Drivers of Young Consumers' Willingness to Reduce Food Waste and Buy Intelligent Packaging

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ABSTRACT

Objectives: As food waste harms the sustainable environment and the economy, some innovations have been made to reduce this issue, such as intelligent packaging. However, the factors leading to consumer behavior to reduce food waste and buy intelligent packaging, particularly in developing countries are still untapped.

Methodology: This study aims to examine the relationship between green perceived value, intention to reduce food waste, and willingness to purchase intelligent packaging. Data from 230 Indonesian young consumers were analyzed using PLS-SEM.

Finding: The results showed that different elements of green perceived value had significant effects on the intention to reduce food waste and willingness to purchase intelligent packaging. Unlike the predicted relationship, the intention to reduce food waste was not significant enough to lead consumers to purchase intelligent packaging.

Conclusion: The presented study gives insights to businesspeople on which green perceived values are important for reducing food waste and encouraging consumers to buy intelligent packaging.

Keywords: Consumption Value Theory; Food Waste; Green Perceived Value; Green Marketing; Intelligent Packaging

INTRODUCTION

Increasing environmental degradation has led to the discussion of environmental preservation issues. One of the topics is food security which has positioned food waste (FW, hereafter) as an important item on the agenda of sustainable development (FAO, 2019). FW has raised concern due to its impacts on the environment and economy (Filimonau et al., 2020). The UN Environment Program stated around 931 million tons of food are wasted each year with 61 percent of the waste being household waste (Marchant, 2021). FW has also become an issue in developing countries, such as Indonesia. Since FW contributes to about 39.8 percent of the waste in Indonesia (Agmasari, 2021) with a total of 184 kg FW per year per capita (Situmorang, 2021).

Understanding consumer behavior and FW management systems may prevent FW from happening (Ghinea & Ghiuta, 2019). Even though many behavioral studies have discussed factors that could affect FW (Aktas et al., 2018; Barone et al., 2019; Cammarelle et al., 2021; Young et al., 2020), only a few have been related to green perceived value (GPV, hereafter), especially with FW. Individuals' attitudes and behaviors are influenced by their values (Seligman & Katz, 1996), and these relationships in the environmental context have been proven in various studies (e.g., Nordlund & Garvill, 2002; Schultz & Zelezny, 2003; Shin et al., 2017; Tamar et al., 2021). Consumers are keener to buy green products if they perceive the value as being high (Chen & Chang, 2012), and will be willing to pay more (De Medeiros et al., 2016; Zaidi et al., 2020).

One of the attempts to reduce FW is through innovative packaging by extending shelf life and preventing spoilage (Emblem, 2012). Innovative packaging, such as smart packaging, consists of active and intelligent packaging (Verghese et al., 2013). Active packaging uses three types of solution (scavengers, emitters, and adaptors) to ensure product quality and prolong their shelf life (Robertson, 2012; Tiekstra et al., 2021), while intelligent packaging applies sensors or detection devices such as temperature indicators, nanosensors, and contamination indicators that record internal or external changes and alert users (Bouwmeester et al., 2009; Cruz et al., 2018).

Like other new technology, smart packaging should gain acceptance from consumers (Li et al., 2020). Tiekstra et al. (2021) found that intelligent packaging was more likely to be successful than active packaging as it enabled consumers to know real-time use by or expiration date. Despite its potential, studies of intelligent packaging in the FW context are still limited to developed economies (Cammarelle et al., 2021; Tiekstra et al., 2021; Young et al., 2020; Arief, H., 2022) while almost none have been used in developing countries. In Indonesia, previous research shows that intelligent packaging features can help monitor perishable foods such as soy milk (Setyani et al., 2022). Although the correlation between GPV and willingness to purchase green products has been examined (Chen & Chang, 2012; De Medeiros et al., 2016; Zaidi et al., 2020), none have examined FW in the intelligent packaging context. Therefore, this study aims to test the relationships between each element of GPV, intention to reduce FW, and willingness to purchase intelligent packaging (WPIP, hereafter).

LITERATURE REVIEW

Environmental Concern and Green Behavior

Environmental Concern (EC, hereafter) is a key factor in influencing behavioral intention (Ringle et al., 2021). Fontes et al., (2021) suggest that consumer purchase intention is influenced by environmental behavior and caused by pro-environmental behavior engagement. Nielsen (2019) reported that almost 75% of global consumers were enthusiastic to pay for products with recycled packaging and more environmentally friendly elements to avoid environmental damage. Ozaki et al. (2011) and Wang et al. (2017) confirmed the significant influence of EC on individuals' attitudes and purchase intentions towards green products, such as intelligent packaging to reduce environmental damage. As such, this study predicts a positive influence of EC on the IRFW and WPIP that is presented as follows:

H1: EC directs to a greater IRFW.

H2: EC directs to a greater WPIP.

Social Value and Green Behavior

Individuals with high social value tend to have a greater environmental awareness that leads them to take pro-environmental behavior, such as reducing FW. Green behavior has become a modern lifestyle and consumers tend to adopt green behavior just for their social identity (Mohd Suki & Mohd Suki, 2015). Social Value (SV, hereafter) may influence consumers' green behavior because of its influence, such as image, acceptance, and group identity (Biwas & Roy, 2015). Woo & Kim (2019) found that SV influences consumers' intention towards green purchasing as they want to obey the SV that is formed by their social relationship. Consumers who are quite sensitive to environmental issues also prefer to buy green products to help prevent environmental damage, even though the price is higher than non-environmentally friendly products (Zaidi et al., 2020). Thus, having a high SV can make consumers purchase green products, including recycled products and intelligent packaging. Given the context, this study proposes the following hypotheses:

H3: SV directs to a greater IRFW.

H4: SV directs to a greater WPIP.

Generativity and Green Behavior

Generativity is closely related to altruism value which focuses on individuals' concern about the consequences of their behavior on others (Hiratsuka et al., 2018). Therefore, generativity can be associated with green consumption behavior (Shiel et al., 2020). Generative individuals prefer products that can help them reduce environmental damage (Handayani et al., 2018) so this can affect their intentions and purchasing behavior. Zaidi et al. (2020) found that consumers with higher generativity were likely to consider products that are good and safe for future generations as a concern. In this study, the effect of generativity is studied on the IRFW, and the WPIP is presented as follows:

H5: GEN directs to a greater IRFW.

H6: GEN directs to a greater WPIP.

Functional Value and Green Behavior

As consumers begin to realize their roles and responsibilities towards the environment, they start appreciating the Functional Value (FV, hereafter) of green products (Cherian & Jacob, 2012). Dangelico et al. (2021) and Adi et al. (2022) reported the significance of FV in

stimulating consumers' willingness to buy green products. In terms of the packaging's role in green behavior, consumers who feel they have a responsibility to reduce environmental issues, especially regarding FW, are more likely to buy food products wrapped in innovative packagings, such as intelligent packaging (Cammarelle et al., 2021). This study suspects its superior functional value will increase consumers' WPIP through the following hypothesis:
H7: FV directs to a greater WPIP.

Relationship between Green Behaviors
Consumers with a high IRFW will generate less FW (Mumtaz et al., 2022) and are more likely to purchase intelligent packaging (Cammarelle et al., 2021; Young et al., 2020). Their concern about the FW issue encourages them to use intelligent packaging due to its ability to provide information about food quality and safety (Cammarelle et al., 2021; Emblem, 2012). Intelligent packaging has an indicator that can interact with internal and external factors to which it will generate responses according to the food's condition. The generated information serves not only for communication but as a tool to reduce FW (Poyatos-Racionero et al., 2018). This study proposes the following hypothesis:
H8: IRFW directs to a greater WPIP.

Figure 1. Research Framework
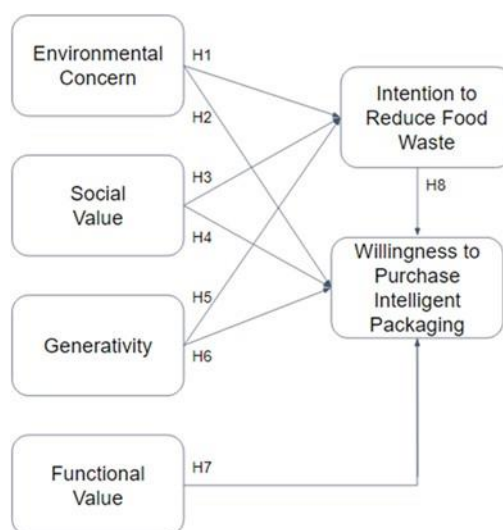
METHOD

Descriptive quantitative research was used to test the proposed hypotheses. This study focused on Generations Y and Z because they have more awareness of the impact of their consumption decisions on the environment and higher pro-environmental responsibility than previous generations (Smith et al., 2012). Generation Y tends to try to reduce FW as much as possible (Bravi et al., 2019), while Generation Z expresses guilt during food wastage (Goh & Jie, 2019). This study chose Generation Y and Z in the Greater Jakarta area as the respondents. Data from the Ministry of Environment and Forestry stated that in 2021 Jakarta produced around 3.08 million tons of waste where 27.8% of it was FW (Rizanty, 2022). Data from National Waste Management Information System (2021) showed that Bogor, Depok, and Bekasi produced 45.55% while Tangerang and South Tangerang produced 62.38% of FW. Despite their

potential, there are still few studies focusing on these segments. Green awareness is one of the key factors that may change consumer behavior toward environmentally friendly products (Ramli et al., 2020; Rizkiatami et al., 2023). In addition, (Wei et al., 2018) said that the higher the green awareness of these consumers, the more willing they are to pay more for green products. Therefore, the sample was selected purposively by targeting young individuals who are aware of the FW issues but may have produced FW either intentionally or unintentionally in the last three months. The minimum sample size of 155 (31 indicators x 5) was needed based on the sample-to-item ratio rule (Memon et al., 2020).

An online closed-ended questionnaire was performed to obtain data from the targeted individuals. The questions were adapted from several previous studies to ensure their validity. The GPV consists of four elements: EC was measured by nine items from Wu et al. (2019), Li et al. (2019), and Biswas and Roy (2015); FV and SV each were measured by five items from Woo and Kim (2019) and Biswas and Roy (2015); and generativity was measured by six items from Harmsel (2021). Six items for IRFW were adapted from Barone et al. (2019) and Aktas et al. (2018). WPIP had six items adapted from Harmsel (2021). All items were measured by a 6-point Likert scale.

The partial least square-structural equation modeling (PLS-SEM) was utilized to test the significance of the proposed relationships. Hair et al. (2011) argue that the PLS-SEM method is appropriate for prediction and theory development. This study applied PLS-SEM to maximize the predictive ability of the consumption value theory when tested in the context of FW and innovative packaging in Asia. Moreover, this study has a relatively small sample size of 230 which makes PLS-SEM a solution for the limitations (Sosik et al., 2009).

RESULTS AND DISCUSSION
Results
After processing the data, 230 of 270 responses could be used to test the hypotheses. This study was dominated by women and well-educated respondents (Table 1). Almost 60 percent of the respondents had a monthly income of less than USD350 which indicated that they had low to moderate purchasing power. It might be because some of them were still studying or early in their career.

Table 1. Profile of the respondents (n = 230)

Demographic Profile		Frequency	Percentage (%)
Gender	Male	46	20.00
	Female	131	56.96
	Rather not say	53	23.04
Age	16 – 25	169	73.48
	26 – 35	34	14.78
	36 – 45	27	11.74
Education	Primary or Middle School	1	0.43
	High School	33	14.35
	Diploma	21	9.13
	Undergraduate degree	150	65.22

	Postgraduate degree	25	10.87
Occupation	Employee	39	16.96
	Civil servant	15	6.52
	Entrepreneur	23	10.00
	Student	111	48.26
	Housewife	5	2.17
	Not Employed	12	5.22
	Others	25	10.87
Monthly Income	Less than IDR 5.000.000	133	57.83
	IDR 5.000.000 - 9.999.999	52	22.61
	IDR 10.000.000 - 14.999.999	29	12.61
	IDR 15.000.0000 - 19.999.999	0	0.00
	IDR 20.000.000 and above	16	6.96

Six indicators had a factor loading of less than 0.7. The remaining 28 indicators met the convergent validity requirements with a factor loading above 0.7 and an AVE (Average Variance Extracted) between 0.586 and 0.705. They were also reliable with composite reliability between 0.828 and 0.941 and Cronbach's alpha ranging from 0.692 to 0.927 as shown in Table 2. Discriminant validity was also met where all HTMT ratios were below 0.85 (Table 3).

Table 2. Result of the descriptive statistics, validity, and reliability test (n = 230)

Variable (item)	Descriptive Statistics		Convergent Validity	Reliability		
	Mean	S.D.	Factor Loading	AVE	Composite Reliability	Cronbach's Alpha
Intention to Reduce FW				0.617	0.828	0.692
IRFW1	5.000	0.850	0.720			
IRFW2	5.326	0.886	0.823			
IRFW3	5.430	0.729	0.810			
Environmental Concern				0.665	0.941	0.927
EC3	5.209	0.951	0.771			
EC4	4.996	1.006	0.868			
EC5	5.109	1.014	0.862			
EC6	5.078	0.943	0.833			
EC7	5.165	0.982	0.846			
EC8	4.952	1.120	0.730			
EC9	5.074	1.063	0.842			
EC10	4.843	0.996	0.759			

Functional Value				0.586	0.849	0.767
FV1	5.074	0.864	0.814			
FV3	5.152	0.817	0.704			
FV4	5.191	0.785	0.716			
FV5	5.017	1.034	0.820			
Social Value				0.705	0.905	0.860
SV1	4.765	1.045	0.849			
SV2	4.726	1.103	0.878			
SV3	4.957	0.917	0.833			
SV5	4.922	0.943	0.796			
Generativity				0.612	0.863	0.789
GN1	5.343	0.722	0.803			
GN2	5.400	0.714	0.793			
GN3	5.296	0.769	0.724			
GN4	5.396	0.622	0.805			
Willingness to Purchase Intelligent Packaging				0.679	0.927	0.905
WPIP1	5.035	0.927	0.843			
WPIP2	5.126	0.912	0.802			
WPIP3	4.904	0.978	0.826			
WPIP4	4.878	1.031	0.820			
WPIP5	4.917	1.041	0.857			
WPIP6	4.926	0.941	0.792			

Table 3. Discriminant Validity (HTMT) (n=230)

	EC	FV	GEN	IRFW	SV	WPIP
EC						
FV	0.271					
GEN	0.656	0.251				
IRFW	0.558	0.489	0.492			
SV	0.232	0.756	0.142	0.224		
WPIP	0.229	0.760	0.198	0.333	0.614	

Table 4 shows that GPV could explain the variability of IRFW by 23.4 percent. From three GPV, EC (β= 0.346; p-value = 0.000) and generativity (β= 0.168; p-value = 0.012) had a significant positive influence on IRFW while the effect of SV was insignificant (β= 0.076; p-value = 0.127). Furthermore, GPV could explain the WPIP by 46.9 percent. Two GPVs namely SV (β = 0.233 and p-value = 0.001) and FV (β = 0.491 and p-value = 0.000) had a significant positive influence on the WPIP while EC (β= 0.029 and p-value = 0.302) and GEN (β= 0.016

and p-value = 0.389) were insignificant. Unlike the proposed hypothesis, IRFW had no considerable influence on WPIP (β= 0.033 and p-value = 0.324).

Table 4. Result of the hypothesis testing (n = 230)

	Path	β	S.E.	t-value	p-value	Remark
H1	EC → IRFW	0.346	0.067	5.147	0.000	Supported
H2	EC → WPIP	0.029	0.056	0.520	0.302	Not Supported
H3	SV → IRFW	0.076	0.067	1.142	0.127	Not Supported
H4	SV → WPIP	0.233	0.072	3.238	0.001	Supported
H5	GEN → IRFW	0.168	0.074	2.255	0.012	Supported
H6	GEN → WPIP	0.016	0.057	0.281	0.389	Not Supported
H7	FV → WPIP	0.491	0.080	6.156	0.000	Supported
H8	IRFW → WPIP	0.033	0.072	0.455	0.324	Not Supported

Discussion

Between significant GPV on IRFW, EC has a greater effect than generativity. Individuals with higher EC tend to have a positive environmental attitude which increases their willingness to conduct pro-environmental behaviors (Clark et al., 2003). The positive impact of generativity on the IRFW is in accordance with Zaidi et al. (2020). Their study found that consumers with high generativity tended to consider products that are good for future generations as a concern. Against expectations, this study fails to prove the effect of SV on the IRFW which contradicts the research by Mohd Suki and Mohd Suki (2015). The difference might be due to the different characteristics of respondents.

In terms of willingness to purchase intelligent packaging, the effect of FV is stronger than SV. Even though both active and intelligent packaging may prolong product shelf-life, intelligent packaging has sensors that can inform consumers about product changes and quality (Cruz et al., 2018). Due to these benefits, consumers prefer to buy intelligent packaging than active packaging (Cammarelle et al., 2021; Tiekstra et al., 2021) and are more willing to pay a premium price. While SV is insignificant in directing consumers to reduce FW, it has a positive effect on consumers' willingness to purchase intelligent packaging. Social identification creates pressure to gain acceptance in society that will trigger individuals to buy green products (Zaidi et al., 2020). Although green products, such as intelligent packaging, are sold at a higher price than conventional products (Thøgersen & Ölander, 2003), consumers are willing to pay for these products if they help portray the consumers' pro-environmental image and fulfill their public expectations (Mai, 2019).

Contrary to the prediction, EC has no significant effect on the willingness to purchase intelligent packaging. Generativity also does not have considerable influence on the willingness to purchase intelligent packaging which does not support the assumption that generative individuals prefer products that can help them reduce environmental damage (Bragd et al., 2008). Generally, a stronger IRFW will lead to a higher willingness to purchase green products due to their concern for the environment (Zaidi et al., 2020). Nevertheless, this study does not

support the result of previous studies (La Barbera et al., 2014; Cammarelle et al., 2021; Prakash & Pathak, 2017) which might be due to the characteristics of respondents that are dominated by those aged 16-25 with a low monthly income. In contrast, green products are relatively pricey (Leszczyńska, 2015; Thøgersen & Ölander, 2003).

CONCLUSION
While it is believed that GPV encourages green behaviors, this study finds the significance of each green perceived value may differ. When tested in the context of FW and purchasing behavior toward intelligent packaging, EC and generativity affected consumer IRFW while SV and FV influenced consumer WPIP. Even though intelligent packaging may prolong product life and alert consumers about food product quality, this study found that consumers' IRFW did not necessarily increase their WPIP. This study confirmed the green behavior of consumers in developing countries is different from their developed country counterparts as reported by Cammarelle et al. (2021).

Furthermore, intelligent packaging is still quite uncommon in Indonesia and the price is significantly higher than conventional packaging. Thus, the demand for conventional packaging is still high than for intelligent packaging. This result verified Mufidah et al.'s (2018) argument that people in developed countries tended to have both the intention and action toward environmentally friendly behaviors compared to those in developing countries.

These findings are expected to be useful for F&B businesses that want to contribute to reducing FW and produce as little waste as possible. The companies together with the government and NGOs should educate young people about environmental issues and their effects in the future. Simple yet effective communication campaigns could be used to encourage young people to perform green behaviors in their daily life, either simple or complex actions such as avoiding FW, product recycling, using green products, and doing forestation. Since EC and generativity are important to form consumers' IRFW, a business with an environmentally friendly image may attract consumers who have a sense of care for the environment and the willingness to protect nature and future generations (Zaidi et al., 2021).

In terms of green products, such as intelligent packaging, product functionality, and social pressure may direct consumers to consider purchasing an environmentally friendly product. Therefore, a business that is planning to offer food products packaged in intelligent packaging can start increasing awareness regarding the advantages and value-added of intelligent packaging through the right promotions. The promotions will be more effective if they target generations Y and Z who tend to be more serious and conscious about the environment than previous generations (Smith et al., 2012). These promotions should be customized to the consumers' lifestyles and characteristics to show how intelligent packaging can help them reduce environmental problems, especially FW. Therefore, further studies may consider including price value or price sensitivity to obtain a more comprehensive understanding of the studied phenomenon since it may affect consumers' purchase decisions (Astini & Yustian, 2020). Comparison studies of green behavior between consumers in developed and developing countries are also encouraged.

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