

Analyzing Factors That Influence the Indonesia's Gen Z in Reducing Food Waste

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Abstract

Zero hunger is one of the goals that is still being realized in the Sustainable Development Goals (SDGs). With conditions in Indonesia, which currently occupies fourth place in the amount of food waste worldwide, with a weight reaching 20.93 tons per year. This is certainly a serious enough problem to realize sustainable development. Indonesia, which is currently dominated by Gen Z, certainly needs to pay more attention to this food waste so that it doesn't continue in the future. This problem makes it important to analyze the factors that influence Gen Z Indonesia in reducing food waste. This research aims to form a structural model that explains the factors that influence Gen Z in reducing food waste. The variables used in this research are the influence of social media content, millennial eating manners, food consumption efficiency, the role of social demographics, and commitment to reducing food waste. which was analyzed using the Structural Equation Modeling Partial Least Square (SEM-PLS) method. The research results show that the factors that influence Gen Z are the influence of social media content and the role of social demographics. Through this research, recommendations for activities related to efforts to reduce food waste based on SEM-PLS can be formulated to realize one of the goals of sustainable development.

Keywords

SEM PLS, Gen Z, Food Waste, SDGs

Introduction

Food waste is a combination of two important words, namely food losses and food waste. Lipinski (2013) defines food waste as food that meets human needs but is thrown away before or after the consumption process, including losses at the distribution and final consumption stages. Food waste

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has been widely recognized as an important obstacle to achieving global sustainability (Wang et al., 2018). Food waste not only impacts food security, but also has consequences for the environment, economy, and ethical and emotional aspects. The study by Kaur et al. (2020) and Schanes et al. (2018) shows that food waste can threaten food security, cause climate change, gas emissions, and economic losses (Asyari & Rika, 2024). Based on research data from the Economist Intelligence Unit (EIU), the number of food waste phenomena tends to increase from year to year. Indonesia is ranked as the second largest producer of food waste in the world after Saudi Arabia, with an estimate of 300 kg of food waste per capita every year (Ministry of Agriculture of the Republic of Indonesia, 2019). This food waste phenomenon is exacerbated by the condition of the Indonesian population which suffers from hunger, amounting to 13.5% of the total population of 269 million people (Central Statistics Agency, 2019).

In facing the food waste emergency in Indonesia, Sustainable Development Goals (SDGs) offer a global framework that outlines various global challenges, including eliminating hunger (Zero Hunger) (Hanafi, 2023). The framework initiated by the United Nations (UN) in 2015 consists of 17 values, one of which is Zero Hunger. Zero Hunger is one of these values which can be linked to practical knowledge related to food and public health. Increasing public awareness of this issue is reflected in the SDGs agenda regarding the target of halving global food waste per capita.

To achieve this target, the role of the younger generation is very important. The majority of Indonesia's population is dominated by Gen Z (born in 1997 - 2012) and the Millennial Generation (born in 1981 - 1996) with the proportion of Gen Z as much as 27.94 percent and the Millennial Generation as much as 25.87 percent (Central Statistics Agency, 2020). Gen Z, known as future consumers, will shape new shopping trends (Kymäläinen et al., 2021) and influence the way people consume in the future (Wajon & Richter, 2019). Gen Z has broad access to technology and social media which can be used to change consumer behavior towards food and reduce food waste. This is in line with the SDGs, where efforts to reduce food waste are an important component in achieving the targets. The results of a case study in the journal "The Role of Social Media in Food Waste Prevention Behavior" in 2021 confirm that social media plays a crucial role in shaping attitudes and norms regarding food waste (Chai et al., 2021). Gen Z's closeness to technology and social media means that Gen Z can be relied on to become the nation's next generation towards a Golden Indonesia 2045 (Siti et al, 2022).

Considering the importance of Golden Indonesia 2045, the high rate of food waste in Indonesia is an urgent challenge to be resolved. Research on food waste is still limited, so it is urgent to carry out further studies. In this research, the variables used as factors that determine the commitment of Gen Z Indonesia to reducing food waste are the influence of social media content, millennial eating manners, food consumption efficiency, and the role of social demographics. These variables have a complex relationship and cannot be measured directly, so the author chose to solve it using the Structural Equation Modeling - Partial Least Square (SEM-PLS) method. The SEM-PLS method is used to estimate variables simultaneously (Netha et al., 2021).

Through this research, it is hoped that the best recommendations for reducing the level of food waste in Indonesia can be found. Focusing on understanding the factors that influence Gen Z's behavior in reducing food waste can help develop effective programs for increasing awareness and practice of preventing food waste in Indonesia.

Methodology

Research Data Sources

The research data source comes from primary data. Primary data is data obtained directly from respondents at the research location (Sugiyono, 2012). The data collection technique uses a survey method by filling out questionnaires which are distributed directly to respondents. The respondent population in this study was Generation Z Indonesia (age range 12-27 years).

This research is quantitative research using SEM-PLS analysis. The sample size was determined based on Gefen's (2000) statement that the minimum sample for SEM-PLS analysis is at least 10 times the number of indicators. So the minimum sample size in this research is 100 samples.

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Research Variables

The research variables and indicators used in this research are presented in Table 1. Each indicator has a scale of 1 to 4, each of which describes a scale from the strongly disagree category to the strongly agree category.

Table 1. Research variable

Variable	Indicator
Influence of Social Media Content (X1)	Interaction with social media content (Q1, Q2) Satisfaction with social media content (Q3) Positive behavioral changes (Q4, Q5) The relevance of social media content to reducing food waste (Q6) Motivation for sharing social media content (Q7) Maintain cleanliness when eating (Q8, Q9)
Millennial Dining Manners (X2)	Eat appropriate portions (Q10, Q11)
Food Consumption Efficiency (X3)	Sharing food with others (Q12, Q13) Sustainable food choices (Q14, Q15) Awareness of food portion control (Q16)
Role of Social Demographics (X4)	My environmental habits in disposing of waste (Q17, Q18)

	Awareness of the impact of food waste (Q19)
	Knowledge about reducing food waste (Q20)
	Strategy and commitment to reduce food waste (Q21)
	Waste management in my environment (Q22)
Commitment to Reduce food waste (Y)	Correct use of food before the expiration date (Q23)
	Proper portion management (Q24)
	Reusing leftover food for other things (Q25)

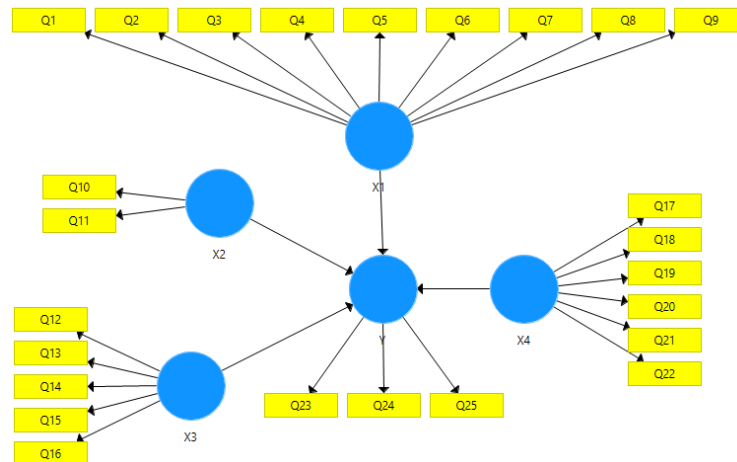


Figure 1. Main Model

Figure 1 is an image of the main model or initial SEM-PLS model used in this research. These variables consist of 5 latent variables, 4 exogenous variables (X1, X2, X3, and X4) and 1 endogenous variable (Y). The indicators used consist of 18 indicators (Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q1, Q18, Q19, Q20, Q21, Q22, Q23, Q24, and Q25).

Results and Discussion

Evaluation of the Measurement Model

Evaluation of the measurement model was carried out in several stages. The first stage is to check internal consistency reliability using composite reliability statistics. The second stage is to check the reliability indicators using the indicator's outer loadings. The third stage is to check Convergent validity using Average Variance Extracted (AVE) statistics. The final stage is to check discriminant validity using Cross loading.

The composite reliability (ρ_c) value presented in Table 2, on the indicators of the influence of social media content (X1), food consumption efficiency (X3), and the role of social demographics (X4) has a value greater than 0.7. So it can be said that these three constructs have quite high internal consistency. Meanwhile, millennial eating manners (X2) and commitment to

reducing food waste (Y) have a value of less than 0.7, so it can be said that both constructs have low internal consistency.

Table 2. Construct Reliability and Validity

Indicator	Cronbach's Alpha	Composite Reliability (rho_A)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
X1	0.852	0.852	0.859	0.394
X2	0.515	0.524	0.537	0.358
X3	0.572	0.504	0.714	0.267
X4	0.681	0.669	0.728	0.275
Y	0.658	0.659	0.659	0.392

Meanwhile, the outer loading values presented in Table 3 for indicators Q1, Q3, Q4, Q5, Q8, Q14, Q15, Q16, Q17, Q18, Q19, and Q21 are invalid because they are less than 0.7. Thus, the Influence of Social Media Content (X1), Millennial Eating Manners (X2), Food Consumption Efficiency (X3), Social Demographic Role (X4), and Commitment to Reducing Food Waste (Y) respectively have four valid indicators, two valid indicators, two valid indicators, two valid indicators, and three valid indicators.

Table 3. Outer Loading Values in the Main Model

	X1	X2	X3	X4	Y
Q1	0.570				
Q2	0.734				
Q3	0.621				
Q4	0.629				
Q5	0.598				
Q6	0.769				
Q7	0.770				
Q8	0.694				
Q9	0.703				
Q10		0.869			
Q11		0.766			
Q12			0.786		
Q13			0.829		
Q14			0.551		
Q15			0.559		
Q16			-0.154		
Q17				0.661	
Q18				0.539	
Q19				0.453	
Q20				0.772	
Q21				0.431	
Q22				0.776	
Q23					0.758

Q24	0.758
Q25	0.796

Next, an evaluation of the SEM-PLS model was carried out based on the outer loading, composite reliability (ρ_c), and AVE values. Based on the results presented in Table 2 and Table 3, invalid indicators are characterized by outer loading and composite reliability (ρ_c) values of less than 0.7 and AVE values of less than 0.5. So, estimates are carried out on the structural model using all valid indicators. The re-estimation results show an outer loading and composite reliability (ρ_c) value of more than 0.7 and an AVE value of more than 0.5 as presented in Table 4 and Table 5.

Table 4. Composite Reliability Comparison

Composite Reliability	Main Model	New model
X1	0.859	0.781
X2	0.537	1,000
X3	0.714	1,000
X4	0.728	1,000
Y	0.659	1,000

Table 5. Comparison of Average Variance Extracted (AVE) values

AVE	Main Model	New model
X1	0.394	0.533
X2	0.358	1,000
X3	0.267	1,000
X4	0.275	1,000
Y	0.392	1,000

Figure 2 is an adjustment model of the main SEM-PLS model, where indicators that are declared invalid and not feasible are removed based on Table 3, Table 4, and Table 5 for measurement.

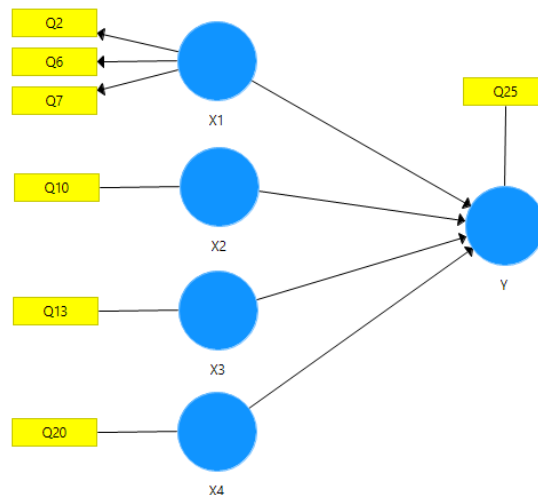


Figure 2. Adjustment Model

Structural Model Evaluation

Before testing the significance of the structural model, a collinearity test was first carried out between the influence variables of social media content, millennial eating manners, food consumption efficiency, and the role of social demographics on the commitment to reduce food waste through VIF statistics. All VIF values greater than 0.2 and smaller than 5 are presented in Table 6.

Table 6. Collinearity Testing

Exogenous Latent Variables	VIF New Model
X1	1,713
X2	1,000
X3	1,000
X4	1,000

The adjusted model obtained has a coefficient of determination value (R^2) of 0.367 as presented in Table 8. This shows that the model prediction accuracy level of 36.7% can explain the relationship between the influence of social media content, millennial eating manners, food consumption efficiency, and social roles. demographics on commitment to reducing food waste, where this relationship is included in the moderate criteria as presented in Table 7.

Table 7. R-Square Value Criteria

Criteria	R-Square Value
Weak	< 0.33
Moderate	$0.33 \leq R^2 \leq 0.67$
Strong	> 0.67

Table 8. Coefficient of Determination

Endogenous Variables	R-Square	R-Square Adjusted
Y	0.367	0.348

Next, to validate the combined performance between the structural model and the measurement model, a Goodness of Fit (GoF) value is required with the following formula:

$$\text{GoF} = \sqrt{\text{com } R^2}$$

Table 9. GoF Value Criteria

Criteria	GoF value
Small	$0 \leq \text{GOF} \leq 0.25$
Medium	$0.25 \leq \text{GOF} \leq 0.36$
Large	> 0.36

With \overline{com} is the mean of AVE and $\overline{R^2}$ is the mean of R-Square. The average communality and average R-Square values are obtained from the average communality and R^2 . The value of \overline{com} is 0.9036 and the value of $\overline{R^2}$ is 0.367, so the value of GOF is 0.576 which is classified as the Large category as presented in Table 9.

Then, to determine the effect of exogenous variable indicators on endogenous variables, it is necessary to test hypotheses using path coefficient and t-statistics values obtained through the bootstrap process. The results of this processing are summarized in Table 10.

Table 10. Significance of Relationships in the Structural Model (New Model)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)
X1	0.286	0.309	0.096	3,038
X2	0.019	0.023	0.094	0.206
X3	0.204	0.196	0.130	1,570
X4	0.364	0.245	0.103	2,397

Statistical hypothesis testing using a significance level of $\alpha = 5\%$ and t-table = 1.96. Based on the analysis results presented in Table 10, the interpretation of the inner model hypothesis testing results is as follows:

- a. H_0 : The influence of social media content (X1) does not have a significant effect on the commitment to reduce food waste (Y)

H_1 : The influence of social media content (X1) has a significant effect on the commitment to reduce food waste (Y)

Based on Table 8, a t-statistics value of 3.038 is accepted. Because the t-statistics value is $3.038 > t\text{-table}$ is 1.96. So the influence of social media content (X1) has a significant effect on the commitment to reduce food waste (Y)

- b. H_0 : Millennial Eating Manners (X2) do not have a significant effect on the Commitment to Reduce Food Waste (Y)

H_1 : Millennial Eating Manners (X2) have a significant effect on the Commitment to Reduce Food Waste (Y)

Based on Table 8, the t-statistics value of 0.206 is rejected. Because the t-statistics value is $0.206 < t\text{-table}$ is 1.96. So Millennial Eating Manners (X2) do not have a significant effect on the Commitment to Reduce Food Waste (Y)

- c. H_0 : Food Consumption Efficiency (X3) has no significant effect on the Commitment to Reduce Food Waste (Y)

H_1 : Food Consumption Efficiency (X3) has a significant effect on the Commitment to Reduce Food Waste (Y)

Based on Table 8, the t-statistics value of 1.570 is rejected. Because the t-statistics value is $1.570 < t\text{-table}$ is 1.96. So Food Consumption Efficiency (X3) does not have a significant effect on the Commitment to Reduce Food Waste (Y)

d. H_0 : The role of social demographics (X4) does not have a significant effect on the commitment to reduce food waste (Y)

H_1 : The role of social demographics (X4) has a significant effect on the commitment to reduce food waste (Y)

Based on Table 8, a t-statistics value of 2.397 is accepted. Because the t-statistics value is $2.397 >$ the t-table is 1.96. So the role of social demographics (X4) has a significant effect on the commitment to reduce food waste (Y)

The results of the SEM-PLS modeling are presented in Figure 3. The final form of the SEM-PLS model can be written mathematically as follows:

$$\hat{Y} = 0,286 \hat{X1} + \zeta_1 \tag{1}$$

$$\hat{Y} = 0,364 \hat{X4} + \zeta_4 \tag{2}$$

- Y : Endogenous Variable (Commitment to Reduce Food Waste)
- ζ_1 : Error Error Exogenous Variable X1
- ζ_4 : Exogenous Variable Error Error X4
- $\hat{X1}$: Exogenous Variables (Influence of Social Media Content)
- $\hat{X4}$: Exogenous Variables (Social Demographic Role)

Based on Equation (1), it can be seen that the commitment to reduce food waste (Y) will cause the influence of social media content (X1) to increase by 28.6%, taking into account the error (ζ). The same thing is also shown by Equation (2) which indicates that every increase in commitment to reducing food waste (Y), will increase the role of socio-demographics (X4) by 36.4% by considering the error (ζ). The presence of an error (ζ) indicates that there are other unobserved factors. In other words, the commitment to reduce food waste (Y) is influenced by the influence of social media content (X1), the role of social demographics (X4) and other unobserved factors.

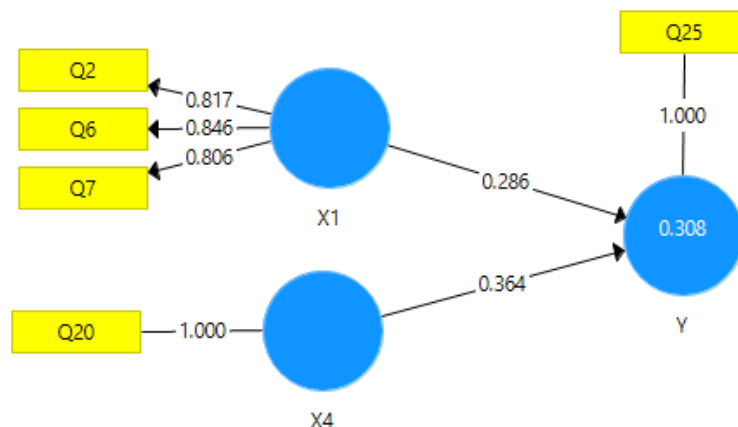


Figure 3. Final Model

The intention to throw away or leave food behind is motivated by three strongest factors, namely attitudes, norms, and behavioral control felt by the individual (Ajzen, 2011). This intention then underlies individuals in carrying out food waste (Aktas et al. 2018). Therefore, Gen Z's commitment to reducing food waste can certainly be influenced by the surrounding environment, both directly and through social media. For this reason, efforts that can be made to increase Gen Z's commitment to reducing food waste need to be done together, both in the surrounding environment and on social media. Recommendations for activities based on the results of structural equation modeling that have been obtained to increase Gen Z's commitment to reducing food waste are presented in Table 11.

Table 11. Recommended Activities

Surrounding environment	Social media
<ol style="list-style-type: none"> 1. Carrying out workshops and seminars that can be tailored to Gen Z's interests, such as business opportunities from leftover food. 2. Forming a community that cares about food waste, so that with this community various social actions can be carried out. 3. Collaborating with various parties who support food waste care activities as well as educational activities to reduce food waste. 	<ol style="list-style-type: none"> 1. Create educational content about food waste that can attract the attention of Gen Z. 2. Create a challenge on social media that invites Gen Z to reduce food waste by adding hashtags and giving attractive prizes to winners to increase participation.

Conclusion

Based on the results of the analysis using the SEM-PLS model that has been carried out, it can be concluded that there are several factors that most influence Gen Z in reducing food waste, namely the influence of social media content and the role of social demographics. Other factors, namely millennial eating manners and food consumption efficiency, are supporting factors in influencing Gen Z to reduce food waste. The influence of social media content is considered to be able to influence Gen Z in reducing food waste because today's young people or what are usually called Gen Z use social media more to interact with each other than to interact directly socially in their environment. The influence of social media content is such as creating creative content on social media, creating educational campaigns related to food waste management, and forming online communities on social media that take the initiative to discuss issues related to reducing food waste by sharing tips, experiences, and support with the hope of reducing food waste. Then, the role of social demographics can influence Gen Z in reducing food waste because young people today tend to take part in activities that are trending in their environment. These trends include environmentally friendly lifestyles and efforts to be more aware of the environmental impact of food consumption habits. In addition, education through various platforms and programs that support sustainability also plays an important role in shaping Gen Z's awareness and actions. Thus, active participation in environmental campaigns and social initiatives that are popular among them can encourage behavioral changes toward reducing food waste. This study highlights the importance of understanding these factors to design effective strategies for achieving sustainable

development goals and is considered to be able to help and motivate Gen Z to reduce food waste towards these goals.

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