The Role of Promotions on Food Delivery Service Platforms in Shaping Generation Z's Sustainable Behavior in Managing Food Waste

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Abstract
Food waste is a global problem that intensifies environmental pressure and greenhouse-gas emissions. In Indonesia, the rapid adoption of online food delivery among Generation Z is often driven by promotions that may shape post-consumption food-waste management. Building on the Theory of Planned Behavior (TPB), this study examines whether promotion influences sustainable food-waste management behavior, and whether the relationship is mediated by price consciousness and perceived behavioral control (PBC). Distinct from Kristia et al. (2023), this study tests an alternative TPB mechanism by substituting "knowledge/subjective norms" with price consciousness and situates the model in Denpasar as a context with strong local pro-environmental narratives (treated here as contextual interpretation rather than a measured cultural construct). A survey of 142 active Generation Z users of online food delivery in Denpasar was analyzed using PLS-SEM (SmartPLS 4) with bootstrapping. Results show that promotion does not directly predict sustainable behavior ($p = 0.176$), and price consciousness is not a significant predictor nor a mediator ($p > 0.05$). In contrast, PBC strongly predicts sustainable behavior ($\beta = 0.759$; $p < 0.001$) and significantly mediates the promotion–sustainable behavior link (bootstrapped indirect effect: $p < 0.05$). Theoretically, the findings reinforce PBC as the key determinant of sustainable behavior in highly promotion-intensive digital consumption contexts. Practically, "save money" messaging alone is unlikely to curb food waste; platform features and micro-education that enhance user control (portion planning, storage reminders, reuse guidance) are more promising.

I. INTRODUCTION

The rapid development of information and communication technology in the digital era has significantly reshaped consumer behavior, particularly among younger generations (Kristia et al., 2024; Shidqi et al., 2024). Generation Z—individuals born between 1997 and 2012—is characterized by deep engagement with digital technology and social media (Kristia et al., 2023). Digital platforms are widely used to fulfill daily needs (Tobing et al., 2022), including food ordering through online food delivery applications such as GoFood, GrabFood, and ShopeeFood. According to Statista (2023), Indonesia's food delivery market has experienced substantial growth in recent years, reaching IDR 45 trillion in 2023, with Generation Z representing a significant share of users. This growth is largely driven by Generation Z's strong preference for convenience, speed, and accessibility offered by food delivery applications (Jahidi et al., 2022). While this trend reflects a broader transformation in consumption patterns, it also introduces new sustainability challenges, particularly related to food waste.

The World Resources Institute (2024) estimates that 30% to 40% of global food production is wasted, with a considerable contribution coming from individual consumers. Food waste poses both economic and environmental challenges. Uneaten food represents inefficient use of natural resources such as water, land, and energy utilized during production. Furthermore, improper food waste management contributes to environmental issues, including pollution and greenhouse gas emissions—particularly methane generated during decomposition (Zuhra & Angkasari, 2023). These emissions can have significant adverse effects on local ecosystems.

In Indonesia, this phenomenon is particularly evident in urban areas such as Denpasar. As a city with a substantial youth population, Denpasar demonstrates high engagement with digital technology, including food delivery platforms. Data from Statistics Indonesia (BPS) indicate that approximately 30% of Denpasar's population is under 25 years old, representing a significant segment of Generation Z (Badan Pusat Statistik Kota Denpasar, 2025). This demographic group shows strong engagement with social media and food delivery services such as GoFood, GrabFood, and ShopeeFood, making Denpasar a relevant setting for examining consumer behavior in the digital food economy.

Denpasar also exhibits high internet penetration and smartphone usage. According to the Indonesian Internet Service Providers Association (APJII, 2024), internet access in Denpasar exceeds 90%. The widespread availability of digital infrastructure makes Denpasar an ideal context for investigating the impact of promotional strategies on food delivery platforms and their influence on consumer behavior, particularly among technologically literate Generation Z users. Moreover, Denpasar has experienced significant growth in online food commerce (Google & Temasek, 2024). As the capital of Bali Province, the city hosts numerous local and international restaurants, further driving demand for food delivery services and

potentially contributing to increased food waste generation.

The Denpasar Regional Waste Management Agency (BBPSD, 2023) reports that organic waste, including food waste, accounts for approximately 60% of total municipal waste in Denpasar. Despite ongoing waste management efforts, there remains substantial potential to enhance Generation Z's awareness of sustainable consumption practices. Decisions to use food delivery services are influenced by multiple factors, including promotional offers, environmental awareness, and subjective norms within social groups (Kristia et al., 2023).

Promotions on food delivery platforms have become a key strategy for boosting sales. Discounts, vouchers, and viral marketing campaigns often encourage consumers to order more food than needed, leading to overconsumption and food waste. A study by the Bureau of International Recycling (2021) found that 60% of consumers admitted being influenced by promotional offers when ordering food online, even when they did not finish their meals. These marketing strategies frequently target Generation Z, a demographic particularly responsive to visually appealing promotions and engaging social media content (Samudra et al., 2021). However, limited education regarding the environmental consequences of excessive consumption makes individuals more susceptible to unsustainable practices (Fitriani et al., 2021).

Beyond external factors such as promotions, sustainable consumption behavior is also influenced by individual knowledge and subjective norms (Nurlinda, 2023). A comprehensive understanding of the environmental impacts of food waste can motivate consumers to reduce excessive consumption. Nevertheless, UNEP (2024) reports that insufficient awareness regarding food waste management remains prevalent among Generation Z, particularly in urban settings like Denpasar. Subjective norms also play a crucial role. Environmental concern and food waste reduction behaviors are more likely to emerge when individuals perceive that their peers prioritize sustainability (Kristia et al., 2023; Silmi Asy-Syifaa et al., 2024). Conversely, if social norms tolerate excessive consumption and food disposal, such behaviors are likely to persist.

Although numerous studies have examined Generation Z's sustainable consumption behavior, limited research specifically investigates the influence of promotional pricing in online food delivery platforms on Generation Z's sustainable behavior in reducing food waste, particularly in Denpasar. Prior research has focused on sustainable behavior related to environmentally friendly packaging (Fitriani et al., 2021), Generation Z's behavior in e-commerce usage (Wijaya & Ekayasa, 2022), the effect of fear of missing out (FoMO) on impulsive online food delivery purchases among Generation Z (Asyifa et al., 2024), and the influence of promotional strategies on purchasing decisions (Silmi Asy-Syifaa et al., 2024). This study extends the conceptual framework developed by Kristia et al. (2023) by contextualizing the analysis within Denpasar City.

This study aims to examine the impact of promotional strategies on online food delivery platforms, price awareness, and perceived behavioral control on Generation Z's sustainable behavior related to food waste management in Denpasar. The findings are expected to provide insights for policymakers, businesses, and communities in designing more effective behavior-based strategies to reduce food waste. Additionally, this research seeks to understand how these factors influence consumption decisions and food waste management among Generation Z, a demographic known for dynamic consumption patterns and strong responsiveness to digital information and social trends. Overall, this study contributes to environmental sustainability efforts by emphasizing behavioral approaches. By leveraging digital technologies and media that are integral to Generation Z's daily life, this research aims to propose contextually relevant and practical solutions. Consequently, the study is intended not only to contribute to academic discourse but also to offer actionable recommendations for stakeholders seeking to promote sustainable consumption practices.

II. METHOD

Based on the Theory of Planned Behavior (TPB) proposed by Ajzen (2020) and supported by findings from previous empirical studies, a conceptual framework was developed as presented in Figure 1. This framework integrates the key determinants of behavior—particularly those relevant to sustainable consumption and food waste management—and will be applied to the case study conducted in Denpasar City.

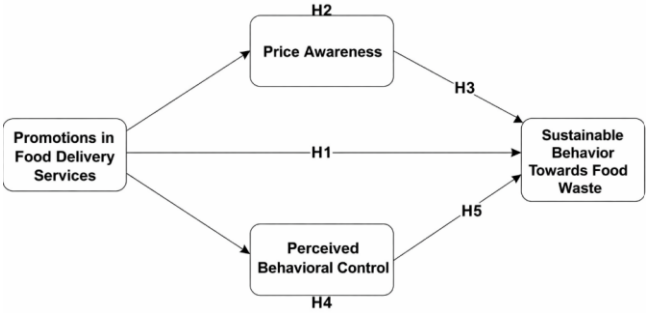

Figure 1. Research Framework

Based on the relationships among variables in the conceptual framework, the research hypotheses are formulated as follows:

1. H1: Promotions have a significant effect on Generation Z's sustainable behavior in managing food waste in Denpasar City.
2. H2: Price awareness mediates the relationship between promotional effectiveness and Generation Z's sustainable behavior in managing food waste in Denpasar City.
3. H3: Price awareness has a significant effect on Generation Z's sustainable behavior in managing food waste in Denpasar City.
4. H4: Perceived behavioral control mediates the relationship between promotional effectiveness in food delivery service applications and Generation Z's sustainable behavior in managing food waste in Denpasar City.
5. H5: Perceived behavioral control has a significant effect on Generation Z's sustainable behavior in managing food waste in Denpasar City.

This study employed a quantitative approach with a survey design to examine the relationships among constructs within the Theory of Planned Behavior (TPB) framework. The study was conducted in Denpasar City, Bali, focusing on Generation Z's sustainable behavior in managing food waste in relation to the use of food delivery service platforms. The target population consisted of Generation Z individuals residing or actively engaging in activities in Denpasar City who use food delivery applications. The inclusion criteria were: (1) belonging to Generation Z, (2) being an active user of food delivery applications, and (3) having at least one year of usage experience. The sampling technique used was convenience sampling, whereby participants were selected based on accessibility and their voluntary willingness to participate.

Data were collected using an online questionnaire containing statements measuring four main constructs: Promotion (PR), Price Consciousness (KH), Perceived Behavioral Control (PBC/KP), and Sustainable Behavior (SB/PB). All items were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The indicators for each construct are presented in Table 1 of the manuscript (not via external links) to comply with academic reporting standards. The questionnaire was distributed online through social media platforms such as WhatsApp and Instagram. Data collection took place from early October to mid-November 2025. After data collection, responses were screened for completeness and validity to ensure that only eligible responses were included in the analysis.

To determine the minimum sample size, this study used the A-priori Sample Size Calculator for Structural Equation Models (Soper DS, 2025). This online calculator is widely recognized in SEM research (Cohen, 1992; Hair et al., 2017; Westland, 2010). There are two lower-bound criteria for determining sample size in Structural Equation Modeling (SEM): the first is based on the ratio of observed variables (indicators) to latent variables, and the second depends on the minimum effect size, statistical power, and significance level. The analysis indicated a minimum required sample size of 137 to detect structural effects in SEM. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS version 4.0.

III. RESULTS AND DISCUSSION

A. Results

Based on the survey conducted from early October to mid-November 2025, a total of 142 valid responses were obtained. All respondents met the inclusion criteria, namely Generation Z individuals who had actively used food delivery applications for at least one year. Demographically, the majority of respondents were female (59.9%), and most resided in South Denpasar District. In terms of occupation, respondents were predominantly private-sector employees (62.0%), reflecting the characteristics of a productive-age group with relative economic independence. Regarding platform preference, ShopeeFood was the most frequently used application (61.3%), followed by GoFood (54.2%), GrabFood (50.0%), and MaximFood (0.7%). In terms of usage duration, most respondents had used food delivery services for 3–5 years (46.5%), followed by 1–2 years (38.0%), and more than 5 years (15.5%), indicating relatively mature usage experience. Monthly ordering frequency was dominated by the 1–5 times category (45.1%) and 6–10 times (32.4%), while higher frequencies accounted for smaller proportions. Overall, usage intensity can be categorized as moderate.

Data analysis was conducted using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with SmartPLS version 4. The initial stage of model evaluation focused on assessing the measurement model to ensure the validity and reliability of latent constructs. Following the recommendations of Hair et al. (2017), the evaluation included indicator loadings, internal consistency reliability, and construct validity. The results showed that out of the initial 19 indicators, 14 met the convergent validity threshold with outer loadings above 0.70, while the remaining indicators that did not meet the threshold were removed from the model. These findings indicate that the constructs demonstrate adequate reliability and validity for further analysis at the structural model stage.

Table 1. Structural Model Results (Path Coefficients and Significance)

Hypothesis	Parameter	T-statistics	P Values (<0,05)	Conclusion
H1	Promotion (PR) → Sustainable Behavior (SB)	1.352	0.176	Rejected
H2	Promotion (PR) → Price Consciousness (PC) → Sustainable Behavior (SB)	1.058	0.290	Rejected
H3	Price Consciousness (PC) → Sustainable Behavior (SB)	1.078	0.281	Rejected
H4	Promotion (PR) → Perceived Behavioral Control (PBC) → Sustainable Behavior (SB)	6.190	0.000	Accepted
H5	Perceived Behavioral Control (PBC) → Sustainable Behavior (SB)	10.787	0.000	Accepted

The structural model was tested using a bootstrapping procedure to assess the significance of the relationships among variables by comparing p-values with a 5% significance level. The results indicate that out of the five proposed hypotheses, two were supported while three were rejected. Empirically, promotion does not have a significant direct effect on sustainable behavior (p = 0.176), and price consciousness is not supported as a significant predictor or mediator in the model (p >

0.05). In contrast, promotion has a significant effect on perceived behavioral control ($p < 0.001$), and perceived behavioral control significantly influences sustainable behavior ($p < 0.001$). Thus, the effect of promotion on sustainable behavior operates indirectly through the enhancement of perceived behavioral control (PBC), which emerges as the primary determinant of Generation Z's sustainable behavior in managing food waste.

Furthermore, the coefficient of determination (R^2) analysis shows that the adjusted R^2 values for all endogenous variables exceed 0.26, indicating a substantial level of explanatory power. The model explains 76.9% of the variance in Price Consciousness (PC), 36.2% of the variance in Perceived Behavioral Control (PBC), and 83.3% of the variance in Sustainable Behavior (SB). These values demonstrate a strong predictive capability of the model, particularly in explaining sustainable behavior as the main outcome variable. Predictive relevance was further confirmed through Stone–Geisser's Q^2 values, all of which are greater than zero, indicating that the model has adequate predictive relevance for each latent construct. Additionally, the effect size (f^2) evaluation reveals three substantial effects: the influence of Perceived Behavioral Control on Sustainable Behavior, Promotion on Price Consciousness, and Promotion on Perceived Behavioral Control. The remaining two paths show negligible effects due to their lack of statistical significance. Overall, these findings highlight that in a promotion-intensive digital consumption context, perceived behavioral control plays a more critical role in shaping sustainable behavior than price consciousness considerations alone

B. Discussion

This study aimed to examine the effect of promotions on food delivery service platforms on Generation Z's sustainable behavior in managing food waste in Denpasar, considering the mediating roles of price consciousness and perceived behavioral control. The statistical results indicate that two hypotheses (H4 and H5) are supported, while three hypotheses (H1, H2, and H3) are rejected. The following discussion elaborates these findings from both theoretical and empirical perspectives.

1. The Effect of Promotion on Sustainable Behavior

   The results show that Hypothesis 1 is statistically rejected (p-value = 0.176), indicating that promotion does not have a significant direct effect on Generation Z's sustainable behavior in managing food waste in Denpasar. At first glance, this finding appears counterintuitive, given that prior studies suggest digital promotions often stimulate impulsive purchases that may increase food waste (Asyifa et al., 2024; Bureau of International Recycling, 2021; Kristia et al., 2023). However, this result can be interpreted through the complexity of Generation Z's consumption motivations. Kristia et al. (2023) noted the existence of an "attitude–behavior gap" among Indonesian Generation Z consumers. In the Denpasar context, promotions may no longer serve as the primary trigger of overconsumption because respondents have developed cognitive mechanisms to filter excessive promotional stimuli. This finding aligns with Tsalis et al. (2021), who found that promotions can also support waste-reduction behavior when consumers use them strategically to obtain value rather than to overconsume.

   Thus, the rejection of this hypothesis does not imply that promotions have no influence at all; rather, their influence operates indirectly through psychological variables—particularly perceived behavioral control. This highlights the limitation of models that focus solely on direct effects and reinforces the importance of adopting a more holistic framework such as the Theory of Planned Behavior (TPB).

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2. The Direct and Mediating Role of Price Consciousness

   Hypotheses 2 and 3 are also statistically rejected (p-value > 0.05). The findings indicate that price consciousness neither significantly predicts sustainable behavior nor mediates the relationship between promotion and sustainable behavior. This is an interesting result, as it contradicts the common assumption that economic considerations are the primary drivers of frugal and sustainable behavior. Academically, this rejection can be explained by the shifting value orientation of Generation Z. Studies by Djafarova & Foots (2022) and Ziesemer et al. (2021) show that although Generation Z is price-sensitive, they are increasingly motivated by identity, social reputation, and sustainability values. In Denpasar—where the cultural philosophy of *Tri Hita Karana* emphasizes harmony between humans and nature—moral responsibility may outweigh purely economic considerations.

   Price consciousness in this study reflects the pursuit of the "best quality at the most affordable price." However, when ordered portions exceed actual needs, price considerations become irrelevant to waste outcomes. Janssens et al. (2019) similarly found that perceived behavioral control, rather than price consciousness, plays a more decisive role in preventing food waste. In other words, price awareness may influence purchase decisions, but it does not necessarily determine how much food is ultimately wasted.

3. The Critical Role of Perceived Behavioral Control

   The acceptance of H4 and H5 underscores the central role of Perceived Behavioral Control (PBC) in shaping sustainable behavior. Hypothesis H5 demonstrates that PBC has a strong direct effect on sustainable behavior ($\beta = 0.759$, $p < 0.001$). This provides strong empirical validation of the core proposition of the Theory of Planned Behavior (Ajzen, 2020), which posits that individuals' perceptions of their ability to perform a behavior are key determinants of actual behavior. This finding is consistent with Siaputra et al. (2022), who found that PBC was the only variable capable of mediating the relationship between food consumption and

waste-reduction intentions. In this study, respondents who felt capable of controlling portion sizes, storing leftovers properly, and managing excess food effectively were more likely to engage in sustainable practices. This suggests that functional capacity and practical skills are more influential than mere intentions or economic awareness.

The acceptance of H4 further reveals that PBC mediates the relationship between promotion and sustainable behavior. This provides an important strategic insight: promotions are not inherently detrimental; their impact depends on consumers' perceived control. A "buy one get one" promotion may lead to waste among consumers with low perceived control but may represent a rational and efficient choice for those with high perceived control who plan to store or reuse leftovers. This supports Kristia et al. (2023), who argue that food waste interventions should focus on consumer empowerment rather than merely restricting promotional activities.

4. Theoretical and Practical Implications

Theoretically, these findings extend the application of TPB in the context of digital consumption and sustainability. In a highly promotion-driven digital environment, perceived behavioral control acts as a cognitive filter that determines whether external stimuli lead to sustainable or unsustainable behavior. Practically, the findings provide actionable recommendations. For food delivery service providers, rather than eliminating promotions, integrating features that enhance users' perceived control would be more effective. For example, applications could include "recommended portion size based on number of people" or "leftover management tips" at checkout. For policymakers and educators, interventions should focus on practical skill-building—such as food storage techniques and leftover processing—rather than solely delivering moral messages about the dangers of food waste.

For future research, additional variables that may strengthen perceived behavioral control—such as peer norms, social support, or interface design nudges—should be explored. Overall, although several initial hypotheses were rejected, the study uncovers deeper psychological mechanisms that are highly relevant to addressing food waste challenges in the digital era.

IV. CONCLUSION

This study demonstrates that promotions on food delivery service platforms do not have a direct effect on Generation Z's sustainable behavior in managing food waste ($p = 0.176$). Price consciousness also does not exert a significant direct effect nor function as a mediating variable ($p > 0.05$), indicating that a "saving-oriented" mindset alone is insufficient to encourage post-consumption food waste reduction practices. In contrast, perceived behavioral control emerges as the primary determinant of sustainable behavior, exerting a strong direct effect ($\beta = 0.759$; $p < 0.001$) and significantly mediating the relationship between promotion and sustainable behavior ($p < 0.05$). These findings imply that food waste reduction strategies will be more effective when focused on strengthening individuals' capacity and habitual control over consumption decisions, rather than merely intensifying promotional activities or emphasizing cost-saving messages.

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