A BEHAVIORAL MODEL OF *FOOD WASTE DISPOSAL* USING *THE THEORY OF PLANNED BEHAVIOR* APPROACH AMONG GENERATION Z

Food Waste Disposal Behavior Model Using the Theory of Planned Behavior Approach in Generation Z

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ABSTRACT

Consumption is a basic activity necessary for humans to maintain their quality of life. Consumer consumption patterns in daily life include the type of food, the amount of food consumed, and the time spent consuming food. However, errors in the consumption patterns adopted by the community can potentially lead to food waste. Therefore, this study examines consumer behavior that contributes to food waste, focusing on Generation Z as the subject, due to their susceptibility to engaging in food waste. Additionally, the food waste campaign was utilized as a mediating variable. Data analysis was conducted using a quantitative research approach, and data collection was carried out via an online questionnaire. The research sample was selected using purposive sampling. The research data were analyzed using the SEM-PLS tool with the WarpPLS 7.0 approach. Based on the findings, it can be concluded that the variables in the Theory of Planned Behavior (TPB) can explain food waste behavior through intention as a mediating variable; however, the food waste campaign does not moderate the relationship between intention and behavior.

Keywords: *Food waste, Theory of Planned Behavior, Generation Z*

ABSTRACT

Consumption is a fundamental activity required by humans to support quality of life. The consumption patterns exhibited by consumers in daily life include the types of food, the quantity of food consumed, and the amount of time spent eating. However, errors in the consumption patterns adopted by society have the potential to lead to *food waste*. Therefore, this study examines consumer behavior that leads to *food waste*, using Generation Z as the subject, as this generation is particularly prone to food disposal practices. Additionally, a *food waste* campaign was employed as a mediating variable. Data analysis was conducted using a quantitative approach, with data collection performed via an *online* questionnaire. The research sample was selected through *purposive sampling.* The research data were analyzed using SEM-PLS with the WarpPLS 7.0 approach. Based on the research conducted, it can be concluded that the variables in *the Theory of*

Planned Behavior (TPB) can explain food disposal behavior through intention as a mediating variable; however, the *food waste* campaign does not moderate the relationship between intention and behavior.

Keywords: *Food waste*, *Theory of Planned Behavior,* Generation Z

INTRODUCTION

Consumption is a fundamental activity required by humans to support quality of life. Consumption patterns in daily life include the types of food, the quantity consumed, and the time spent eating. According to Diki (2021), consumers regulate the amount of food consumed to meet their needs. Therefore, consumption is inextricably linked to population size; an increase in population leads to higher food demand. Furthermore, population growth can also have adverse effects, as highlighted by BAPPENAS in 2021: with a population exceeding 200 million, Indonesia faces a significant potential for *food loss* and *waste* (FLW), with percentages that are already very high and continue to rise annually.

Food waste refers to food waste that falls under the category of food loss because it is discarded at various stages of the food supply chain (Stancu *et al*., 2016). Every year, there is a massive loss of food and food waste intended for human consumption, with an estimated loss of approximately 24% of the global food supply for human consumption (Kummu *et al.,* 2012). According to data from the Ministry of Environment and Forestry (KLHK) (2018), food waste accounts for 44% of the total waste generated in Indonesia. *Food waste* is not limited to food loss but also causes other impacts on the environment, society, and the economy. Unfortunately, consumers do not sufficiently associate *food waste* with the environmental issues it causes; instead, they focus on the social impacts of food waste and household economic concerns related to time and money (Watson *et al*., 2013).

However, research on consumer behavior that influences the generation of *food waste* remains very limited compared to studies that estimate the amount of food waste and its impacts. Therefore, this study adopts a consumer behavior perspective grounded in *the Theory of Planned Behavior* (TPB). Based on previous research conducted by the Indonesian Food and Nutrition Research Center ( ) on food disposal behavior in relation to *food waste,* it was found that the population segment most likely to cause *food waste* or most prone to discarding food is young people or Generation Z. Furthermore, as the dominant demographic, Generation Z also dominates social media usage in Indonesia (Widyati, 2022). Therefore, this study focuses on Generation Z as the subject and analyzes *food waste* campaign factors as moderating variables of food disposal behavior.

RESEARCH METHOD

This study employs a quantitative approach by developing hypotheses related to the phenomenon under investigation. The study focuses on Generation Z individuals from various geographic backgrounds as the subjects. Data were collected directly via a questionnaire administered through *Google Forms*. Sampling was conducted using *purposive sampling*, and the minimum sample size required for the study was determined based on the calculations by Hair *et al*. (2014), following the guidelines in the table below:

Table 1. Sample Calculation

Maximum Number of Arrows Pointing at a Construct	*Significance Level*											
	1%				5				10			
	Minimum R^2				*Minimum* R^2				*Minimum* R^2			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

Source: Hair *et al* (2014)

Based on the calculations using the table above, the minimum sample size with a 10% significance level and the number of arrows in the structural model for this study is 128 respondents. The data obtained from the respondents will be analyzed using descriptive analysis and quantitative analysis methods, specifically the PLS (*Partial Least Squares*) method, with the assistance of the WarpPLS 7.0 software.

RESULTS AND DISCUSSION

1. Respondent Characteristics

The respondents participating in this study are Generation Z, aged 15 to 24 years, and have heard of or seen *food waste* campaigns. Respondent characteristics include gender, age, highest level of education, occupation, and income level, as detailed in Table 2 below.

Table 2. Respondent Characteristics

No.	Variable	Interval	Percentage (%)
1	Gender	Female	71

		Male	29
2	Age	15–18	5
		19–21	26
		22–24	69
3	Highest level of education	High School	71
		Diploma	5
		Bachelor's Degree	23
		Master's Degree	1
4	Employment	Students	95
		Entrepreneurs	5
5	Income level	1,000,000–1,500,000	70
		1,500,000–2,000,000	14
		>2,000,000	16

Source: Processed Primary Data (2023)

Respondent Characteristics by Gender

Based on the gender composition of respondents in Table 2, it can be seen that the number of female respondents is greater than the number of male respondents, with 94 female respondents (71%) and 39 male respondents (29%). This aligns with the findings of Afifah (2018), who stated that women possess greater knowledge regarding household consumption behavior.

Respondent Characteristics by Age

Based on the data regarding respondent characteristics by age in Table 2, it is evident that all respondents meet the study's criteria, specifically Generation Z within the age range of 15 to 24 years. This aligns with the research by Mondejar-Jimenez *et al*. (2016), which found that Generation Z, aged 15 to 24, is the population segment most prone to generating *food waste,* as their data indicates they discard more than 6% of the food they consume each week.

Respondent Characteristics by Highest Level of Education

A total of 94 respondents (71%) had a high school (SMA) education as their highest level of education, making them the largest group compared to respondents with diplomas or master's degrees. Respondents with a bachelor's degree as their highest level of education constituted the second-largest group, with 31 respondents (23%). Meanwhile, consumers with a postgraduate degree as their highest level of education constituted the smallest group, with only 2 respondents, representing 1%. Several studies indicate that education plays a significant role in shaping individual behavior regarding *food waste*. Research by Piras *et al*. (2023) demonstrates that education can have a positive impact on individual behavior regarding food waste.

Respondent Characteristics by Occupation

The occupational groups among the respondents were students and entrepreneurs. The largest occupational group, comprising 127 respondents (95%), was students, while the smallest group was entrepreneurs, with 6 respondents (5%). Students are classified as Generation Z, with an age range of 18 to 24 years. Existing research indicates that students' general interest in *food waste* issues has a high positive impact on their behavior regarding *food waste*.

Respondent Characteristics by Income Level

Based on the data on respondent income composition presented in Table 2, it can be seen that the highest income bracket—with an amount exceeding Rp2,000,000—was not the most common income group among respondents. Instead, the lowest income bracket—ranging from Rp1,000,000 to Rp1,500,000—had the highest number of respondents, totaling 93 people (70%). This aligns with the research by Saputro *et al*. (2021), which states that urban residents with sufficient income tend to purchase food ingredients or buy ready-to-eat meals. However, this tendency does not always lead to food waste, as recent studies have found a negative correlation between income and food waste (Chalak *et al*., 2019).

2. Descriptive Statistical Analysis

Descriptive analysis was conducted prior to analyzing the data using SEM-PLS (*Structural Equation Modeling-Partial Least Squares*). The purpose of descriptive statistical analysis is to describe the data, determine the distribution of data from the respondents' " " responses, and calculate the mean of each indicator and variable used in the study.

Table 3. Descriptive Statistical Analysis of Variables

	Variable	Min.	Max.	Mean	Std. Deviation
X_1	Attitude				
$X_{1.1}$	Attitude toward Food Waste	2	5	4.30	0.75
$X_{1.2}$	Concerns	2	5	4.47	0.74
X_2	Subjective Norm				
$X_{2.1}$	Environmental Influence	2	5	4.11	0.78
$X_{2.2}$	Emotional	2	5	4.41	0.76
$X_{2.3}$	Social Norms	2	5	4.45	0.68
X_3	Perception of Self-Control				
$X_{3.1}$	Perceived Ease	2	5	4.49	0.67
$X_{3.2}$	Perceived Usefulness	2	5	4.66	0.51
$X_{3.3}$	Perception of Self-Control	2	5	4.54	0.68
X_4	*Food Waste* Campaign				
$X_{4.1}$	Effectiveness	2	5	4.14	0.78
$X_{4.2}$	Exposure	2	5	4.24	0.73
Y_1	Intention				
$Y_{1.1}$	Interest	2	5	4.45	0.69
$Y_{1.2}$	Planning	2	5	4.31	0.74
Y_2	Behavior				

	Variable	Min.	Max.	Mean	Std. Deviation
$Y_{2.1}$	Processing	2	5	4.27	0.75
$Y_{2.2}$	Implementation	2	5	4.53	0.63

Source: Processed Primary Data (2023)

Based on the calculations of all mean values and standard deviations of the variables, it was found that the highest mean value was obtained by the self-control perception variable, which falls into the "good" category with a mean value of 4.66 for $X_{3.2}$ (perceived usefulness), and the lowest mean value was obtained by the subjective norm variable, which still falls into the "good" category with a mean of 4.11 for $X_{2.1}$ (environmental influence). According to Aggarwal (2013), if the standard deviation exceeds the mean, the data for an observed item or variable contains outliers. However, based on the data presented in Table 3, it is found that all variables and indicators used have standard deviations greater than their respective means, indicating the absence of *outliers*.

3. Measurement Model Analysis

This study employs the SEM-PLS (*Structural Equation Modeling-Partial Least Squares*) method, utilizing structural equation modeling via the WarpPLS 7.0 analysis tool. The analysis includes evaluation of the measurement model (*outer model*) and the structural model (*inner model*) as follows.

Outer Model (Measurement Model Evaluation)

The Outer Model (Measurement Model Evaluation) describes the specifications of the relationships between latent variables and their indicators to be tested by examining the values of convergent validity to determine whether the variables used are valid. This includes tests of convergent validity, discriminant validity, and reliability.

1. Convergent Validity

Convergent validity can be determined through the correlation coefficient values between reflective indicator scores and latent variable scores.

Table 15. *Output of Combined Loadings and Cross-Loadings*

	X_1	X_2	X_3	X_4	Y_1	Y_2	P-value
$X_{1.1}$	(0.860)	0.027	-0.106	0.023	-0.104	0.032	<0.001
$X_{1.2}$	(0.860)	-0.027	0.106	-0.023	0.104	-0.032	<0.001
$X_{2.1}$	0.184	(0.647)	-0.046	0.220	-0.255	0.212	<0.001
$X_{2.2}$	-0.036	(0.878)	-0.082	-0.065	0.137	0.029	<0.001
$X_{2.3}$	-0.105	(0.834)	0.122	-0.102	0.054	-0.195	<0.001
$X_{3.1}$	-0.108	0.073	(0.771)	-0.178	0.038	0.156	<0.001
$X_{3.2}$	0.077	0.032	(0.762)	0.189	0.038	-0.342	<0.001
$X_{3.3}$	0.033	-0.105	(0.773)	-0.009	-0.076	0.181	<0.001
$X_{4.1}$	0.026	0.037	-0.090	(0.923)	0.100	-0.002	<0.001
$X_{4.2}$	-0.026	-0.037	0.090	(0.923)	-0.100	0.002	<0.001

$Y_{1.1}$	-0.062	0.023	0.015	0.024	(0.886)	-0.205	<0.001
$Y_{1.2}$	0.062	-0.023	-0.015	-0.024	(0.886)	0.205	<0.001
$Y_{2.1}$	-0.009	-0.043	0.043	-0.015	-0.301	(0.846)	<0.001
$Y_{2.2}$	0.009	0.043	-0.043	0.015	0.301	(0.846)	<0.001

Source: Processed Primary Data (2023)

Based on the *factor loadings* shown in Table 4, it can be seen that all values are above 0.5, which means that all indicators used in each latent variable have met the criteria for convergent validity.

2. Discriminant Validity

Discriminant validity has two approaches: discriminant validity for each indicator and discriminant validity for the questionnaire. Discriminant validity for each indicator can be seen from a comparison of *loading* and *cross-loading* values; if the *loading* value of each indicator is greater than the *cross-loading* value in the latent variable, it is said to meet discriminant validity. Based on the data in Table 4, the *loading* values for all indicators are greater than the *cross-loading* values, thus meeting discriminant validity. As for the discriminant validity of the questionnaire, this can be determined by examining the *square root of the average variance extracted* (AVE). If the AVE value is greater than that of the relevant latent variable, it can be concluded that more than half of the indicators used in the questionnaire have explained their respective latent variables very well.

Table 5. *Correlation* Values of *Latent Variables with Square Roots of AVEs*

	X_1	X_2	X_3	X_4	Y_1	Y_2
X_1	(0.860)	-0.118	-0.075	-0.032	-0.032	-0.012
X_2	-0.118	(0.793)	0.134	0.379	0.155	0.117
X_3	-0.075	0.134	(0.769)	0.003	0.380	0.353
X_4	-0.032	0.379	0.003	(0.923)	0.292	0.212
Y_1	-0.032	0.155	0.380	0.292	(0.886)	0.562
Y_2	-0.012	0.117	0.353	0.212	0.562	(0.846)

Source: Processed Primary Data (2023)

The AVE values in Table 5 shown in parentheses indicate higher values compared to the respective variables (without parentheses); therefore, it can be concluded that discriminant validity has been met and more than half of the indicators used in the questionnaire have explained their respective latent variables very well.

3. Reliability

Reliability tests were used to measure the questionnaire's reliability using composite reliability and internal consistency reliability (*Cronbach's alpha*). The composite reliability and internal consistency reliability values are presented in Table 6.

Table 6. *Composite reliability* and *Cronbach's alpha* values

Variable	Composite Reliability Coefficients	Cronbach's Alpha Coefficients
Standard Value	**≥ 0.70**	**> 0.60**
X_1	0.851	0.649
X_2	0.833	0.696
X_3	0.812	0.654
X_4	0.920	0.826
Y_1	0.880	0.727
Y_2	0.834	0.605

Source: Processed Primary Data (2023)

Based on the *composite* reliability and internal consistency (*Cronbach's alpha*) values presented in Table 18, it can be seen that all variables used in the study meet the established criteria, and the indicators used in the questionnaire are reliable and consistent.

***Inner Model* (Structural Model Evaluation)**

The Inner Model (Structural Model Evaluation) aims to identify the relationships among latent variables (*inner model*) in relation to the assumptions or theories used. Structural model evaluation involves several stages, examining *R-Squared*, *Q-Squared*, *Effect Size* (f^2), and *Goodness of Fit* (GoF) to assess the model's fit (Solimun *et al.,* 2017).

1. *R-Squared*

The *R-Squared* value represents the proportion of the endogenous variable (dependent variable) that can be explained by the exogenous variables (independent variables). The following are the *R-Squared* values from this study.

Table 7. *R-Squared* Values

Indicator	Y_1	Y_2
R-Squared	0.160	0.312

Source: Processed Primary Data (2023)

Based on the *R-squared* values in Table 7, there are two criteria: the first *R-squared* value is 0.16 (weak), meaning that approximately 0.16 or 16% of the variability in intention is explained by the independent variables in the model, while 84% is explained by other variability outside the variables considered in the analysis. Intention has an influence on food waste behavior with a value of 0.31 or 31%, while the remaining 69% is influenced by other variables.

2. *Q-Squared*

Q-squared is used to assess the predictive validity or relevance of a set of exogenous variables (independent variables) on endogenous variables (dependent variables), where a standard *Q-squared* value > 0 indicates good *predictive power*. The following are the *Q-squared* values in this study.

Table 20. *Q-Squared* Values

Indicator	Y_1	Y_2
Q-Squared	0.206	0.373

Source: Processed Primary Data (2023)

Based on the test results, it is known that the *Q-squared* values of variables Y_1 and Y_2 are 0.20 and 0.37, respectively. These results indicate that both values meet the *Q-squared* criteria

3. *Effect size* (f^2)

The effect size (f^2) test was conducted to determine the proportion *of variance* from the exogenous variables (independent variables). The following are *the effect size* (f^2) values in this study.

Table 21. *Effect size* (f^2) values

	X_1	X_2	X_3	Y_1
Y_1	0.019	0.022	0.156	
Y_2			0.062	0.271

Source: Processed Primary Data (2023)

Based on Table 21, it can be seen that the *effect size* (f^2) varies across different ranges: from X_1 (attitude) to Y_1 (intention) is 0.01 (small), from X_2(subjective norms) to Y_1(intention) of 0.02 (small), X_3(perception of self-control) to Y_1(intention) of 0.15 (moderate), X_3 (perceived self-control) to Y_2 (behavior) of 0.06 (small), and Y_1 (intention) to Y_2 (behavior) of 0.27 (moderate).

4. *Model Goodness of Fit* (GoF)

The following are the results of the *Goodness of Fit* (GoF) evaluation in this study.

Table 22. *Goodness of Fit* (GoF) Evaluation

Goodness of Fit	**Fit Criteria**	**Results**	**Notes**
Average path coefficient (APC)	P < 0.05	0.183 (P = 0.007)	Accepted
Average R-squared (ARS)	P < 0.05	0.236 (P = 0.001)	Accepted
Average adjusted R-squared (AARS)	P < 0.05	0.213 (P = 0.007)	Accepted
Average block VIF (AVIF)	Acceptable if ≤ 5, ideal if ≤ 3.3	1.150	Ideal
Average full collinearity VIF (AFVIF)	Acceptable if ≤ 5, ideal if ≤ 3.3	1.344	Ideal
Tenenhaus GoF (GoF)	Low ≥ 0.1 Medium ≥ 0.25	0.423	High

Sympson's paradox ratio (SPR)	High ≥ 0.36 Acceptable if ≥ 0.7, ideal if = 1	0.833	Accepted
R-squared contribution ratio (RSCR)	Acceptable if ≥ 0.9, ideal if = 1	0.918	Accepted
Statistical suppression ratio (SSR)	Accepted if ≥ 0.7	1.000	Accepted
Nonlinear bivariate causality direction ratio (NLBCDR)	Accepted if ≥ 0.7	0.938	Accepted

Source: Processed Primary Data (2023)

Based on the GoF test results in Table 22, it can be seen that all GoF criteria values meet the requirements.

Analysis of Variables in *the Theory of Planned Behavior*

The results of the study found that all variables in *the Theory of Planned Behavior,* including attitude, subjective norms, and perceived self-efficacy, directly influence the intention and behavior of food waste among Generation Z. Attitude is a form of evaluative response to an object that is positive or negative, and when linked to the p-value results, it is known that attitude influences food waste behavior among Generation Z, where a positive attitude toward reducing food waste and concern about its impact on the environment are important factors in the practice of reducing food waste among Generation Z.

The second variable in this study is subjective norms, with indicators of environmental, emotional, and social influences, which also exhibit a significant relationship ( ) with intentions and behavior based on a *p-value* of 0.06. This aligns with the research by Kristina *et al*. (2023), which demonstrates that subjective norms can significantly influence food waste behavior. Environmental influences that shape social norms are one indicator of subjective norms, referring to Generation Z's tendency to be directly influenced by social environments such as family or close friends, which shape responsible food waste behavior.

Next, we examine the self-control perception variable, which is reflected through several indicators, including perceived ease, perceived usefulness, and perceived self-control, all of which influence Generation Z's decisions regarding food waste. Self-control perception has a *p-value* of < 0.01 for intention and 0.02 for behavior, consistent with the research by Kristina *et al*. (2023) that a strong sense of self-control can motivate individuals to actively engage in food waste reduction practices, thereby playing a role in shaping responsible food waste disposal behavior among Generation Z.

Moderating Variable: *Food Waste* Campaign

Data processing and analysis results indicate that the *food waste* campaign variable does not exert a moderating influence on the relationship between intention and food waste behavior among Generation Z. This may be attributed to several factors, one of which is the lack of further evaluation of the numerous *food waste* campaigns introduced, resulting in a lack of environmental awareness among the public, particularly in developing countries (Zamri *et al*., 2020). Furthermore, among the public in developing countries, the urgency of environmental protection efforts regarding *food waste* is still considered a low priority; therefore, the development of *food waste* campaign strategies is necessary to strengthen food waste reduction behaviors, particularly among Generation Z.

CONCLUSION

Conclusion

1. Food waste behavior among Generation Z, analyzed using *the Theory of Planned Behavior* (TPB), reveals the influence of attitude, subjective norms, and perceived self-control on intention. With a deeper understanding of what responsible food waste behavior should entail, intervention steps are needed to raise awareness through campaigns.
2. The research results indicate that *food waste* campaigns do not influence food waste behavior. Development strategies are needed to create campaign strategies that can influence food waste behavior as an effort to foster responsible food waste practices and reduce *food waste* rates.

Recommendations

1. Future researchers can expand the variables used to investigate in greater depth and detail the factors influencing food waste behavior among Generation Z. Additionally, the scope of the study can be broadened beyond this specific generation to develop findings and strategies that can reduce *food waste* on a wider scale.
2. As part of developing a *food waste* campaign to achieve the goal of moderating or serving as a reinforcing variable for intentions regarding food waste behavior, practical and implementable solutions to reduce food waste need to be developed—not merely presenting information about its negative impacts—and collaboration between supermarkets, restaurants, and community organizations should be fostered to create an environment that supports food waste reduction efforts.

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