Food delivery platform and food waste: Deciphering the role of promotions, knowledge, and subjective norms among Indonesian generation Z

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ABSTRACT

With the popularity of food delivery applications in Indonesia, there is a need to promote responsible consumption habits, specifically in mitigating food waste. This study examined the influence of promotion, knowledge, and subjective norms on sustainable food waste behaviour among Generation Z individuals in Indonesia. The study involved an online survey of 561 Generation Z users of meal delivery platforms, with data analysis conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS) through SMART-PLS 4 software. The study contradicted that promotion and knowledge directly affect food waste reduction behaviour. Promotion can positively impact responsible food waste behaviour when mediated by price consciousness and perceived behavioural control. Knowledge requires attitude and perceived behavioural control to influence responsible food-wasting. It became apparent that subjective norms directly affected responsible food waste and were mediated by attitude. The antecedent variables examined in this study explained a 63.7% variance of sustainable behaviour towards food waste, indicating moderate explanatory power. Promotion conducted by food delivery service applications, accompanied by information and practical strategies to enhance consumers' perceived behavioural control, can increase the likelihood of sustainable food waste behaviour among Generation Z consumers, particularly price-conscious consumers. To foster positive attitudes and subjective norms towards sustainable food waste behaviour, policymakers can incentivize academic institutions, culinary businesses, and influencers to promote food waste reduction.

1. Introduction

As the world's second-largest producer, Indonesia is grappling with a significant global food waste problem (Waluyo and Kharisma, 2023). This issue has far-reaching implications for food security, environmental stability, and economic productivity (Conrad and Blackstone, 2021; Lins et al., 2021). The burgeoning meal delivery services further exacerbate the situation, which results in heightened consumption and the possibility of waste (Chu et al., 2021; Liu et al., 2020a; Xie et al., 2021). The phenomenon of rapid growth in the use of food delivery service applications occurs in Indonesia, especially among young consumers, following the global trend that also appears in nations with the largest populations in the world, like China and the United States (Lee et al., 2019; Wahyudin et al., 2023). The proliferation of food delivery service

applications in Indonesia is fostered by the significant internet penetration rate, projected to surpass 80% of the country's population by the end of 2023 (Sangadji and Handriana, 2023). Additionally, the convenience of ordering (Sangadji and Handriana, 2023; Talwar et al., 2023a), the availability of diverse restaurant options, and the plethora of food selections contribute to this development (Saad, 2021). The meal delivery service industry has experienced a surge in demand, which has prompted intense competition among prominent companies such as GoFood, GrabFood, and ShoopeFood. These companies commonly employ promotional tactics to attract and retain customers, including food discounts, free shipping, loyalty programs, and special deals on occasions like twin dates or holidays (Prasetyo et al., 2021; Tandon et al., 2021). In the context of Indonesian consumers, research around price promotion of food delivery service applications is mainly

associated with its effect on customer satisfaction (Hasbi et al., 2022), value, or loyalty (Sidharta et al., 2021). Still, to the best of authors' knowledge, no research examines the impact of price promotion on food delivery service applications with sustainable behaviour, especially food waste reduction. Price promotions, in particular, have proven effective in capturing customers' attention, especially among young customers, who tend to take advantage of such offers (Büyükdağ et al., 2020; Zhong et al., 2022). However, previous research has yielded conflicting results concerning the impact of promotions on food waste behaviour. Some studies suggest that price discounts may encourage over-consumption, leading to the purchase of more food than can be consumed and, ultimately, resulting in food waste (Fook and McNeill, 2020; Skrynka and Vincent, 2019; Tsalis et al., 2021).

Additionally, when food is purchased at a low price, people may be more likely to discard it when they feel full or bored with the taste (Gaiani et al., 2018). Conversely, alternative research has indicated that discounts might effectively reduce food waste, particularly in the context of merchants, by promoting the consumption of "imperfect produce" or items nearing their expiration date (Cho and Heacock, n.d.; Cicatiello et al., 2019). Similarly, among consumers, individuals who exhibit price sensitivity and frequently avail themselves of price reductions continue to prioritise reducing food waste to mitigate the economic repercussions associated with squandered resources (Buisman et al., 2019; Katt and Meixner, 2020). The impact of price promotion on an individual's attempts to reduce food waste varies as additional mediating variables, including price consciousness, attitude, level of awareness, and several other factors that influence it (Tsalis et al., 2021).

Most of the previous research related to food waste reduction behaviour has been conducted at the household level with married people and middle-aged respondents (Abdelradi, 2018; Aschemann-Witzel et al., 2017; Attiq et al., 2021b; Graham-Rowe et al., 2014; Jaciow et al., 2022; Jörissen et al., 2015; Koivupuro et al., 2012; Nabi et al., 2021; Ponis et al., 2017; Porpino et al., 2015; Qian et al., 2020; Sassi et al., 2016; Schmidt, 2016; Silvennoinen et al., 2014; Tsalis et al., 2021; Visschers et al., 2016; Williams et al., 2012). Household consumers in Indonesia are responsible for approximately 60% of the total food waste, with projections indicating that this volume will double in the coming decade compared to 2019 (Diana et al., 2022; Venessa and Aripradono, 2023; Waluyo and Kharisma, 2023). Antecedent variables that are considered to influence behaviour related to food waste at the household level are attitudinal factors such as motivation and perceptions regarding efforts to reduce food waste (Falasconi et al., 2019); knowledge related to the impact of consumption behaviour on social, economic and environmental aspects as well as ability related to how to cook and how to store food has also been shown to affect a person's behaviour in managing food waste (Mohamed, 2022; Mumtaz et al., 2022). Sociodemographic factors like family life cycle and age have also been found to affect food waste management patterns (Boulet et al., 2021; Falasconi et al., 2019; Grasso et al., 2019; Qian et al., 2022). At a younger behavioural level, similar variables have also been shown to influence food waste reduction behaviour, including attitude and knowledge related to the impact of food consumption (Attiq et al., 2021a; Mohamed, 2022). The main focus was on the Indonesian Generation Z, projected to constitute three-quarters of the nation's population by 2025 (Boulet et al., 2021; Ulhaq and Wahid, 2022). The major aim was to evaluate the influence of various food delivery applications' promotion approaches and consumer knowledge on the efforts to accomplish UN SDG No. 12, which primarily targets food waste reduction. Generation Z, including predominantly those in the undergraduate or early professional demographic, is recognised for their heightened consciousness regarding sustainable practices, ethical consumption, and their astute understanding of the ecological ramifications associated with their lifestyle choices (Kristia, 2023; Puiu et al., 2022). Individuals who possess a comprehensive understanding of the interconnections between worldwide environmental issues and exhibit extensive

knowledge of mitigating the detrimental impacts of consumption on the environment, as well as strategies for minimising food waste, are anticipated to demonstrate responsible consumption habits in their daily lives, especially making efforts to reduce food waste (Attiq et al., 2021b; Dhir et al., 2021; Hossain et al., 2022; Roh et al., 2022). Nevertheless, some previous findings indicated that a profound knowledge of responsible and ethical lifestyles does not automatically translate into sustainable consumption patterns. This discrepancy between knowledge, attitude, and actual behaviour may be attributed to multiple barriers that hinder the practical application of such principles (Kristia et al., 2023; Park and Lin, 2020; Ran and Zhang, 2022; Yamoah and Acquaye, 2019).

In order to assess the impact of price promotions offered by food delivery apps and environmental sustainability awareness in curbing food waste, the authors utilised several mediating factors drawn from the Theory of Planned Behaviour (TPB). This included attitudes towards reducing food waste and perceived behavioural control (Ayar and Gürbüz, 2021; Lee et al., 2018; Paul et al., 2016; Pillai et al., 2022; Shen et al., 2022; Wang et al., 2018; Wu and Chen, 2014). Pressures and subjective norms from the immediate social environment and the teachings instilled by the family can also have an influence on a person's food purchase, portion of food consumed and attitude towards food waste (van der Werf et al., 2019). Prior research has shown that three factors can significantly contribute to mitigating the adverse impacts of consumption, particularly in preventing food waste (Schrank et al., 2023; Wang et al., 2022; Wu et al., 2022). Furthermore, the role of price consciousness, as a mediating variable in the association between price promotions offered by food delivery service applications and consumers' environmental knowledge regarding efforts to reduce food waste, was also examined. The underlying rationale was that individuals who prioritised price considerations when purchasing food were more inclined to economise their expenses and opt for lower-priced offers during particular occasions (Wang et al., 2020). Consequently, they conscientiously evaluated potential financial losses associated with their consumption practices, ultimately fostering behaviours that contribute to reducing food waste (Aschemann-Witzel et al., 2017).

It was also a main goal to examine the impact of promotions in food delivery apps, the environmental knowledge of reducing food waste, and subjective norms on the sustainable behaviour of Generation Z in Indonesia. The current research can be distinguished from previous studies by focusing on the combination of variables, especially the development of the TPB within the respondent context. However, a special emphasis was placed on the demographic focus of Generation Z, which has more impulsive characteristics in buying products and is more familiar with technology. On the other hand, the purchasing motivation of Generation Z is often dominated by hedonistic motivation and is sensitive to price but also has high awareness related to environmental conservation issues compared to older generations (Gazzola et al., 2020; Koch et al., 2020). In fact, prior studies have also examined the younger generation's consumption of sustainable goods in Indonesia, particularly concerning sustainable-sounding foods and products (Chen et al., 2021; Kristia, 2021, 2022). Nevertheless, there is a scarcity in the discourse surrounding post-consumption elements, namely the behaviour of food waste, which is crucial to achieving sustainable consumption. Therefore, author explored a recently emerging contextual area, specifically the increasing prevalence of price promotions provided by food delivery service applications and their influence on food waste behaviour among the Z Generation population. Past studies have had mixed results regarding how promotions, knowledge and subjective norms impact ethical consumption behaviour, especially in reducing food waste. Therefore, a more nuanced understanding should be provided by considering other factors that may affect this relationship, such as price consciousness, attitudes towards food waste, perceived behavioural control and subjective norms. These variables are essential because they align with the TPB, a widely-used framework for understanding consumer behaviour. By exploring these mediating variables,

authors aimed to offer a more comprehensive understanding of how promotions, knowledge and subjective norms can influence food waste reduction. The following research hypotheses were formulated:

H1: Promotion has a significant effect on sustainable behaviour towards food waste
H2: Gen Z's knowledge of food waste reduction significantly influences their sustainable behaviour towards food waste.
H3: Subjective norms play a significant role in Gen Z's sustainable behaviours towards food waste.
H4: Price consciousness mediates the relationship between promotion effectiveness and Gen Z's sustainable behaviour towards food waste.
H5: Attitudes mediate the relationship between knowledge and Gen Z's sustainable behaviour towards food waste.
H6: Attitudes mediate the relationship between subjective norms and Gen Z's sustainable behaviour towards food waste.
H7: Perceived behavioural control mediates the relationship between promotion effectiveness and Gen Z's sustainable behaviour towards food waste.
H8: Perceived behavioural control mediates the relationship between Gen Z's knowledge of food waste reduction and their sustainable behaviour towards food waste.

2. Theoretical background

2.1. The relationship between price promotion and sustainable behaviour towards food waste

A common strategy, companies use to employ in order to gain and maintain a stable customer base, is through price promotions that involve reducing the cost of services or providing financial incentives to attract new customers, foster loyalty among existing ones, and encourage more frequent service use (Chang and Su, 2022; Katt and Meixner, 2020; Watt et al., 2020). In Indonesia, food delivery apps frequently offer promotions such as discounted food prices, free delivery, exclusive, time-limited offers, and bundled product discounts to entice customers (Hasbi et al., 2022). There is a great concern that price incentives and promotions, aiming to stimulate consumer purchasing, may inadvertently contribute to the generation of both edible food waste and waste from food packaging to ensure food quality during delivery (Islam, 2020; Moshtaghian et al., 2021). Previous research has produced contradictory findings regarding the relationship between promotion and responsible food waste disposal behaviour. Some of the studies found that consumers who took advantage of promotions offered by sellers tended to waste more food (Graham-Rowe et al., 2014; Schmidt, 2016; Setti et al., 2016; Silvennoinen et al., 2014; Tsalis et al., 2021; Williams et al., 2012) or that there was a negative relationship between promotion and food waste reduction behaviour. Several qualitative studies also revealed that the underlying reason for this was that consumers who utilised promotions such as "buy one, get one free" (Silvennoinen et al., 2014) or buy in bulk (Farr-Wharton et al., 2014) would necessarily purchase more products than intended, thereby increasing the likelihood of food waste. Various contextual factors, including culture and habits, influence the relationship between price-conscious consumers and their food waste. In the European context, customers seeking out price promotions tended to exhibit a higher frequency of food waste (Hengi and House, 2022). This can be attributed to their inclination to purchase food items that did not align with their taste preferences, resulting in an excess quantity surpassing their needs (Eičaitė et al., 2021; Ilakovac et al., 2020). On the contrary, other research found that there was a significant and positive relationship between promotions and responsible food waste behaviour (Aschemann-Witzel et al., 2017; Calvo-Porral et al., 2017); namely, the more interested a group of consumers were in using promotions offered by sellers to purchase, the more responsible they were with the products

they have purchased in terms of not wasting food. Consumers who prioritised price tended to meticulously shop to identify the most cost-effective alternative that offered comparable quality. Individuals would refrain from purchasing excessive quantities of products, and during the post-consumption phase they would also be reluctant to discard unconsumed food if unable to consume it in a single instance (Ang et al., 2021; Aschemann-Witzel et al., 2017). Due to the discrepancies in findings with respect to the impact of promotions on food waste, authors had a keen interest in testing the following hypothesis:

H1. Promotion has a significant effect on sustainable behaviour towards food waste

2.2. The relationship between knowledge and sustainable behaviour towards food waste

Knowledge of food waste reduction is a person's insight and understanding of strategies to reduce and even prevent food waste generated to reduce the adverse impact of their consumption on the environment (Attiq et al., 2021b; Limon and Villarino, 2020; Soma et al., 2020). Such awareness encompasses knowing how to correctly store and reuse edible surplus food, devising meal plans to avoid excess, regulating serving sizes, and composting food no longer fit for consumption (Knezevic et al., 2019; Zębek and Žilinskienė, 2021). Prior research has established an indirect relationship between environmental preservation knowledge and food waste behaviour (Aydin and Yildirim, 2021; Wang et al., 2019). Individuals who comprehended the environmental impacts caused by their consumption behaviour have been shown to decrease food waste and repurpose unconsumed food to avoid waste (Attiq et al., 2021b; Fanelli, 2019). Personal norms, driven by awareness and knowledge of the consequences of the consumption process, significantly influenced an individual's intention to reduce the amount of food wasted (Chun T'ing et al., 2021). However, it was also demonstrated by several studies that an individual's knowledge of environmental preservation and the consequences of the consumption habits might not directly impact the actual environmental protection behaviour (Das and Ramalingam, 2019; Debora Indriani et al., 2019). Within the context of respondents from Indonesia, it was also found that knowledge had no significant effect on sustainable behaviour (Ruf et al., 2016). To promote the translation of prior knowledge into more sustainable consumption behaviour, it is imperative to consider the influence of mediating variables such as attitude towards environmentally friendly consumption behaviour, perceived behavioural control, and price consciousness (Ayar and Gürbüz, 2021; Dabbous and Tarhini, 2019; Debora Indriani et al., 2019; Park and Lin, 2020; Wang et al., 2019). The impact of an individual's environmental knowledge on ecologically friendly behaviour has yielded inconsistent results, leading the authors to propose the following hypothesis for further investigation:

H2. Knowledge of food waste reduction has a significant effect on sustainable behaviours towards food waste.

2.3. The relationship between subjective norms and sustainable behaviour towards food waste

Subjective norms are one of the variables in the TPB, which refer to the social influences individuals encounter from various sources, including parental guidance, the opinions of close acquaintances, and the norms established within their community (Madden et al., 1992; Tarkiainen and Sundqvist, 2005). Such influences can significantly impact the decision-making process, particularly concerning responsible consumption and food waste reduction (Kim and Hall, 2019; Elshaer et al., 2021; Bellany and Corkery, 2020; Falasconi et al., 2019; Liu and Nguyen, 2020; Wikström et al., 2019). Collectivist societies, like Saudi Arabia, China, and Indonesia, emphasised the role of subjective norms in shaping behaviour due to cultural values of conformity and resistance to deviation (Elshaer et al., 2021; Ng et al., 2020). The influence of

subjective norms on food waste behaviour can also vary depending on other specific contexts, such as the share of persons living alone or with their family. Specifically, in households with multiple occupants, subjective peer pressure played a significant role in shaping an individual's behaviour towards food waste (Bell and Ulhas, 2020). It was also indicated that individuals in solitary living exhibited responsible food waste behaviours, including proactively planning meal patterns and portions and utilising leftover food items (Stancu et al., 2016). Present study examined the influence of subjective norms on both groups of Generation Z, those who still live with their families and those living in single-person households.

H3. Subjective norms have a significant effect on sustainable behaviours toward food waste.

2.4. The mediating role of price consciousness in the relationship between promotion towards sustainable food waste behaviour

Price consciousness pertains to an individual's level of attention towards the financial consequence of purchasing a product or service (Jose et al., 2020). Those with a high degree of price consciousness were inclined to compare similar-quality products to seek more economical options (Balakrishnan et al., 2014; Schmidt et al., 2020). They might also exhibit a favourable response to marketing approaches that involved price promotions (Djafarova and Foots, 2022; Zhang et al., 2021). However, their emphasis on cost-related aspects could lead to reduced product loyalty (Mohammed and Murova, 2019). Generation Z is a cohort, characterised by the proficient utilisation of internet-enabled devices, which could gain access to information on sustainability matters, especially on the significance of reducing food waste (Su et al., 2019). This heightened awareness can be attributed to the proliferation of influencers disseminating knowledge on environmental preservation and educational institutions such as schools and universities actively promoting sustainable lifestyles (Nikolić et al., 2022; Orea-Giner and Fusté-Forné, 2023). In the context of young consumers in developed nations, such as the United States, multiple studies have indicated that Generation Z preferred purchasing products that possessed ethical value and demonstrated a commitment to environmental sustainability. Furthermore, this demographic segment was willing to pay extra for brands that advocated by socially and environmentally beneficial causes (Kristia, 2021, 2022; Ming et al., 2022). Nevertheless, implementing sustainable purchasing behaviour among Generation Z consumers might face obstacles arising from financial limitations, particularly among the lower middle class (Fogarassy et al., 2020; Kreuzer et al., 2019; Maciaszczyk et al., 2022). This segment of the younger generation was susceptible to price sensitivity and exhibited heightened affordability consciousness (Djafarova and Foots, 2022; Tunio et al., 2021; Ziesemer et al., 2021). Price promotions provided consumers with an enhanced value for their money and a potential to engage in excessive food ordering above their actual requirements (Watt et al., 2023). However, when influenced by price consciousness, which means that customers are more cautious in evaluating financial consequences, it was anticipated that consumers would exhibit greater mindfulness and refrain from squandering the acquired things (Janssens et al., 2019; Savelli et al., 2020; Silvestri et al., 2022). Hence, the following hypothesis were developed:

H4. Price consciousness mediates the relationship between promotion and sustainable behaviour towards food waste

2.5. The mediating role of attitude in the relationship between knowledge and subjective norms towards sustainable food waste behaviour

Attitude refers to an individual's assessment and perception of specific objects or behaviours (Madden et al., 1992). The present study examined an individual's attitude towards responsible behaviour concerning food waste behaviour. Based on the TPB, individuals with a favourable attitude towards managing and reducing food waste were more inclined to translate this attitude into tangible behavioural actions (Nunkoo et al., 2020; Przezbórska-Skobiej and Wiza, 2021). The knowledge-attitude-behaviour model posited that knowledge acquisition influenced an individual's cognitive processes, perception, and attitudes, manifesting in observable behaviours (Chen et al., 2022; Dhir et al., 2021). Within food waste, attitude could serve as a mediating factor, a catalyst for behaviour and a lens through which an individual's information could be filtered (Zand et al., 2020). Consequently, individuals were compelled to undertake behaviours to diminish the quantity of food waste generated. Merely understanding the detrimental consequences of food waste, and being well-informed on strategies to mitigate it, might not be sufficient to motivate individuals to behave responsibly (Heeren et al., 2016). However, cultivating a positive attitude would encourage translating this knowledge into practical action (Amoako et al., 2020; Liu et al., 2020b).

The role of attitude in mediating the association between subjective norms and responsible food waste behaviour could also be observed. The more positive outlook someone had and the more someone adhered to personal norms of sustainable living, the more likely it was to act accordingly (Bandanuka et al., 2020; Elshaer et al., 2021; Mejia et al., 2021; Tsai et al., 2020). The influence of subjective norms and social factors, such as family, close friends and respected individuals, could significantly impact an individual's attitudes towards adopting sustainable practices, particularly concerning food waste reduction. These influences could form an individual's perception of responsible behaviour towards food waste and elicit feelings of guilt when engaging in wasteful practices (Janssens et al., 2019). Observing the behaviour of individuals in their immediate social circles about meal preparation, food storage and utilisation of leftovers had the potential to foster a constructive attitude towards food waste reduction (Essiz and Mandrik, 2022). This might result in a diminished sense of reluctance towards reheating and repurposing leftover food, and an engagement in innovative composting practices to salvage edibles that are no longer fit for consumption (Andrews et al., 2018; Kopaei et al., 2021). Therefore, researchers explored how attitude mediated the connection between knowledge, subjective norms, and responsible food waste behaviour.

H5. Attitudes mediate the relationship between knowledge and sustainable behaviour towards food waste

H6. Attitudes mediate the relationship between subjective norms and sustainable behaviour towards food waste

2.6. The mediating role of perceived behavioural control in the relationship between promotion and knowledge towards sustainable food waste behaviour

Perceived behaviour control, as a component of the TPB, refers to an individual's subjective assessment of the level of ease. It is associated with engaging in specific behaviours and their perceived ability to overcome obstacles to enact these behaviours (Ajzen, 2020). It arises from positive experiences, self-assurance in abilities, access to resources and sufficient knowledge, all of which contribute to one's confidence in taking an effective action (van Geffen et al., 2020). In the context of this study, this perception was specifically relevant to the pursuit of sustainable food waste behaviour. Based on the TPB, individuals with a heightened sense of perceived behavioural control were more likely to manifest their intended behaviour (Madden et al., 1992; Stancu et al., 2016). One of the hypotheses was that perceived behavioural control can mediate the relationship between promotions and sustainable food waste behaviour on the basis of price promotions which can make foods financially more feasible for customers, providing more control over portion sizes and meal planning, and potentially reducing food waste (de Moraes et al., 2020). The effect of price promotion utilisation on perceived behavioural control and food waste reduction behaviour is complex, and only a few studies discussed this relationship (Sawada

et al., 2019). However, recent findings indicated that households that utilised multi-unit deals promotions supported by proper food storage, such as frozen excess food, reported wasting less food than households that purchased products at regular prices (van Lin et al., 2023). van Lin et al. (2023) findings indicate that if consumers have reasonable perceived behavioural control, such as storing food properly and making wise use of promotions provided by retailers, they are likely to generate less food waste. Acquiring knowledge of the skills and techniques required for managing meal amounts, storing leftovers, and employing food reprocessing methods can enhance an individual's sense of competence in minimising food waste (Galván-Mendoza et al., 2022). Consequently, heightened perceived behavioural control should be translated into tangible efforts to reduce food waste. Based on the above mentioned, the following hypotheses were developed:

H7. Perceived behavioural control mediates the relationship between promotion and sustainable behaviour towards food waste

H8. Perceived behavioural control mediates the relationship between knowledge and sustainable behaviour towards food waste

Present research contributed to the current knowledge base by investigating various factors that influence sustainable behaviour towards food waste among the Indonesian Generation Z. Authors aimed to bridge the research gap in the existing literature by conducting a thorough analysis of the interaction between technological advances (such as promotion offered by delivery service application, knowledge, subjective norms) and mediating variables (including price consciousness, perceived behavioural control, attitude in influencing sustainable behaviour towards food waste).

3. Methodology

3.1. Participants and design

A quantitative approach was employed by using a questionnaire in order to collect primary data. The questionnaire was administered via a Google form and the link was shared through various channels including WhatsApp groups, status updates, and referrals from students and university lecturers. The respondent population in this study was Generation Z, who used food delivery service applications in Indonesia. The number of food delivery service application users in Indonesia until the beginning of 2023 was around 19.85 million users (Statista, 2021). For a population size that exceeded 1 million, a minimum of 384 samples was required (Krejcie and Morgan, 1970), while in this study, the authors used 561 respondents, which exceeded the minimum sample requirement. To ensure representativeness, purposive and quota sampling methods were used. The purposive sampling criteria were Generation Z, who recently made food purchase transactions by using food delivery service applications such as GoFood, GrabFood, ShopeeFood and other applications. Next, quota sampling was used to increase the sample's representativeness in terms of geographical distribution. Questionnaires were distributed to universities in Central Java, Yogyakarta, Jakarta, East Java, West Java, Bali, Kalimantan, Sumatra, and Nusa Tenggara. Most of the participants were from Java island, which included Jakarta and its surroundings (27%), Yogyakarta and Central Java (35%), West Java (18%), and East Java (18%). According to the latest estimates, Java hosted the most significant number of users for food delivery applications in Indonesia, owing to its high internet user population and numerous universities on the island (Abrar, 2020). A mere 2% of the respondents came from other areas outside of Java island. Authors also tried to ensure gender representativeness in the sample. Indonesia's food delivery app users were almost equally split between men and women but with a slightly higher number of female users (Rakuten Insight, 2023). Regarding gender representation, the authors utilised a Chi-Square test to compare the gender proportions of the current survey to a previous survey conducted by Rakuten Insight in 2023, which had

9874 participants. Table 2 displayed the Chi-Square test results according to which a Pearson's Chi-square value of 0.280 was obtained with an Asymptotic Significance (2-sided) of 0.597, surpassing the 5% significance level. The Continuity Correction method, Likelihood Ratio, Linear-by-Linear Association and Fisher's Exact Test also produced similar findings as p-values were greater than 0.05. These results suggested no significant difference between the gender distribution in the research survey sample and the previous survey (Rakuten Insight, 2023), indicating the presence of gender representation with a proportion of 43.6% male respondents and 56.3% female respondents.

The survey commenced with a cover letter explaining the research objectives, the required characteristics of the respondents and respondents were assured that their participation would be anonymous and the provided information would remain confidential. The subsequent section of the survey pertained to the demographic attributes of participants, encompassing inquiries with respect to gender, residential arrangement, average monthly expenditure on shopping via a food delivery application, and the preferred food delivery application (Fig. 1). A total of 561 valid responses were gathered through the questionnaire distribution process. Regarding gender, the survey yielded that 43.6% of the participants were male (245 respondents) and 56.3% were female (316 respondents). Concerning the prevailing meal delivery service application platforms, it was observed that the most commonly used food delivery apps were ShopeeFood (43.4%), followed by GoFood (38.8%) and GrabFood (17.6%). As for monthly spending on food delivery, the majority of respondents (73.2%) reported spending less than 300,000 rupiahs per month; 17.6% of respondents spent between 300,000 and 599,000 rupiahs per month, while 3.2% spent between 600,000 and 899,000 rupiahs. The remaining respondents reported spending more than 900,000 rupiahs per month. In terms of the type of residence, it was found that 360 (64.1%) respondents lived in boarding houses; 159 (28.3%) respondents lived at home with parents or family; 37 (6.5%) respondents lived in a rented house; and 5 (0.8%) respondents lived in an apartment.

3.2. Measures

The questionnaire items were carefully selected and adapted from prior research instruments to ensure validity and reliability, as shown in Table 1. The survey used a five-point Likert scale, where 1 represented strong disagreement and 5 indicated strong agreement. The promotion of the food delivery service application variable was adapted from a study examining similar variables in the context of online food delivery services in Indonesia [13] and was complemented by the authors with the price promotion type often offered by food delivery service platforms. The questions used to measure knowledge were derived from scholarly investigations conducted in Romania (Burlea-Schiopoiu et al., 2021), Turkey (Aydin and Yildirim, 2021) and Malaysia (Jarjusey and Chamhuri, 2017), which explored the understanding of strategies to mitigate the consequences of food waste on environment. In order to measure the price-consciousness variable, multiple studies were used which examined the impact of price focus (Aschemann-Witzel et al., 2017), financial attitudes (Aktas et al., 2018) and financial concerns (Attiq et al., 2021a) on consumer response to promotional stimuli provided by retailers and their impact on food waste. The questions, which measured attitude (Aktas et al., 2018; Aydin and Yildirim, 2021; Talwar et al., 2022), perceived behavioural control (Al Amin et al., 2021; Talwar et al., 2023a,b) and subjective norms (Elhoushy and Jang, 2021; Talwar et al., 2023a), were selected from various studies incorporating variables from the TPB to examine the impact on food waste behaviour. Lastly, the questions, that were used to measure sustainable behaviour towards food waste, were adapted from prior studies that explored responsible food waste behaviour through meal planning, management of excess food storage, willingness to consume leftovers and decomposition of food unsuitable for eating (Burlea-Schiopoiu et al., 2021; Chen, 2019; Talwar et al., 2021).
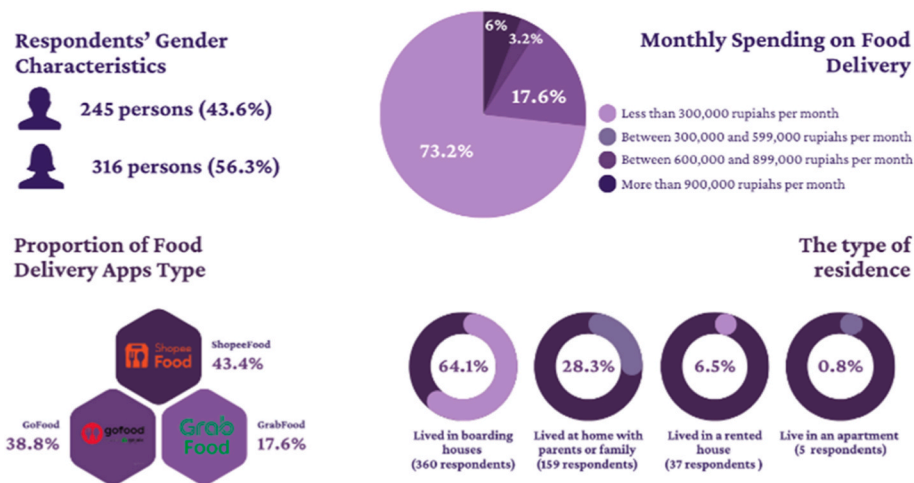
Fig. 1. Respondents' demographic characteristics.
Source: authors' own elaboration.

3.3. Data processing procedures

The data collected from survey responses were analyzed by Structural Equation Modeling—Partial Least Squares (SEM-PLS) approach using SMART-PLS 4 software. This method was selected due to its capability to manage sophisticated relationships between multiple variables including direct, indirect and mediating effects (Teoh et al., 2022). In order to extend existing theories like the TPB, novel variables and relationships were also introduced such as the impact of price promotion and price consciousness on responsible food waste behaviour. Data processing involved two stages, the measurement model (relationships between the latent consturcs and their variables) and structural model (relationships between the latent constructs) evaluation. Firstly, the measurement model evaluation consisted of the assessment of the indicator reliability, internal consistency, convergent validity and discriminant validity. Secondly, the structural model evaluation stage included the collinearity test, the significance and relevance of structural model relationships and the explanatory power of the model (Hair et al., 2019; Sarstedt et al., 2022).

4. Results

4.1. Measurement model evaluation

The indicator reliability means the extent of indicator variance that is explained by its corresponding construct and is equal to the squared factor loadings. So as to explain at least 50% of the variance, factor lodings should be at least 0.7 (Sarstedt et al., 2022). Factor loadings of all questionnaire items surpassed the desired threshold of 0.7 (Table 1). Two questionnaire statements, namely "I am aware when there is an increase in the price of the food that I often buy (Aktas et al., 2018)" from price consciousness construct and "I will share my excess food with friends or loved ones, rather than throwing it away (Burlea-Schiopoiu et al., 2021)" from sustainable food waste behaviour construct, had lower factor loadings than 0.7 and should be omitted from further analysis. Despite that previous studies have shown validity of both questionnaire statements, they were proved to be unreliable when applied to Indonesian Z Generation respondents. Internal consistency was assessed by calculating the Cronbach Alpha and composite reliability values. These values could be considered satisfactory as they fell between 0.7 and 0.9 (Aburumman et al., 2023) indicating reliable constructs (Table 1). Concerning the convergent validity of the variables, it can be observed that all average variance extracted (AVE) values surpassed the desired threshold of 0.5 (Sarstedt et al., 2022). This

indicated that each latent construct explained over 50% of the observed variance of its own indicators.

In previous research studies there were two reliable methods to assess discriminant validity, Fornell-Larcker and Heterotrait-Monotrait Ratio of Correlations (HTMT). The Fornell-Larcker approach, outlined in Table 3, affirmed that all latent constructs were unique from one another. This was evident because the Average Variance Extracted (AVE) of each latent construct was higher than the squared correlations between the given latent construct and all other constructs (Sarstedt et al., 2022).

HTMT measured the similarity between latent constructs. Table 4 displayed the HTMT analysis and showed that all values were below the threshold of 0.85 (Hair et al., 2019). Hence, all constructs met the discriminant validity and were distinct.

4.2. Structural equation model evaluation

The evaluation of the structural equation model involved the examination of multicollinearity (highly correlated variables) by calculating the so called Variance Inflation Factor (VIF). This value for each construct should be and was below the threshold of 5 (Becker et al., 2015), as shown in Table 5. This indicated the absence of multicollinearity and therefore the next stage, the examination of the statistically significant path coefficients and effects (both direct and indirect), could be started.

In order to examine the proposed hypotheses, the authors performed a significance analysis on the path coefficients through the bootstrapping process, as presented in Table 6. 5000 subsamples were used during the calculation in SmartPLS, which means that the software resampled the data 5000 times to estimate the sampling distribution of the estimators (Sarstedt et al., 2019). The bias-corrected and accelerated bootstrap method was employed to compute the confidence intervals. This method is advantageous as it can effectively address any bias or skewness within the sampling distribution and yields more accurate confidence intervals (Becker et al., 2023). A two-tailed test with a 5% significance level was used to determine whether the exogenous variables had a negative or positive effect on the endogenous variables. The results indicated that the hypothesised direct relationships between promotion and sustainable food waste behaviour (H1) and relationships between knowledge and sustainable food waste behaviour (H2) were statistically insignificant as t-statistics were less than 1.96/p-values were grater than 0.05/(Sarstedt et al., 2022). Based on the findings, hypotheses 1 and 2 could be rejected, indicating that the direct impact of promotion and awareness on responsible behaviour for mitigating food

Table 1
Measurement model.

Constructs	Item Code	Questionnaire Items	Factor loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Promotion of food delivery service application (Prasetyo et al., 2021)	PR1	Food price discount promos make me interested in ordering food immediately.	0.846	0.868	0.905	0.656
	PR2	I feel that the free delivery vouchers offered on the application make me interested in ordering food immediately.	0.853			
	PR3	Promos that offer cheap delivery costs have made me interested in ordering food on the online food delivery service application.	0.842			
	PR4	Time-limited discount promos (for example, daily discounts or price discounts only at certain hours) make me interested in ordering food on the online food delivery service application.	0.761			
	PR5	The food bundling promo (e.g., buy one get one free) offered by the online food delivery service application made me interested in ordering food.	0.740			
Knowledge related responsible food waste (Aydin and Yildirim, 2021; Burlea-Schiopoiu et al., 2021; Jarjusey and Chamhuri, 2017)	K1	I know how to lessen the amount of food that goes to waste.	0.813	0.829	0.886	0.661
	K2	I have knowledge on the bad impact on the environment caused by food waste.	0.842			
	K3	I have knowledge on how to store excess food so it doesn't spoil easily.	0.793			
	K4	I have the knowledge that reducing food waste is one of the efforts to preserve the environment.	0.803			
Price consciousness (Abdelradi, 2018; Aktas et al., 2018; Aschemann-Witzel et al., 2016, 2017; Attiq et al., 2021a)	PC1	I am interested in buying food when it is cheap.	0.734	0.712	0.822	0.536
	PC2	When I go shopping for food, I check prices of similar items and buy the ones that are the least expensive.	0.707			
	PC3	I always check the price before buying food.	0.732			
	PC4	I always try to get the best quality food at the most affordable price.	0.756			
Attitude (Aktas et al., 2018; Aydin and Yildirim, 2021; Talwar et al., 2022)	ATT1	Wasting food makes me feel guilty.	0.828	0.923	0.940	0.722
	ATT2	Wasting food is against my conscience.	0.869			
	ATT3	Wasting food makes me feel bad.	0.889			
	ATT4	Wasting food is against my morals.	0.841			
	ATT5	Wasting food in vain makes me feel regretful.	0.870			
	ATT6	I was brought up to think that food shouldn't go to waste, and I still believe this.	0.798			
Perceived behavioural control (Al Amin et al., 2021; Talwar et al., 2023a)	PBC1	I do not find it difficult to minimise the amount of food I waste.	0.747	0.848	0.891	0.622
	PBC2	I do not experience problems in the process of storing the excess food that I have.	0.811			
	PBC3	I have no problems reprocessing the excess food that I have.	0.798			
	PBC4	I don't experience problems determining my portion of food so that later there is no food left.	0.792			
	PBC5	I have no problem finishing the food that I have bought.	0.792			
Subjective norms (Elhoushy and Jang, 2021; Talwar et al., 2023a)	SN1	The people closest to me think minimising food waste is good.	0.804	0.814	0.877	0.642
	SN2	My family encourages me to minimise the amount of food I waste.	0.795			
	SN3	My closest friends think that wasting food is a bad thing.	0.805			
	SN4	The people closest to me try not to waste food in vain.	0.801			
Sustainable behaviour towards food waste (Burlea-Schiopoiu et al., 2021; Chen, 2019; Talwar et al., 2021)	FWB1	I try to control the portion of food so as not to waste food.	0.773	0.850	0.893	0.626
	FWB2	I try to minimise wasted food.	0.814			
	FWB3	I will reheat the excess food from the previous meal and consume it later if it is still fit for consumption.	0.853			
	FWB4	I consume my own leftovers to save.	0.764			
	FWB5	I try to process excess food before it spoils.	0.747			

Source: authors' own calculation

waste was inconclusive. The effect of subjective norms on sustainable behaviour towards food waste (H3) was proved to be statistically significant (t-value = 6.104; $p < 0.001$). The direction of the relationship between subjective norms and sustainable food waste behaviour was positive as the path coefficient was 0.254, which means that more favourable subjective norms resulted in higher sustainable behaviour towards food waste.

In order to examine the mediating effect of attitude, perceived behavioural control and price consciousness (H4 - H8), it was necessary to review the significances of the indirect effects, as shown in Table 6. All t-values exceeded the critical value of 1.96, hence the p-values were below 0.05 (Hair et al., 2019; Sarstedt et al., 2022), which indicated that all indirect effects of the tested mediation variables were significant. Price consciousness, attitude, and perceived behavioural control fully mediated the relationship between promotion and knowledge of sustainable food waste behaviour, therefore H4, H5, H7 and H8 could be

Table 2
Chi square test of gender representativeness.

	Value	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.280[a]	0.597		
Continuity Correction[b]	0.236	0.627		
Likelihood Ratio	0.280	0.597		
Fisher's Exact Test			0.599	0.314
Linear-by-Linear Association	0.280	0.597		

Source: authors' own calculation

supported. Regarding the Indonesian Generation Z, promotion and knowledge can influence sustainable food waste behaviour if mediated by price consciousness, favourable attitude regarding food waste reduction efforts, and reasonable perceived behavioural control. The mediating effect of attitude on the relationship between subjective norms and sustainable food waste behaviour (H6) was partial and complementary because without the presence of attitude, subjective norms can also significantly affect (directly) sustainable food waste behaviour, and both effects (direct and indirect) were equally positive.

The effect sizes of the mediation effects measured the strength of the indirect relationship and can be assessed by calculating the upsilon value (Lachowicz et al., 2018), as presented in Table 7. The magnitude of the mediation effect size of price consciousness and price behavioural control in the context of the association between promotion and sustainable food waste behaviour was relatively low, as the upsilon values were 0.004 and 0.01, respectively. The mediation effect size of perceived behavioural control on the association between knowledge and sustainable food waste behaviour was 0.023, indicating a medium effect. This classification was based on the criterion that the value should be within the range of 0.01 and 0.075 (Ogbeibu et al., 2021).

The R^2 measures were analyzed to evaluate the explanatory power of the inner regressions and the quality of the structural model by calculating the proportion of variance in the dependent variable explained by the independent variables (Hair et al., 2021). Table 8 showed that the Adjusted R^2 value on price consciousness was 0.162, which suggested

that the promotion variable explained only 16.2% of the variance of price consciousness. However, the knowledge and promotion offered by the food delivery service application had a moderate explanatory power of 37.7% on the perceived behavioural control variable. Similarly, knowledge had moderate explanatory power on the subjective norms towards the attitude of sustainable food waste behaviour, which was 44.1%. Sustainable behaviour towards food waste can be explained by all the independent variables involved in the study by 63.7%, which could be classified as a moderate explanatory power (Hair et al., 2021). The Q^2 value was necessary to assess the model's predictive relevance or capability when applied to a sample with a holdout and its capacity to generalise newly collected data (Sarstedt et al., 2022). Table 8 presented that all endogenous variables, namely price consciousness, perceived behavioural control, attitude, and sustainable food waste behaviour, have Q^2 values that were grater than 0, indicating that the exogenous factors possessed predictive relevance to their respective endogenous variables (Sarstedt et al., 2022). The suitability of the model, based on the collected empirical data, can be evaluated by looking at the Standardized Root Mean Square Residual (SRMR) value. The SRMR value in this study was 0.10, which still fitted the data (Schermelleh-Engel et al., 2003). The summary of the conceptual framework as well as the path coefficients were shown in Fig. 2. The R^2 values were given only in case of the endogenous variables, while path coefficients and p-values were reported on each arrow connecting variables of the inner model.

Table 9 utilised the f^2 value to evaluate the degree to which the independent variables explained the variance in the dependent variable at a structural level. The findings indicated that knowledge greatly impacted perceived behavioural control, with a value of 0.455, surpassing the threshold of 0.35 (Hair et al., 2019, 2021). The effects of promotion on price consciousness and subjective norms on attitude were medium as the f^2 values were within the range of 0.15–0.35 (Hair et al., 2019, 2021). Following the significance test results on the path relationship, promotion and knowledge did not affect sustainable food waste behaviour (f^2 values were 0.001).

5. Discussion

The study found that promotion did not directly affect the pattern of environmentally friendly behaviour, specifically to minimise food waste produced, contrary to the initial hypothesis (H1). Regarding the

Table 3
Fornell-Larcker criterion.

	Attitude	Sustainable Food Waste Behaviour	Knowledge	Perceived Behavioural Control	Price Consciousness	Promotion	Subjective norms
Attitude	0.722						
Sustainable Food Waste Behaviour	0.458	0.626					
Knowledge	0.255	0.270	0.661				
Perceived Behavioural Control	0.301	0.415	0.360	0.622			
Price Consciousness	0.231	0.276	0.143	0.116	0.536		
Promotion	0.067	0.101	0.088	0.098	0.163	0.656	
Subjective norms	0.388	0.448	0.231	0.308	0.210	0.094	0.642

Note: Average Variance Extracted (AVE) can be seen across the main diagonal, squared correlations are given below the main diagonal.
Source: authors' own calculation

Table 4
Heterotrait-Monotrait ratio of correlations (HTMT).

	Attitude	Sustainable Food Waste Behaviour	Knowledge	Perceived Behavioural Control	Price consciousness	Promotion
Sustainable Food Waste Behaviour	0.758					
Knowledge	0.577	0.619				
Perceived Behavioural Control	0.618	0.753	0.714			
Price consciousness	0.591	0.673	0.488	0.434		
Promotion	0.288	0.366	0.349	0.365	0.507	
Subjective norms	0.718	0.796	0.584	0.666	0.598	0.364

Source: authors' own calculation

Table 5
Variance inflation factor (VIF).

Constructs	Item Code	VIF
Promotion of food delivery service application	PR 1	2.203
	PR 2	2.621
	PR 3	2.426
	PR 4	1.738
	PR 5	1.561
Knowledge	K1	1.786
	K2	2.026
	K3	1.647
	K4	1.718
Price Consciousness	PC1	1.366
	PC2	1.315
	PC3	1.409
	PC4	1.406
Attitude	ATT1	2.783
	ATT2	3.224
	ATT3	3.382
	ATT4	2.742
	ATT5	2.931
	ATT6	2.018
Perceived Behavioural Control	PBC1	1.681
	PBC2	2.234
	PBC3	2.048
	PBC4	1.887
	PBC5	1.886
Subjective norms	SN1	1.791
	SN2	1.751
	SN3	1.931
	SN4	1.900
Sustainable Food Waste Behaviour	FWB1	2.345
	FWB2	2.637
	FWB3	2.483
	FWB4	2.211
	FWB5	2.001

Source: authors' own calculation

Table 6
Direct effects on stainable food waste behaviour.

Hypotheses	Path	Path coefficient	t-statistics	p-value	Conclusion
H1	Promotion → Sustainable Food Waste Behaviour	0.006	0.195	0.845	Not supported
H2	Knowledge → Sustainable Food Waste Behaviour	0.030	0.749	0.454	Not supported
H3	Subjective norms → Sustainable Food Waste Behaviour	0.254	6.104	<0.001	Supported

Source: authors' own calculation

Indonesian Generation Z, instant gratification in the form of discounted food prices and free shipping promotions offered by food delivery service applications did not align with activities aimed at environmental preservation through food waste reduction. There were no discernible directions in the participant feedback regarding price promotions in food delivery apps. While price promotions have the potential to result in over-consumption and worsen the problem of food packaging and waste (Le Borgne et al., 2018; Tsalis et al., 2021), some respondents believe that such promotions and complimentary delivery services can aid in their endeavours to save money while simultaneously cutting down on food waste (Bech-Larsen et al., 2019; Purwanto et al., 2023). Nevertheless, the study did reveal that promotions can influence sustainable behaviour towards reducing food waste when paired with price consciousness (H4 was supported) and perceived behavioural control (H7 was supported). This suggested that the impact of promotional activities on sustainable behaviour was not direct but contingent on other factors. Generation Z, who were price-conscious, tended to leverage inexpensive food deals and other promotional offers while being mindful of their consumption patterns to obtain the best value for their money. This price-consciousness led to more sustainable behaviours, such as controlling food portions, minimising food waste and reprocessing excess food to avoid financial losses. Previous research has indicated that individuals prioritising affordability might encounter obstacles in making eco-friendly purchases with a heftier price tag or opting for healthier alternatives like organic food (Aschemann-Witzel and Zielke, 2017; Yue et al., 2020). Regardless of the findings of the current research, being mindful of prices could encourage sustainable behaviour, even if the effect was relatively small. Perceived behavioural control also significantly influenced the relationship between promotion and sustainable behaviour towards food waste reduction. Price promotions on food delivery platforms could help individuals to control their food portions. This can be particularly helpful for single residents with limited or no food storage facilities, as they can order small portions and enjoy free delivery promotions. Conversely, those with larger families or equipped with adequate food storage facilities can benefit from discounts on food bundling packages. Meal portion control was a component of perceived behavioural control, which had been shown to influence food waste reduction. Although the mediation effect sizes of each price-consciousness and perceived behavioural control were relatively small, they significantly mediated the relationship between promotion and sustainable food wastage behaviour. The theoretical implication of this study was the exploration and substantiation of the

Table 8
Structural Model Assesment (R^2 and Q^2 measures).

Constructs	R^2	R^2 Adjusted	Q^2
Price consciousness	0.163	0.162	0.084
Perceived Behavioural Control	0.380	0.377	0.233
Attitude	0.443	0.441	0.316
Sustainable behaviour towards food waste	0.637	0.633	0.390

Source: authors' own calculation.

Table 7
Indirect effects on sustainable food waste behaviour.

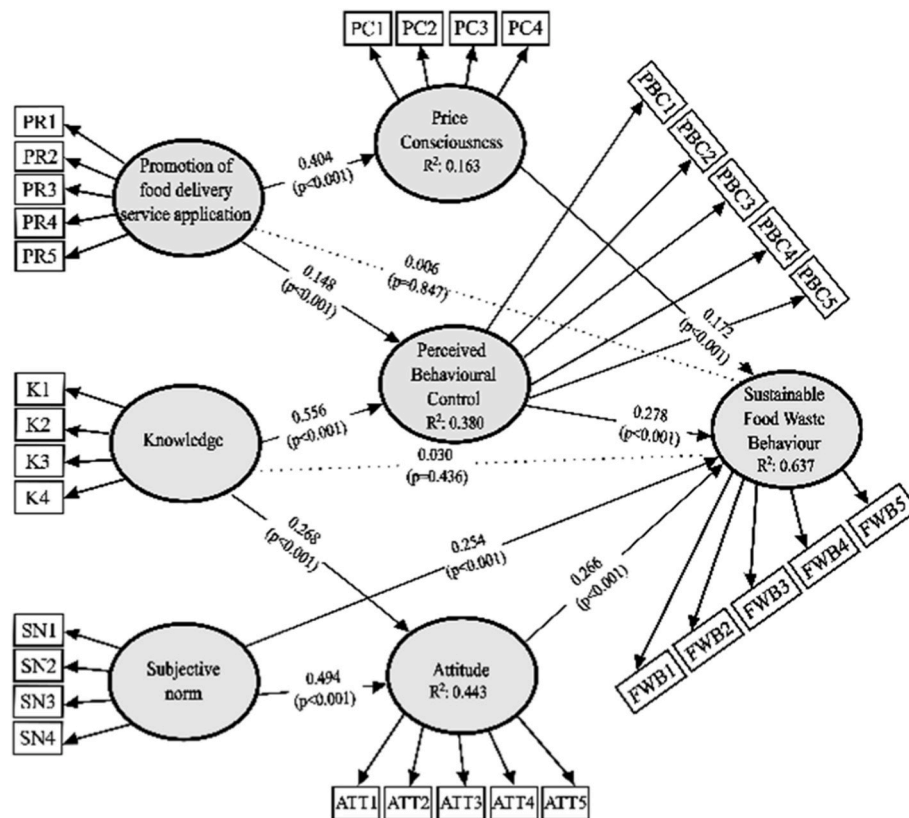| Hypotheses	Path	path coefficient	t-statistics	p-value	Upsilon (υ)	Conclusion
H4	Promotion → Price consciousness → Sustainable Food Waste Behaviour	0.069	3.724	<0.001	0.004	Supported – full mediation
H5	Knowledge → Attitude → Sustainable Food Waste Behaviour	0.071	4.893	<0.001	0.005	Supported – full mediation
H6	Subjective norms → Attitude → Sustainable Food Waste Behaviour	0.131	5.525	<0.001	0.017	Supported - partial mediation
H7	Promotion → Perceived Behavioural Control → Sustainable Food Waste Behaviour	0.041	3.415	0.001	0.001	Supported - full mediation
H8	Knowledge → Perceived Behavioural Control → Sustainable Food Waste Behaviour	0.155	5.578	<0.001	0.023	Supported - full mediation

Source: authors' own calculation

Fig. 2. Final Path Model and coefficients from the bootstrapping.
Source: authors' own calculation.

Table 9
Effect sizes (f^2 measure).

Path	f^2	Effect Size
Promotion → Sustainable behaviour towards food waste	0.001	No effect
Promotion → Price consciousness	0.195	Medium
Promotion → Perceived Behavioural Control	0.032	Small
Knowledge → Attitude	0.099	Small
Knowledge → Sustainable behaviour towards food waste	0.001	No effect
Knowledge → Perceived behavioural control	0.455	Large
Subjective norms → Attitude	0.337	Medium
Subjective norms → Sustainable behaviour towards food waste	0.092	Small
Attitude → Sustainable behaviour towards food waste	0.098	Small
Perceived Behavioural Control → Sustainable behaviour towards food waste	0.110	Small
Price consciousness → Sustainable behaviour towards food waste	0.053	Small

Source: authors' own calculation.

indirect effect of price promotion offered by food delivery service applications in the context of young consumers, especially Indonesian Generation Z, to minimise their food waste. Contrary to previous research findings that expected price promotions by retailers can directly encourage consumers to reduce their food waste (Bech-Larsen et al., 2019), other previous studies have also found that price promotions can cause over-consumption problems (Le Borgne et al., 2018; Tsalis et al., 2021). This research added nuances by revealing how the effects of promotion were mediated through price consciousness and perceived behavioural control to form positive behaviour of the younger generation to minimise their food waste. In terms of practical implications, this research offered valuable insights for food delivery companies and other retailers regarding their responsibility to assist consumers in

reducing their food waste levels, which is also a form of ethical business practice to achieve sustainability goals. Food delivery companies have the potential to take the lead in promoting sustainability by leveraging their platform interface and adapting their marketing strategies. A user-friendly interface that features options for discounted products nearing expiration but still safe for consumption and smaller portion sizes for individuals who live alone and lack storage space for leftovers can contribute to reducing food waste and simplifying portion control for consumers. By incorporating these measures, these companies can align their practices with sustainability initiatives and set themselves apart in a fiercely competitive market.

The study revealed an interesting finding that even though the participants had sufficient knowledge about reducing food waste (such as storing food correctly and reusing leftovers, and were aware of the negative impact of wasting food), this knowledge alone did not necessarily translate into responsible behaviour when it comes to managing food waste. The research was built upon the theoretical foundations of the TPB and emphasised the crucial role of attitude formation and perceived control over one's behaviour in facilitating knowledge translation into tangible action. No direct and significant relationship was found between what young people knew about food waste and their behaviour. Even though some of them understand the environmental impacts of food waste, they may not act to reduce it. Conversely, others who may have limited knowledge still attempt to prevent food waste.

The absence of a direct correlation between knowledge and sustainable food waste behaviour might be attributed to the intricate nature of human behaviour, which was influenced by factors beyond simply awareness and comprehension acquired from a university education or insights obtained through the internet (Heeren et al., 2016; Longo et al., 2019). The realisation of knowledge regarding responsible and sustainable food waste behaviour can be mediated through the influence of attitude variables (hypothesis H5 was supported) and perceived

behavioural control (hypothesis H8 was supported). A person with a positive attitude towards food waste was aware that wasting food was bad and not in line with their conscience; they felt guilty when they waste food and were willing to make efforts to minimise food waste. Knowledge itself was proved to affect attitudes by increasing awareness and cognitive knowledge about the environmental impact of food waste and the importance of reducing it. Likewise, the construct of perceived behavioural control encompassed an individual's perception of the level of ease or difficulty in exerting control over many aspects of food management, such as regulating food quantities, effectively storing and repurposing surplus food, and minimising the generation of food waste. This construct also served as a mediating factor in the association between knowledge and behavioural outcomes. The large f^2 value on the effect of knowledge on perceived behavioural control implied that knowledge enhanced perceived behavioural control by providing practical information on how to reduce food waste, such as storing excess food properly and controlling food portions. To significantly reduce food waste, policymakers should encourage collaboration between players in the culinary industry and educational institutions, including universities. This collaborative effort should emphasise awareness campaigns and aim to cultivate positive attitudes and increase individuals' sense of control over food waste reduction. Positive attitudes can be fostered by providing consumers with an enjoyable experience when they successfully minimise their food waste, interactive educational programs, communication highlighting actionable waste reduction tactics, and a comprehensive approach integrating knowledge dissemination, attitude shaping and perception enhancement. This approach will effectively promote sustainable food waste behaviour.

Subjective norms also had a positive influence on sustainable food waste behaviour (H3 was supported). This suggested that those who held favourable views of social influence and received support from their family and friends were more likely to adopt sustainable food waste behaviours (Apolonio and Lacaza, 2022). Furthermore, it was shown that attitude mediated the relationship between subjective norms and sustainable food waste behaviour, therefore H6 was supported. This implied that when individuals believed that their close social circle supported being accountable for their food waste, they were more inclined to adopt a favourable attitude towards this behaviour. Consequently, this positive attitude motivated individuals to actively engage in sustainable food waste practices [92]. This finding supported the TPB, emphasizing the role of personal attitudes and social norms in encouraging sustainable food waste practices. From a practical perspective, these findings highlighted the need to cultivate positive attitudes and supportive social environments when promoting waste reduction efforts. To achieve this, tactics such as community-led food waste minimization campaigns, influencer endorsements, and customer testimonials can be employed to showcase a collective action towards reducing food waste.

6. Conclusion, limitations, and recommendations

In summary, authors demonstrated the significance of taking into account various factors, including promotion, knowledge, subjective norms, price consciousness, perceived behavioural control and attitude, when examining the development of food waste reduction behaviour among Indonesian individuals of Generation Z, particularly those who utilised food delivery service applications. The study's results indicated that the availability of promotional deals on food delivery service applications did not have a direct impact on promoting sustainable food waste behaviour. However, this influence was mediated through several variables such as price consciousness and perceived behavioural control. The possession of knowledge regarding sustainable food waste did not guarantee an individual's inclination towards responsible behaviour in managing their own food waste. This insight needed to be accompanied by a positive attitude and favourable perceived behavioural control to make someone engage in sustainable behaviour. This work has

demonstrated that individuals were more likely to adopt sustainable food waste behaviour when they had support from their family, friends and close acquaintances who exhibit good subjective norms. Positive subjective norms along with an internal positive attitude were proved to make respondents behave more responsible towards their personal food waste.

The limitations of the study were related to the explanatory power of the model, which seemed moderate. This implied that there might be additional variables, which could potentially influence responsible food waste disposal behaviour. These variables may encompass factors such as time constraints, habits related to waste reduction, moral values, religious beliefs and a range of other variables. The utilisation of purposive sampling, however practical, might impose restrictions on how much the findings could be generalised. Subsequent investigations may employ more stringent sampling techniques, such as stratified random sampling or cluster sampling, to enhance the sample's representativeness. This study exclusively focused on a specific population, namely Generation Z, and its findings may not be directly applicable to developing sustainable food waste behaviour in other demographics with distinct cultural and socioeconomic backgrounds. The present study additionally utilised self-reported data obtained from survey responses, which introduced the possibility of social desirability bias. This bias might arise from the fact that participants often overstate their engagement in sustainable food waste practices due to social influence or motivation to present a favourable self-image. Subsequent investigations may benefit from employing more impartial methodologies to assess food waste behaviour, such as waste audits or environmental input-output analyses.

A unique finding of the research work was, on one hand, that promotion by food delivery service application and knowledge cannot directly influence sustainable food waste behaviour. On the other hand, the influence of subjective norms within the Indonesian Generation Z was confirmed. Moreover, tailored recommendations for Indonesian policymakers, food delivery services and educational institutions were also provided. The article contributed a more nuanced understanding of food waste behaviour and offers actionable strategies for waste reduction involving multiple stakeholders. In order to combat food waste more effectively, all stakeholders must prioritise responsible behaviour over merely profit-driven promotions. Food delivery companies can significantly promote sustainability by educating and empowering Generation Z individuals in Indonesia with the knowledge, skills and resources needed to minimise food waste. Moreover, offering affordable prices and giving consumers control over sustainable food waste behaviour is essential. The food delivery platform has the potential to partner with restaurants and food producers to reduce food waste at the source. One effective strategy is to highlight the affordable food items that may appear unattractive or are approaching their expiration date and still entirely safe to consume. The issue of food waste is not limited solely to the consumer level but also extends to the producer level. Nevertheless, the government and educational institutions should take further steps to promote sustainable living efforts and engage young people in actionable activities. It should be more recognised that knowledge, attitude and subjective norms are all critical factors in promoting sustainable food waste behaviour. So as to encourage the engagement of culinary producers and businesses in initiatives aimed at mitigating food waste, governmental bodies may consider offering incentives to enterprises that proactively adopt measures or enforce more stringent waste management regulations during the manufacturing process. Hence, by fostering collaborations between food delivery platforms and restaurants and implementing policy reform, a comprehensive and inclusive strategy involving multiple stakeholders could establish a societal standard promoting sustainability. Consequently, this approach can substantially enhance food waste practices among individuals in Generation Z.

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Declaration of competing interest

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

Data availability

Data will be made available on request.

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