR) for plastic packaging waste in Viet Nam. In:World Wide Fund for Nature
103. WB (2022) Toward a National Single-use Plastics Roadmap in Vietnam: Strategic Options for Reducing Priority Single-use Plastics. In
104. Valle POD, Rebelo E, Reis E et al (2005) Combining behavioral theories to Predict Recycling involvement. Environ Behav 37:364–396
105. Taufik D, Reinders MJ, Molenveld K et al (2020) The paradox between the environmental appeal of bio-based plastic packaging for consumers and their disposal behaviour. Sci Total Environ 705:135820
106. Salhofer S, Jandric A, Soudachanh S et al (2021) Plastic recycling practices in Vietnam and related hazards for Health and the Environment. Int J Env Res Public Health 18:4203
107. Heidbreder LM, Bablok I, Drews S et al (2019) Tackling the plastic problem: a review on perceptions, behaviors, and interventions. Sci Total Environ 668:1077–1093
108. Nguyen HT, Ho TTQ, Hoang BL et al (2024) Impacts of education and perception on Vietnamese high school students' behaviors regarding plastic waste: the mediating role of attitude. Environ Sci Pollut Res 31:19543–19555