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Environmental Awareness and Food Waste Reduction Among Generation Z in Indonesia

Edi Purwanto[1*], Naurissa Biasini[2], Aries Yulianto[3], Carles Sitompul[4], Theresia Gunawan[5]

[1] Department of Management & Jaya Launch Pad, Universitas Pembangunan Jaya, South Tangerang 15413, Indonesia
[2] Department of Communication & Jaya Launch Pad, Universitas Pembangunan Jaya, South Tangerang 15413, Indonesia
[3] Department of Psychology & Jaya Launch Pad, Universitas Pembangunan Jaya, South Tangerang 15413, Indonesia
[4] Department of Industrial Engineering, Universitas Katolik Parahyangan, Bandung 40141, Indonesia
[5] Department of Business Administration, Universitas Katolik Parahyangan, Bandung 40141, Indonesia

Corresponding Author Email: edi.purwanto@upj.ac.id

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ABSTRACT

This study aimed to examine the effect of environmental awareness on attitudes and intentions to reduce food waste, as well as the impact of intention to reduce food waste on behavior to reduce food waste among Generation Z in Indonesia. Given this generation's critical role in shaping sustainable practices for the future, understanding their attitudes and behaviors toward food waste is vital. By addressing this gap in the literature, the research aims to contribute to more effective strategies for promoting environmentally conscious behaviors among Gen Z, ultimately leading to a reduction in food waste and its associated environmental impacts. This study applies the convenience sampling technique. The questionnaires were distributed online via a google form. The respondents came from several big cities on the island of Java, such as Jakarta, Tangerang City, South Tangerang City, Bekasi City, Depok, Bogor City, Bandung, Yogyakarta, Semarang, and Surabaya. The total population on the island of Java is 151.6 million, which means 55 percent of Indonesia's 273.5 million total population. The total sample collected and analyzed in this study was 1,000 samples. The study's results prove that environmental awareness has a positive and significant effect on attitude (the T-statistics value of 14,286 > 1.96, and the *p*-value is 0.00 < 0.05) and intention to reduce food waste (the T-statistics value of 3.845 > 1.96 and the *p*-value is 0.00 < 0.05). Then, the attitude was also proven to have a positive and significant effect on the intention to reduce food waste (the T-statistics value of 11.579 > 1.96, and the *p*-value is 0.00 < 0.05). Finally, the intention to reduce food waste is proven to have a positive and significant effect on behavior to reduce food waste (the T-statistics value was 14,000 > 1.96, and the *p*-value was 0.00 < 0.05). This study contributes to the literature by investigating the relationship between environmental awareness, attitudes, intentions, and behavior toward food waste reduction among Gen Z in Indonesia. The findings highlight environmental awareness's positive and significant effects on attitudes, intentions, and subsequent behaviors to reduce food waste, providing valuable insights for developing targeted interventions and campaigns to promote sustainable practices among Gen Z.

1. INTRODUCTION

Food waste has become a pressing global concern, adversely affecting environmental sustainability and food security. Alarming conditions surrounding food waste in Indonesia have propelled the need for a comprehensive investigation into this issue. According to the Food Sustainability Index (FSI), Indonesia is the second-largest producer of food waste worldwide. This alarming statistic is surpassed only by Saudi Arabia, highlighting the urgency of addressing this challenge [1]. The extent of this problem is further illuminated by the estimation that 13 million tons of food are wasted annually in Indonesia, primarily stemming from the catering, retail, and restaurant sectors [2]. The magnitude of this waste raises concerns not only for food security but also for the ecological footprint.

Indonesia's demographic landscape is predominantly shaped by the presence of Gen Z and Y [3, 4], signifying their pivotal role in the nation's future. Various initiatives, such as the collaboration between DPS Bank and communities like *Saya Pilih Bumi* (I Choose Earth), Yummybox, and Zero Waste ID, have highlighted the potential of Gen Z in championing the Zero Food Waste campaign. The success of these endeavors, reducing up to 20 tons of food waste in a year, underscores the crucial contribution of Gen Z towards fostering a zero-waste lifestyle [5].

However, a concerning paradox emerges as Gen Z, the torchbearers of tomorrow, are both the hope for positive change and inadvertent contributors to food waste due to a lack of education. Empirical studies consistently reveal young individuals' impulsive and diverse food choices that exacerbate food waste [6]. This predicament is further highlighted by a study conducted by Karunasena et al. [7], which revealed that insufficient abilities in managing food, including tasks like shopping, storage, and cooking, amplifies the issue of escalated food wastage among the younger

demographic. In parallel, Kaur et al. [8] have noted that Baby Boomers in India exhibit heightened consciousness toward sustainable consumption practices, surpassing the awareness levels observed among Gen Z. Similarly, Lemy et al. [9] have identified that a considerable 45.90 percent of respondents Gen Z lack awareness concerning food waste in their study conducted within the Indonesian context.

Given the scale of this challenge, it becomes imperative to address the disconnect between environmental awareness, attitudes, intentions, and behavior regarding food waste reduction among Gen Z individuals in Indonesia. Understanding the underlying factors that shape their attitudes and intentions can facilitate targeted interventions and strategies to foster sustainable food practices within this demographic.

Most existing studies have focused on other demographic groups or different geographical contexts, for example, studies by Kurniawan et al. [10], Andesta [11], Purwanto et al. [12], and Niha et al. [13]. Therefore, the central focus of this research is to investigate the intricate interplay between environmental awareness, attitudes, intentions, and behavior concerning food waste reduction among Gen Z in Indonesia.

While previous research has explored the direct relationship between environmental awareness and behavior, for example, studies by Attiq et al. [14], Obuobi et al. [15], and Karakaş [16], this study explores whether heightened levels of environmental awareness translate into more favorable attitudes toward food waste reduction and stronger intentions to engage in sustainable behaviors.

Despite the increasing concern surrounding food waste and its environmental repercussions, a research gap pertains to the attitudes, intentions, and behaviors specific to food waste reduction within the Indonesian context. Previous research has explored the direct correlation between environmental awareness and behavior, but understanding needs to be present regarding the mediating role of intention, which bridges attitudes and actions. By examining the mediating nature of intention, this study aims to uncover the cognitive mechanisms that drive the translation of intent into actionable behavior.

Through this study, we aim to bridge the gap in the existing literature by examining the influence of environmental awareness on attitudes and intentions toward food waste reduction among Gen Z individuals in Indonesia. Additionally, by exploring the role of intention as a mediator, we seek to unravel the complex decision-making processes that steer the transition from intent to practice. This endeavor enhances our understanding of Gen Z's stance on food waste. It offers context-specific insights that can inform targeted interventions to combat this pertinent challenge within the Indonesian landscape.

2. LITERATURE REVIEW

2.1 The effect of environmental awareness on the attitude toward food waste

The studies discussed above collectively illuminate significant insights into the relationship between environmental awareness and attitudes toward food waste. These studies encompass diverse geographical and cultural contexts, enhancing the breadth of our understanding. By synthesizing their findings, we can discern consistent trends that contribute to formulating the research hypothesis.

Adel et al. [17] conducted a cross-cultural investigation, encompassing respondents from China and Egypt. Their study explored the impact of environmental concern on individuals' attitudes toward suboptimal produce. A parallel trajectory is found in the research by Bhatti et al. [18], where the authors established a robust predictive relationship between environmental concern and attitudes towards food waste. This connection gains further traction in the study by Ng et al. [19], set in a Malaysian context, which reaffirms the substantial influence of environmental concern on shaping people's attitudes towards food waste.

Complementing these findings, Filimonau et al. [20] delved into the role of environmental apathy within managerial attitudes towards food waste in Spanish food service companies. While these studies reflect diverse foci and methodologies, they underscore environmental awareness's prominence in shaping attitudes toward food waste across distinct contexts.

While prior investigations have extensively explored the linkage between environmental awareness and attitudes toward food waste in the general populace, a gap still needs to be addressed within the specific demographic of Gen Z. This study serves as a pivotal step toward filling this gap. By drawing upon the insights obtained from the analyses as mentioned above, this research formulates the following hypothesis:

H1. Environmental awareness has a significant impact on the attitude toward food waste among Gen Z in Indonesia.

2.2 The effect of environmental awareness on the intention to reduce food waste

Filimonau et al. [20] posit a correlation between environmental awareness and managerial attitudes within food service companies in Spain. Subsequently, Adel et al. [17] emphasize the role of environmental awareness in shaping individuals' intentions regarding suboptimal product consumption. Similarly, Sawasdee et al. [21] propose a hypothesis wherein environmental awareness influences the intention to reduce food waste. In addition, Khaleeli and Jawabri [22] unearth a significant link between environmental awareness and the intent of UAE residents to purchase environmentally friendly products. While the study of Khaleeli and Jawabri [22] pertains to environmentally friendly product purchases rather than food waste, both focal points converge on the shared concern of environmental sustainability.

Amidst these interconnected threads, it remains noteworthy that while the abovementioned investigations underscore the influence of environmental awareness on various aspects of consumption behavior, none squarely focus on the Gen Z demographic. Addressing this gap, our study delves explicitly into the Gen Z cohort. Informed by the cumulative insights from these antecedent inquiries, we posit the following second hypothesis:

H2. Environmental awareness has a significant impact on the intention to reduce food waste among Gen Z in Indonesia.

2.3 The effect of attitude on the intention to reduce food waste

The formation of attitudes is rooted in the alignment or divergence of beliefs concerning the outcomes of specific behaviors. Attitudes are pivotal in shaping the inclination to

engage in or refrain from certain behaviors. Furthermore, attitudes predict intentions, subsequently influencing actual behaviors [17]. Numerous researchers have substantiated this predictive relationship between attitude and intention. For instance, Ajzen [23] elucidates this connection, and subsequently, Ghani et al. [24] further emphasize the role of attitude in impacting the intention to reduce food waste.

Similarly, Bhatti et al. [18] affirm that attitudes influence the intention to mitigate food waste. Luu [25] substantiates that one's attitudes toward the issue significantly mold the intention to reduce food waste. In line with this, Ng et al. [19] discover the pivotal role of attitude in shaping the intention to segregate food waste among individuals in Malaysia. Furthermore, Chun T'ing et al. [26] establish a pronounced link between attitude and the intention to curb food waste among the Malaysian populace. In a parallel trajectory, Wang et al. [27] unravel the substantial impact of attitudes towards food waste on the intention to minimize waste, while Palmieri and Palmieri [28] establish a corresponding connection between student attitudes and their intention to reduce food waste within the Campania region of Southern Italy.

While the studies by Ghani et al. [24], Bhatti et al. [18], Luu [25], and Ng et al. [19] do not explicitly target specific generations, nor do they focus solely on attitudes and intentions toward food waste reduction within the Gen Z cohort, studies by Wang et al. [27] and Palmieri and Palmieri [28] center on student populations, a subset inherently comprising the Gen Z demographic. Thus, this study directs its attention to the attitudes of Gen Z individuals and their consequential impact on the intent to curtail food waste. In light of this contextual background, the third hypothesis of this research emerges:

H3. Attitude has a significant impact on the intention to reduce food waste among Gen Z in Indonesia.

2.4 The effect of the intention to behavior to reduce food waste

Intention, as defined, represents the inclination of individuals towards engaging in specific actions [17]. Notably, the intention to reduce food waste emerges as a robust predictor of the corresponding behavior [17]. Luu [25] reinforces this link, substantiating that intentions are reliable precursors of behaviors. In support of this, Luu [25] demonstrates the significant impact of the intention to reduce food waste on actual waste reduction behaviors within the context of hotel employees. Additionally, Wang et al. [27] ascertain that the intention to curtail food waste substantially influences the observed behaviors among student populations. Further insights into this relationship surface in the study by Watanabe et al. [29], indicating that the link between intention and behavior is more pronounced among Brazilians than Americans in the context of food waste reduction.

It is noteworthy that, barring Wang et al. [27], who specifically conducted research within student demographics, the remaining studies delve into the general public to investigate the influence of intention on food waste reduction behaviors. Within this landscape, the current research situates itself, testing this hypothesis within the Gen Z segment of Indonesia. Consequently, the fourth hypothesis of this research materializes as follows:

H4. The intention to reduce food waste has a significant impact on behavior to reduce food waste among Gen Z in Indonesia.

Based on the relationships between the variables, and the hypotheses above, the conceptual framework of this research looks as in Figure 1.

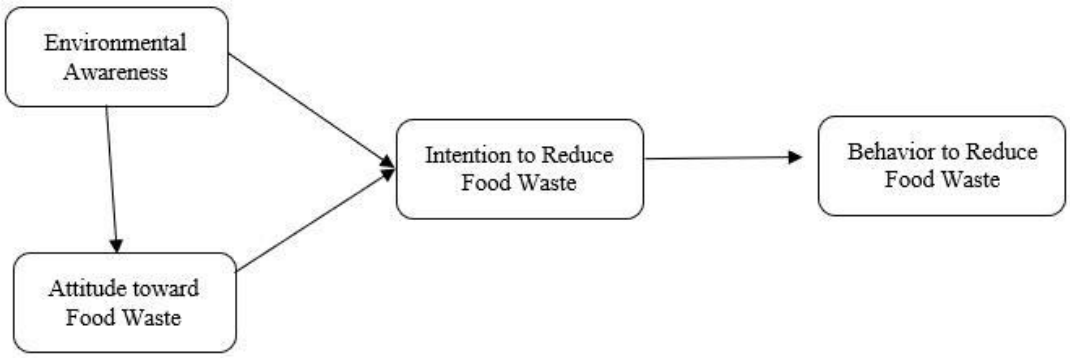

Figure 1. Conceptual framework

3. METHODOLOGY

3.1 Population and sampling

The population of this study is Indonesian Gen Z. In 2022, the Gen Z population will be those between the ages of 11 and 26. Sampling used the convenience sampling technique. Data collection was carried out from March to May 2022. The data collected was 1100 samples, but those that can be used based on the completeness of filling out the survey are 1000 samples. Samples were collected from 10 major cities on the island of Java, namely Jakarta, Tangerang City, South Tangerang City, Bekasi City, Depok, Bogor City, Bandung, Yogyakarta, Semarang, and Surabaya. Java Island has the largest population in Indonesia, 151.6 million in 2020. If the total population of Indonesia is 273.5 million, then the people of Java Island are 55 percent of the total population of Indonesia. Data collection was conducted online using the Google Forms platform. The survey link was disseminated through our network in the cities mentioned above. Respondents could access and complete the survey through the online form, allowing for efficient and widespread data collection. Sample demographics can be seen in Table 1.

3.2 Measures

Environmental consciousness. A 6-item questionnaire assessed this aspect using a five-point Likert scale, with 1

indicating strong disagreement and 5 indicating strong agreement. The 6-item questionnaire comprises the following statements: "I acknowledge the necessity for implementing a mechanism to manage food waste"; "I am aware of the importance of establishing a final disposal policy"; "I understand the significance of implementing a recycling policy in Indonesia"; "I recognize the potential for decreasing food waste through the application of biotechnology"; "I am conscious that involving citizens can lead to a reduction in food waste"; and "I acknowledge the potential for creating compost from food waste."

Table 1. The survey demographics reflected by the study

	Frequency	%
Gender		
Male	402	60
Female	598	40
Total	1,000	100
Qualification		
High school	791	79
Bachelor	209	21
Total	1,000	100
Domicile		
Jakarta	73	7
Bogor	75	7
Depok	97	10
Bekasi	81	8
Tangerang	85	4
South Tangerang	63	6
Bandung	82	8
Semarang	117	12
Yogyakarta	221	22
Surabaya	106	16
Total	1,000	100

Attitude towards reducing food waste. A 3-item measurement gauged this aspect on a five-point Likert scale, where 1 represents strong disagreement, and 5 signifies strong agreement. The 3-item measurement includes: "Unused food should be repurposed in diverse manners," "The reduction of food waste is a shared obligation," and "I will cut down on expenses by engaging in composting."

Intention to reduce food waste. A 3-item scale assessed this aspect on a five-point Likert scale, ranging from 1, indicating strong disagreement, to 5, representing strong agreement. The 3-item scale consists of: "I plan to create compost from food scraps," "I intend to recycle surplus food as a strategy to minimize waste," and "I am committed to ensuring that remaining food items find further use."

Behavior to reduce food waste. A 3-item scale quantified this dimension on a five-point Likert scale, where 1 stands for infrequent, and 5 signifies very frequent. The 3-item scale encompasses: "I frequently transform food waste into compost," "I often convert food waste into eco-enzymes," and "I regularly process food waste to rear maggots/larvae for animal nourishment."

3.3 Analysis technique

This research uses the SEM-PLS analysis technique. The software used is Smart-PLS 3. PLS (Partial Least Square) is a component or variance-based SEM structural equation model. PLS is an alternative approach that shifts from a covariance-based SEM approach to a variance-based approach [30].

4. FINDINGS

In this section, we present the key findings of our study on the behavior and attitudes of Indonesian Gen Z towards food waste reduction. The evaluation of the outer and inner models, based on SEM-PLS analysis, sheds light on several significant insights.

4.1 Outer model evaluation

The evaluation of the outer model establishes the reliability and validity of the measurement constructs. Reflective measurement models were employed, and the results met the recommended thresholds for composite reliability, indicator reliability, convergent validity, and discriminant validity [30]. Composite reliability values exceeded 0.70, demonstrating internal consistency reliability [31]. Indicator outer loading values were above 0.70, satisfying the indicator reliability criterion [32]. Additionally, the average variance extracted (AVE) values surpassed 0.50, confirming convergent validity [33]. Discriminant validity was confirmed by ensuring that AVE values exceeded the corresponding correlation values among constructs.

Table 2. Validity and reliability: Outer loading indicator values

	Attitude	Behavior to Reduce Food Waste	Environmental Awareness	Intention to Reduce Food Waste
ATT1	0.726			
ATT2	0.705			
ATT3	0.721			
BHV1		0.918		
BHV2		0.921		
BHV3		0.832		
ENV1			0.786	
ENV2			0.820	
ENV3			0.761	
ENV4			0.744	
ENV5			0.749	
ENV6			0.754	
INT1				0.836
INT2				0.847
INT3				0.809

Table 2 shows that the outer loading value of all variables is greater than 0.70. Thus the reliability indicator requirements have been met.

Hair Jr et al. [30] suggests testing internal consistency reliability, not by using Cronbach's alpha. Hair et al. [34] means that researchers use composite reliability with a value above 0.70. Table 3 shows that composite reliability value of all variable higher than 0.70, implying that internal consistency reliability has been met. Table 3 also shows that AVE value of all variable is higher than 0.50, so convergent validity has also been met.

Table 3. Construct reliability and validity assessment

	Composite Reliability	Average Variance Extracted (AVE)
Attitude	0.761	0.514
Behavior to Reduce Food Waste	0.921	0.795
Environmental Awareness	0.897	0.592
Intention to Reduce Food Waste	0.870	0.690

Table 4 shows that AVE of all variables is higher than their correlation value, suggesting that the discriminant validity has been met.

Table 4. Discriminant validity assessment

	ATT	BHV	ENV	INT
ATT	**0.717**			
BHV	0.202	**0.892**		
ENV	0.412	-0.032	**0.769**	
INT	0.454	0.384	0.289	**0.831**

4.2 Inner model evaluation

The results of this study on Gen Z in Indonesia show similarities to the research finding by Karunasena et al. [7] in Australia, where the lack of skills of Gen Z in managing food contributes to food waste. For example, some survey questions to see the behavior of reducing food waste among Indonesian Gen Z such as: "I process food waste into compost," 52.9 percent answered, "Very rarely," 19.6 percent answered, "Rarely," 14.5 percent answered, "Sometimes," only 10.5 percent answered, "Often," and 2.5 percent answered, "Very often." As for the survey statement, "I process food waste into eco-enzymes," 61.8 percent answered, "Very rarely," 14.8 percent answered, "Rarely," 12.8 percent answered, "Sometimes," only 8.2 percent answered, "Often," and 2.4 percent answered, "Very often." Then for the survey statement, "I process food waste for magot/larval cultivation as animal feed," 68.4 percent answered, "Very rarely," 13.2 percent answered, "Rarely," 8.2 percent answered, "Sometimes," only 7.9 percent who replied, "Often," and 2.3 percent who answered, "Very often."

Our study's findings align with research conducted in Australia, as both indicate that Gen Z's lack of food management skills contributes to food waste. Notably, our survey revealed that Indonesian Gen Z demonstrated a relatively low frequency of behavior to reduce food waste, such as processing food waste into compost, eco-enzymes, or animal feed. This resonates with the findings of Karunasena et al. [7] in Australia, emphasizing the need for enhanced food-management skills.

While Gen Z showed a lack of food management skills, our study identified their high level of environmental awareness. Respondents exhibited positive attitudes towards reducing food waste, recognizing the need for responsible food waste control mechanisms, final disposal policies, recycling policies, and other eco-friendly strategies. This environmental consciousness presents an opportunity for education and intervention to encourage sustainable food waste reduction behaviors.

Furthermore, Gen Z's positive attitudes were coupled with a relatively high intention to reduce food waste. Respondents expressed intentions to recycle, make compost from food waste, and ensure the reuse of leftovers. This intention, driven by their positive attitudes, creates a solid foundation for targeted interventions to cultivate behavior that aligns with their intentions.

Through hypothesis testing, we confirmed that environmental awareness positively influences attitudes, fostering intentions and behaviors to reduce food waste. The path coefficients and statistical significance levels underscore the interconnectedness of these constructs, validating our research hypotheses.

First, for the survey statement, "I recognize the need for a food waste control mechanism," only 0.3 percent answered, "Strongly disagree," 0.4 percent answered, "Disagree," and 6.1 percent answered, "Neutral," but 47.7 percent answered, "Agree," and 45.5 percent answered, Strongly agree." Second, for the survey statement, "I recognize the need for a final disposal policy," only 0.1 percent answered, "Strongly disagree," 0.4 percent answered, "Disagree," and 4.2 percent answered, "Neutral," but 47.3 percent answered, "Agree," and 48.0 percent answered, "Strongly agree." Third, for the survey statement, "I realize that there is a need for a recycling policy in Indonesia," only 0.1 percent answered, "Strongly disagree," 0.2 percent answered, "Disagree," and 4.1 percent answered, "Neutral," but 39.9 percent answered, "Agree," and 55.7 percent answered, "Strongly agree." Fourth, for the survey statement, "I realize that food waste can be reduced by using biotechnology," only 0.2 percent answered, "Strongly disagree," 1.1 percent answered, "Disagree," and 10.7 percent answered, "Neutral," however. 50.1 percent answered, "Agree," and 37.9 percent answered, "Strongly agree." Fifth, for the survey statement, "I am aware that food waste can be reduced with citizen participation," only 0.3 percent answered, "Strongly disagree," 0.3 percent answered, "Disagree," and 4.2 percent answered, "Neutral," but 44.5 percent answered, "Agree," and 50.7 percent answered, "Strongly agree." Sixth, for the survey statement, "I realize that food waste can be used by making compost," only 0.2 percent answered, "Strongly disagree," 0.6 percent answered, "Disagree," and 11.4 percent answered, "Neutral," however, 52 percent answered, "Agree," and 35.8 percent answered, "Strongly agree."

The survey results indicate a high level of environmental awareness among Indonesian Gen Z. Despite their lack of skills in managing food to prevent waste, the positive attitudes demonstrated by respondents suggest the potential to educate this demographic on the behavior of reducing food waste. By leveraging their existing environmental consciousness, efforts can be made to promote sustainable practices and actively empower Indonesian Gen Z to contribute to food waste reduction.

In addition to high environmental awareness among Indonesian Gen Z, they also have a positive attitude towards reducing food waste. Responding to the survey statement,

"leftover food must be used in various ways," 52 percent answered, "Agree," and 29.9 percent answered, "Strongly agree." Only 0.8 percent answered, "Strongly disagree," 1.8 percent answered, "Disagree," and 15.5 percent answered, "Neutral." Then for the survey statement, "Reducing food waste is everyone's responsibility," 37.5 percent answered, "Agree," and 59 percent answered, "Strongly agree." Only 0.2 percent answered, "Strongly disagree," 0.6 percent answered, "Disagree," and 2.7 percent answered, "Neutral." And, for the survey statement, "I will save money by composting," 40.6 percent answered, "Agree," and 12.8 percent answered, "Strongly agree." Only 0.5 percent answered, "Strongly disagree," 6.8 percent answered, "Disagree," although 39.3 percent answered, "Neutral."

Overall, the survey results highlight the positive attitude of Indonesian Gen Z toward reducing food waste. Their inclination to find various uses for leftover food, recognition of shared responsibility, and belief in the financial benefits of composting demonstrate their readiness to adopt behaviors that minimize food waste. Building on their existing positive attitudes, educational initiatives and interventions can be designed to empower Indonesian Gen Z to actively contribute to the reduction of food waste and create a sustainable future.

The intention to reduce food waste among Gen Z in Indonesia is also relatively high. This is shown by the results of the survey, which included the statement, "I will make compost from food waste," 31.6 percent answered, "Agree," and 7.2 percent answered, "Strongly agree." On the other hand, only 2.7 percent answered, "Strongly disagree," 10.8 percent answered, "Disagree," and the rest answered, "Neutral." Then for the survey statement, "I will recycle leftover food to reduce food waste," 48.1 percent answered, "Agree," and 10.7 percent answered, "Strongly agree." On the other hand, only 1.6 percent answered, "Strongly disagree," 6.3 percent answered, "Disagree," and the rest answered, "Neutral." And for the survey statement, "I'll make sure the leftovers can be reused," 49.6 percent answered, "Agree," and 12.7 percent answered, "Strongly agree." On the other hand, only 0.7 percent answered, "Strongly disagree," 3.4 percent answered, "Disagree," and the rest answered, "Neutral."

Overall, the survey findings indicate a relatively high intention among Gen Z in Indonesia to reduce food waste. Their expressed willingness to make compost from food waste, recycle leftover food, and ensure the reuse of leftovers demonstrates their proactive approach toward minimizing waste. These positive intentions provide a solid foundation for educational initiatives and interventions aimed at empowering Gen Z in Indonesia to translate their intentions into actions, significantly reducing food waste and contributing to a sustainable future.

Hypothesis testing proves that environmental awareness among Indonesian Gen Z creates their positive attitude towards reducing food waste, which encourages their intention to reduce food waste and behavior to reduce food waste.

Table 5. Path coefficients analysis: Relationships between variables

		Original Sample (O)	Sample Mean (M)	T Statistics (|O/STDEV|)	*P* Values	Status
H1	**Environmental Awareness -> Attitude**	0.412	0.415	14.286	**0.000**	Accepted
H2	**Environmental Awareness -> Intention to Reduce Food Waste**	0.122	0.122	3.845	**0.000**	Accepted
H3	**Attitude -> Intention to Reduce Food Waste**	0.404	0.405	11.579	**0.000**	Accepted
H4	**Intention to reduce food waste -> Behavior to Reduce Food Waste**	0.384	0.385	14.000	**0.000**	Accepted

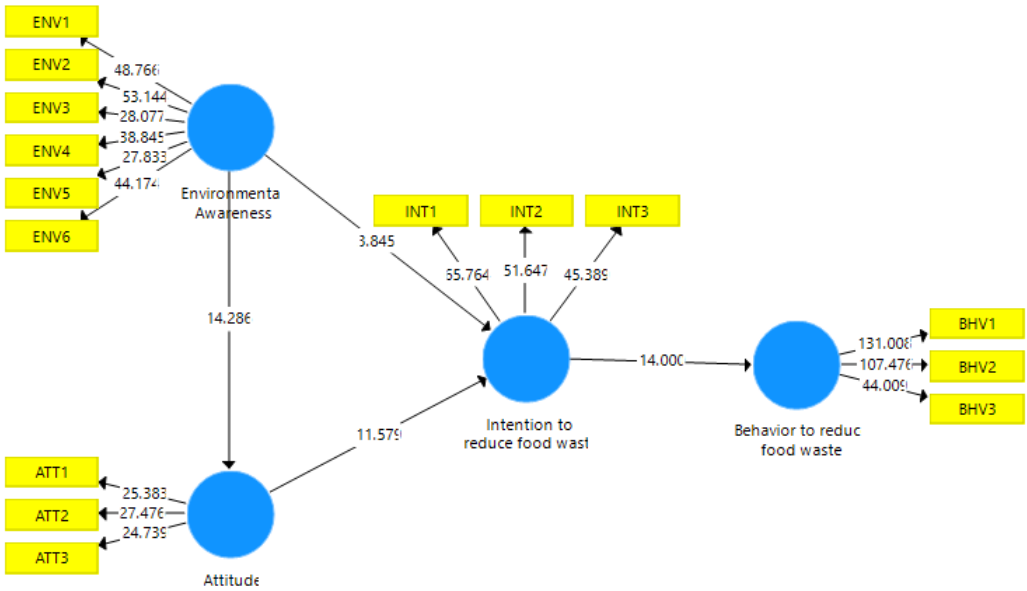

Figure 2. Bootstrapping bootstrapping results for PLS-SEM: Confidence intervals and significance testing

Table 5 and Figure 2 show that the effect of environmental awareness on attitude toward food waste has a T-statistics value of 14,286 > 1.96, and the *p*-value is 0.00 < 0.05, so it can be concluded that the effect is positive and significant. Furthermore, the impact of environmental awareness on the intention to reduce food waste also proved positive and significant, as indicated by the T-statistics value of 3.845 > 1.96 and the *p*-value is 0.00 < 0.05. Likewise, the effect of attitude on the intention to reduce food waste has also been shown to be positive and significant, as indicated by the T-statistics value of 11.579 > 1.96, and the *p*-value is 0.00 < 0.05. Then, the effect of intention on the behavior to reduce food waste also proved positive and significant because the T-statistics value was 14,000 > 1.96, and the *p*-value was 0.00 < 0.05. Therefore, the results of hypothesis testing show that all hypotheses, H1, H2, H3, and H4, are proven or accepted.

Table 6 shows that environmental awareness indirectly also has a positive and significant effect on the intention to reduce food waste with attitude mediation. It is indicated by the T-statistics value of 9.026 > 1.96, and the *p*-value is 0.00 < 0.05. Likewise, environmental awareness indirectly also has a positive and significant effect on behavior to reduce food waste by mediating intention. It is indicated by the T-statistics value of 7.799 > 1.96, and the *p*-value is 0.00 < 0.05. Then, attitude also indirectly has a positive and significant effect on behavior to reduce food waste by mediating intention. It is indicated by the T-statistics value of 8.124 > 1.96, and the *p*-value is 0.00 < 0.05.

Table 6. Total indirect effects: Mediation analysis results

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	*P* Values
Environmental Awareness -> Intention to Reduce Food Waste	0.166	0.168	0.018	9.026	**0.000**
Environmental Awareness -> Behavior to Reduce Food Waste	0.111	0.112	0.014	7.799	**0.000**
Attitude -> Behavior to Reduce Food Waste	0.155	0.156	0.019	8.124	**0.000**

These research findings present valuable insights, with potential implications for policies and practices related to food waste reduction among Indonesian Gen Z. The study also unveiled a high level of environmental awareness among Indonesian Gen Z, alongside their positive attitudes toward reducing food waste. This finding holds significant promise for designing educational initiatives that leverage this awareness to promote sustainable behaviors. Policymakers could explore campaigns and programs that capitalize on this environmental consciousness, encouraging Gen Z to engage in food waste reduction efforts actively.

Furthermore, the relatively high intention expressed by Gen Z to reduce food waste, driven by their positive attitudes, serves as a strong foundation for interventions. Policymakers and educators could collaborate to develop programs that channel these intentions into tangible actions, fostering a food waste reduction culture. By linking this intention to practical behaviors, such as recycling, composting, and reusing leftovers, Gen Z could contribute to minimizing food waste and supporting a more sustainable future.

The implications of the study's findings emphasize the interconnectedness of environmental awareness, attitudes, intentions, and behaviors in the context of food waste reduction. The positive associations identified through path coefficient analysis underscore the potential effectiveness of interventions targeting these constructs. Policymakers, researchers, and practitioners can draw upon these insights to formulate strategies that facilitate a shift towards more sustainable food consumption and waste reduction practices among Indonesian Gen Z.

The study offers actionable insights that can inform policy and practice interventions to curb food waste among Indonesian Gen Z. By capitalizing on their environmental awareness, fostering positive attitudes, and cultivating their intentions into behavior. We can drive meaningful change and contribute to a more sustainable future.

5. DISCUSSION

The findings of this study demonstrate a positive and significant effect of environmental awareness on attitudes toward food waste reduction. The T-statistics value of 14.286, which exceeds the critical value of 1.96, suggests a vital statistical significance. Additionally, the *p*-value of 0.00, which is less than the significance level of 0.05, further supports the conclusion that the effect is significant.

The positive effect indicates that individuals with higher environmental awareness tend to hold more positive attitudes toward reducing food waste. This finding aligns with previous research that emphasizes the role of environmental awareness as a predictor of pro-environmental attitudes, for example, studies by Adel et al. [17], Bhatti et al. [18] and Ng et al. [19], and Filimonau et al. [19]. Individuals who are more aware of the environmental consequences of food waste are likely to develop more favorable attitudes toward efforts to reduce waste.

According to Bhatti et al. [18], contextual factors, including economic, social, cultural, and environmental aspects, significantly influence individuals' attitudes and behaviors toward food waste. There needs to be more awareness regarding the environmental consequences of food waste among the general population. However, raising awareness about environmental concerns, such as greenhouse gas emissions, energy and water consumption, and pollution, can effectively influence consumer behavior concerning food waste.

The significant effect of environmental awareness on attitudes toward food waste highlights the importance of fostering environmental consciousness among individuals. Efforts to increase awareness about the environmental impact of food waste can contribute to shaping positive attitudes and promoting behavior change concerning waste reduction.

The findings of this study reveal a positive and significant impact of environmental awareness on the intention to reduce food waste. The T-statistics value of 3.845, which exceeds the critical value of 1.96, indicates a statistically significant relationship. Additionally, the *p*-value of 0.00, which is lower than the significance level of 0.05, further supports the conclusion that the impact is significant.

This pattern of results resonates with earlier research that emphasizes the pivotal role of environmental consciousness in shaping individuals' propensities to engage in pro-environmental behaviors. For instance, studies by Adel et al. [20] and Khaleeli and Jawabri [22] have previously demonstrated similar associations between environmental awareness and behavioral intentions, emphasizing how individuals with greater awareness of the environmental consequences of food waste are more inclined to intend to reduce waste genuinely.

The results of this study align with other findings of [20, 22], where heightened environmental awareness was also linked to stronger intentions to reduce waste. These consistencies suggest that the impact of environmental awareness on behavioral intentions is a cross-contextual phenomenon. The parallel outcomes across studies reinforce the robustness of the identified relationship.

However, it is essential to acknowledge that while our study results are consistent with these earlier findings, there might be nuanced variations influenced by cultural, demographic, or contextual factors. Future research could delve deeper into these potential sources of discrepancy to provide a comprehensive understanding of the factors contributing to similarities and differences across various populations. Such an analysis could contribute to refining intervention strategies and adapting them to address specific populations' unique challenges, ultimately facilitating more effective food waste reduction efforts.

The other findings of this study align with previous research, affirming the positive influence of environmental awareness on intentions to reduce food waste. Int his regard, the relationships highlighted here mirror those discovered in the study of [20, 22]. While consistencies across these studies suggest the generalizability of this relationship, future research could offer more nuanced insights by exploring potential discrepancies stemming from diverse contexts and populations.

The present findings provide evidence of a positive and significant effect of attitude on the intention to reduce food waste. The T-statistics value of 11.579, which surpasses the critical value of 1.96, indicates a high level of statistical significance. Additionally, the *p*-value of 0.00, which is lower than the significance level of 0.05, further supports the conclusion that the effect is significant.

The positive effect suggests that individuals with higher levels of positive attitude are more likely to have stronger intentions to reduce food waste. This finding aligns with previous research highlighting the influence of attitude on shaping individuals' intentions to engage in pro-environmental behaviors. When individuals possess a heightened awareness of the environmental impacts of food waste, they are more inclined to develop sincere intentions to take action.

The significant effect of attitude on the intention to reduce food waste underscores the significance of promoting environmental consciousness to foster behavioral intentions. Strategies to increase positive attitude about the environmental consequences of food waste can strengthen individuals' intentions to reduce waste actively.

The findings of this study demonstrate a positive and significant effect of intention to behavior to reduce food waste. The T-statistics value of 14.000, exceeding the critical value of 1.96, indicates a vital statistical significance. Additionally, the *p*-value of 0.00, lower than the significance level of 0.05, further supports the conclusion that the effect is significant.

The significant effect observed in this study has important implications for promoting sustainable practices in food waste reduction. Individuals who genuinely intend to reduce food waste are more inclined to translate their intentions into concrete actions. Understanding the role of intention in driving behavior change is crucial for developing effective interventions and policies that encourage sustainable consumption patterns.

Our robust statistical significance supports the argument that intention to sustainable behavior significantly reduces food waste. These results align with previous research emphasizing the importance of intentions as critical determinants of pro-environmental behavior [25, 27, 29]. These results contribute to our understanding of the factors influencing individuals' behaviors related to food waste reduction and highlight the importance of fostering strong intentions to promote sustainable practices in this domain.

The findings of this study reveal that environmental awareness has an indirect positive and significant effect on the intention to reduce food waste, mediated by attitudes. Such an indirect effect suggests that individuals' environmental awareness influences their attitudes, affecting their intention to reduce food waste. This finding aligns with theoretical frameworks that propose attitudes as mediators in the relationship between environmental awareness and behavioral intentions. When individuals are more environmentally aware, they are more likely to develop positive attitudes toward waste reduction, strengthening their intentions to engage in such behaviors.

The significant indirect effect of environmental awareness on the intention to reduce food waste with attitude mediation highlights the importance of considering attitudes as a pathway through which environmental awareness translates into behavioral intentions. Interventions and campaigns promoting waste reduction should target environmental awareness and attitudes to influence individuals' intentions and subsequent behaviors effectively.

The findings of this study demonstrate that environmental awareness has an indirect positive and significant effect on behavior to reduce food waste, mediated by intention.

The evidence of a positive and significant link between environmental awareness and attitudes and intentions toward food waste reduction underscores the importance of incorporating environmental education and awareness campaigns into public policy initiatives. Policymakers can consider implementing programs to increase general knowledge about the environmental impact of food waste. These campaigns could highlight the broader ecological consequences, such as greenhouse gas emissions and resource depletion, to encourage individuals to adopt more sustainable behaviors.

Enterprises can leverage these findings to design targeted

marketing and communication strategies promoting positive attitudes toward reducing food waste among consumers. Aligning their branding with environmental concerns and conveying a commitment to waste reduction initiatives can resonate with environmentally conscious consumers. Collaborating with environmental organizations to co-create campaigns or initiatives can enhance their credibility and amplify their impact.

The study's insights also provide environmental organizations with valuable ammunition to design effective interventions. These could involve organizing workshops, seminars, and awareness campaigns emphasizing the interconnectedness of individual actions and ecological health. By framing food waste reduction as a tangible step individuals can take to contribute to a healthier planet, these organizations can stimulate positive attitudes and intentions among their target audience.

While our study has provided valuable insights into the relationship between environmental awareness, attitudes, intentions, and behaviors toward food waste reduction, it remains important to acknowledge certain limitations that may impact the generalizability and interpretation of our findings.

Our survey employed a cross-sectional design, which captures data at a specific point in time. While this approach helps establish associations, it does not allow for causal relationships to be inferred. Future research could employ longitudinal designs to explore better the temporal relationships between environmental awareness, attitudes, intentions, and behaviors, shedding light on the dynamics of these variables over time.

This study relied on self-reported measures for environmental awareness, attitudes, intentions, and behaviors. This method is susceptible to social desirability bias and may not always accurately reflect participants' actual behaviors. Future research could consider incorporating observational measures or behavioral assessments to complement self-reported data and provide a more comprehensive understanding of the relationships studied.

While this study acknowledged the influence of contextual factors on attitudes and behaviors related to food waste reduction, further exploration is warranted. Investigating how cultural, economic, and social contexts shape these relationships could provide nuanced insights for tailoring interventions to specific populations and contexts.

By means of this study we have identified mediation pathways between environmental awareness, attitudes, intentions, and behaviors. However, the mechanisms underlying these relationships remain relatively unexplored. Future research could delve into the psychological processes and motivations that mediate these associations, contributing to a deeper understanding of the underlying drivers of behavior change.

6. CONCLUSION

The study findings uncover a significant positive correlation between environmental awareness and attitudes toward reducing food waste. Individuals exhibiting heightened environmental awareness tend to embrace more favorable attitudes toward waste reduction, underscoring the critical role of promoting environmental consciousness for cultivating positive attitudes.

Likewise, the study establishes a significant positive link between environmental awareness and the intention to reduce food waste. Increased environmental awareness corresponds to stronger intentions to minimize waste, emphasizing the pivotal role of environmental consciousness in influencing behavioral intentions.

Similarly, the study underscores attitudes' significant and affirmative impact on the intention to reduce food waste. Individuals expressing more positive attitudes toward waste reduction demonstrate heightened intentions to partake in such behaviors, reiterating the need to address attitudes to stimulate behavioral change.

Moreover, the research unveils an indirect positive and significant effect of environmental awareness on the intention to reduce food waste, mediated by attitudes. This suggests that environmental awareness shapes attitudes, subsequently influencing the intention to curtail waste. Interventions and campaigns should target environmental awareness and attitudes to shape intentions and subsequent behaviors effectively.

An indirect positive and significant influence of attitudes on waste reduction behavior, mediated by intention was also observed. Attitudes toward waste reduction shape intentions, thereby impacting behavior. This accentuates the critical role of intentions as a conduit through which attitudes manifest into actionable outcomes.

In conclusion, the study accentuates the significance of environmental awareness, attitudes, and intentions in driving behavioral changes concerning food waste reduction. Cultivating environmental consciousness, nurturing positive attitudes, and fortifying intentions emerge as pivotal factors in effectively mitigating food waste.

These findings have substantial implications for practical interventions and campaigns targeting reducing food waste. Augmenting environmental awareness can tangibly shape attitudes, thus impelling behavior change. To this end, initiatives should focus on fostering positive attitudes and fortifying intentions for waste reduction. Educational programs, campaigns, and persuasive messaging can play a vital role in dispelling misconceptions, enhancing knowledge, and fostering favorable attitudes.

However, it is important to note that this study exclusively scrutinized the interplay between environmental awareness, attitudes, intentions, and behavior concerning food waste reduction. In moving forward, future research must expand its purview to encompass additional cultural, social, and individual variables. This holistic approach is integral to comprehending the intricate fabric of attitudes and behavior within food waste reduction.

To summarize, this study's findings substantiate environmental awareness's positive and significant impact on attitudes toward food waste reduction. Interventions geared toward enhancing environmental awareness can shape attitudes, foster behavior change, and fortify intentions for waste reduction. Future research endeavors should delve deeper into the multi-dimensional factors influencing attitudes and behavior in the context of food waste reduction.

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