

Green marketing framing and sustainable consumer behavior: the mediating role of digital marketing among younger consumers in Malaysia

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Abstract

The idea of sustainable consumption remains of great interest in emerging economies, especially among younger consumers who are active online. Although green marketing has been widely researched, little has been done to investigate the role of different framing strategies in shaping consumer responses in digital communication environments. This research is based on framing theory and Consumption Value Theory. To examine the impact of gain framed and loss framed green marketing messages on consumer behavior and the mediating role of digital marketing in the Malaysian context. Data were collected via an online survey from 186 Malaysian consumers and analyzed using partial least squares structural equation modeling. The results show that gain framed messages evoke more positive responses from consumers, whereas loss framed messages have no statistically significant effects. The results indicated that digital marketing had a positive effect on consumer behavior and partially mediated the relationship between gain framing messages and consumer behavior, but did not mediate the relationship with loss framing. These results indicate that gain framed messages are more effective than loss-framed messages particularly when the messages are transmitted through digital channels. The study contributes to the understanding of green marketing communication in the context of emerging economies by investigating the two framing strategies to shed light on the role of digital marketing in promoting sustainable consumer behavior.

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1. Introduction

Environmental sustainability is an issue of global concern for governments, organizations and consumers. However, despite significant efforts made to promote sustainable development, progress towards the SDGs (Sustainable Development Goals) remains uneven, particularly in the area of sustainable consumption and production [1], [2]. Growing population levels and increasing waste volume continue to pressure environmental resources and challenge ongoing sustainability initiatives in Malaysia [3], [4].

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Environmental challenges have been responded to by many organizations through adoption of green marketing practices. These practices include eco-design of products, material selection and communication activities to reduce environmental impacts [5]. The high use of digital platforms and an increasing awareness of environmental issues among younger consumers [6], [7] make this group of consumers a matter of great interest for both researchers and practitioners. As sustainability becomes increasingly embedded in everyday consumer choices, it is important to understand the drivers of consumer behavior.

Green consumer behavior has been examined from different theoretical angles. Previous research has explained environmentally responsible consumption decisions using fuzzy theory, protection motivation theory and belief-based approaches [4], [8], [9]. Framing theory and Consumption Value Theory (CVT) have also been used in sustainability-related research [10], [11]. However, the joint application of the two perspectives to explain the effect of green marketing messages on actual consumer behavior has received little attention. Digital marketing can be an important factor in the communication of environmental information to consumers and how it influences their decisions. Many consumers use digital platforms as an important source of information, interaction and engagement [12], [13]. However, the effectiveness of gain- and loss-framed messages in the context of digital communication environments has been less studied, especially among younger consumers in developing countries. Existing studies have so far mostly examined direct relationships, leaving a less clear understanding of the underlying processes of how framed messages affect consumer behavior.

The present study investigates the relationship between green marketing framing, digital marketing and consumer behavior. The paper's particular focus is on the differential effects of gain and loss framing in a digital sustainability context. The current study focuses on younger consumers in Malaysia and examines how gain- and loss-framed environmental messages influence sustainable consumer behavior in digital environments.

2. Literature review and hypotheses development

2.1. The strategic imperative and persuasion challenges in green marketing

Green marketing is usually associated with the development and promotion of products designed to reduce environmental impact [14]. What started out as a reaction to environmental concerns and stakeholder expectations has developed into a component of broader business strategy [15]. Evidence from various industries suggests that environmentally responsible practices could be related to organizational performance and customer satisfaction [16]. A similar conclusion was drawn by Setyawati et al. [17] who proposed that environmental initiatives could support both market performance and long-term business sustainability.

Green marketing is becoming more visible, but changes in consumer purchasing habits have been less uniform. Many consumers express concern about the environment, but that concern does not always translate into actual purchasing decisions. This situation is often referred to as the attitude–behavior gap [18]. Earlier studies have indicated various reasons including low personal benefits, price-related issues and unwillingness to pay a premium for sustainable products [19]. There are also doubts. In the context of greenwashing [20], consumers may become less willing to support green products when environmental claims are perceived as exaggerated or misleading. Under such circumstances it becomes more and more difficult to credibly communicate environmental benefits. Consumption Value Theory (CVT) provides one explanation for these differences in consumer responses. This theory suggests that several forms of value influence consumer buying decisions, such as functional value, emotional value, and social value [21]. These values have been associated with both environmental attitudes and behavioral outcomes in green consumption research [22]. Consumers who value more environmentally friendly products are more willing to adopt sustainable consumption practices [23]. Emotional value can enhance environmental responsibility and functional value can reduce uncertainty of environmental claims [24]. Hence, the communication of environmental information might be of relevance, in particular when consumers evaluate the benefits of sustainable products.

This is particularly relevant among the younger consumers in Malaysia. Many in this group use digital platforms on a daily basis, and information related to sustainability is easily accessible through these channels. At the

same time, information exposure doesn't automatically mean acceptance of environmental claims. Whether consumers will believe such claims before they affect purchase decisions remains to be seen. Transparent and interactive strategies of green communication may have a significant role in the promotion of sustainable consumer behaviors.

2.2. Green consumption behavior: the ultimate behavioral outcome

Green Consumption Behavior (CB) refers to actions that take environmental considerations into account during purchasing and daily consumption activities. It includes product choice as well as the way products are used and disposed of, so that their impact on the environment can be reduced [25]. Traditionally, consumer behavior research has focused on decisions regarding the purchase and consumption of products and services [26]. In sustainability research, a distinction is often made between purchase intention and actual pro-environmental behavior as positive intentions do not necessarily translate into corresponding actions. This difference is often referred to as the intention-behavior gap [27]. Braga Junior [28] reported similar observations and suggested that environmental concern alone may not be enough to stimulate sustainable purchasing behavior.

In this study, consumer behavior is conceptualized as a construct consisting of green purchase intention and pro-environmental behavior. The combination of these two dimensions provides a more comprehensive perspective of sustainable consumer responses than purchase intention alone [18]. Previous research indicated that consumption-related values could influence not only intentions but also environmentally responsible behaviors [9]. Thus, the effects of green marketing framing can be observed in both actual behavior outcomes and in consumers' intentions.

Digital communication may also influence the relationship between green marketing framing and consumer behavior [29]. Nguyen et al. [30] demonstrated the link between digital interaction and sustainable consumer responses and engagement with environmental information. These issues are particularly important for the younger consumers in Malaysia who spend considerable time in digital environments and are often exposed to sustainability-related content. Their buying decisions are often affected by digital engagement and the value they perceive in the products and services. For this reason, younger consumers provide a useful context for examining how framed environmental messages influence sustainable consumer behavior.

2.3. Green marketing framing and consumer behavior

To reduce consumer skepticism and improve the effectiveness of environmental communication, recent studies have emphasized the importance of message framing in green marketing [31]. Green marketing framing refers to the way environmental information is presented to influence consumer perceptions and purchasing decisions [32]. In sustainability contexts, environmental messages are commonly framed either in terms of potential gains associated with environmentally responsible behavior or losses resulting from environmental neglect.

Previous research has reported mixed findings regarding the effectiveness of gain and loss framing. Some studies suggest that loss-framed environmental messages can increase consumer concern about environmental problems [26]. However, other studies indicate that gain-framed messages may produce stronger responses by emphasizing the positive personal and social benefits of sustainable consumption [33]. In addition, excessive reliance on fear-based environmental appeals may reduce message effectiveness and create negative consumer reactions [34]. Therefore, understanding the effectiveness of different framing strategies remains an important issue in green marketing research. In the current study, green marketing framing is expected to influence consumer behavior by shaping how consumers evaluate the personal, social, and environmental consequences of their purchasing decisions. Gain-framed messages emphasize the benefits associated with green consumption, whereas loss-framed messages focus on the negative consequences of environmentally irresponsible behavior. Previous studies suggest that framed environmental messages can influence consumer attitudes and behavioral responses by increasing the perceived importance of sustainable actions [26]. Similarly, Chan [35] argued that framing strategies may encourage consumers to associate sustainable consumption with socially desirable behavior. Based on these arguments, the following hypotheses are proposed:

H1: Green Marketing (Gain Framing) has a significant positive influence on consumer behavior.

H2: Green Marketing (Loss Framing) has a significant positive influence on consumer behavior.

Digital marketing also plays an important role in delivering framed environmental messages to consumers. Digital platforms are now widely used as sources of information on products and environmental issues. These platforms enable consumers to compare alternatives, question environmental claims, and engage with sustainability-related content. Previous studies have linked such activities to higher engagement with green marketing communication and in some cases to purchase decisions [36]. Hence, the role of digital channels may be important when communicating environmental messages to consumers. Framing of environmental information can influence the interpretation of sustainability messages and how consumers interact with digital content.

2.4. The mediating role of digital marketing in green communication

The use of digital technologies in marketing has grown significantly in recent years [37]. Data can now be shared more quickly through digital platforms, while interaction between organizations and consumers has become easier and more frequent. These channels have also expanded access to sustainability-related information [5], [38].

Many consumers use digital channels as a source of information, product evaluation or interaction with other users online [39]. This has resulted in an increased role of digital marketing in the everyday marketing activities. Digital platforms provide organizations with more opportunities to communicate directly with consumers than traditional communication channels. In the context of green marketing, these platforms could also increase transparency by making environmental information easier to access and evaluate, thereby reducing uncertainty about green products [40]. Figure 1 presents the proposed research framework and the relationships examined in this study.

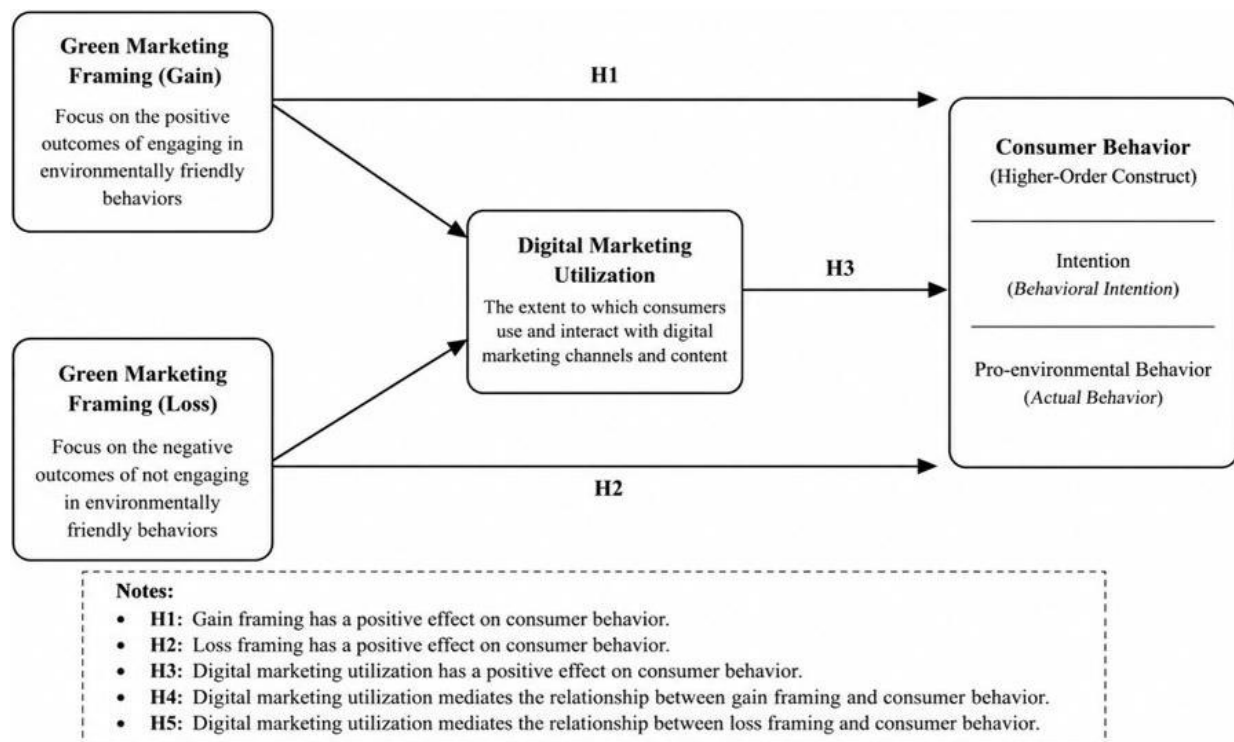


Figure 1. Research framework

Digital marketing could affect consumer behavior by providing more access to environmental information and promoting interaction with sustainability-related content. More exposure to this type of information may influence how consumers evaluate environmental issues and make purchasing decisions. Based on these observations the following hypothesis is formulated:

H3: Digital Marketing Utilization has a significant positive impact on Consumer Behavior.

Digital marketing may also influence the relationship between green marketing framing and consumer behavior. Digital communication channels often reveal messages that emphasize the environmental benefits or losses. These platforms enable consumers to interact with environmental content, exchange opinions and evaluate claims related to sustainability [40]. These interactions may enhance consumer responses to framed environmental messages and affect behavioral outcomes. Therefore, the following hypotheses are proposed:

H4: Digital Marketing significantly mediates the relationship between Green Marketing (Gain Framing) and Consumer Behavior.

H5: Digital Marketing significantly mediates the relationship between Green Marketing (Loss Framing) and Consumer Behavior.

3. Methodology

3.1. Study design, sample size, and procedure

This study applied a quantitative research design to test the proposed hypotheses. An online questionnaire was used to gather data from Malaysian consumers who met the study requirements. Participants were selected using a purposive sampling. The survey was conducted online, thus allowing the collection of responses from individuals with different demographic backgrounds across Malaysia. The G*Power software suggested that a minimum of 85 respondents was needed. The final sample exceeded this minimum and considered adequate for Partial Least Squares Structural Equation Modelling (PLS-SEM) analysis [41]. A total of 186 valid responses were retained for hypothesis testing.

For data collection, 353 potential participants were approached and 260 agreed to fill out the survey. A total of 205 questionnaires were returned. After screening the data and removing incomplete or inconsistent responses, 186 questionnaires were included in the final analysis. The effective response rate was 52.7%. Descriptive statistical analysis was conducted with JASP. The PLS-SEM analysis was conducted with SmartPLS.

3.2. Measurement instrument

Data collection was conducted through a structured questionnaire designed to measure the study constructs. Respondents were given a brief description of the study and procedures before they completed the questionnaire. The questionnaire contained two sections. The first section collected demographic data, and the second section focused on the study variables. Measurement items were adapted from previously validated scales. Green marketing framing was measured through two dimensions, namely gain framing and loss framing, using items adapted from Lee [42] and Amin and Tarun [29]. Digital marketing items were adapted from Chaudhuri [43] and Kiani [44]. Consumer behavior consisted of purchase intention and pro-environmental behavior. Purchase intention items were taken from Amin and Tarun [29], and pro-environmental behavior items were adapted from Nguyen et al. [30] and Zeynalova and Namazova [45].

All measurement items were measured using a seven-point Likert scale ranging from strongly disagree to strongly agree. After data screening, the final measurement model consisted of three items for gain framing, three items for loss framing, four items for digital marketing, three items for purchase intention, and four items for pro-environmental behavior. The full list of measurement items is presented in Appendix A. During the evaluation of the proposal, the questionnaire was reviewed for clarity and readability. A pilot test was subsequently conducted with a small group of consumers to ensure that the items were clear and appropriate for the respondents for whom they were intended. The questionnaire was designed in English and Malay to facilitate participation.

3.3. Descriptive profile of respondents

Demographic characteristics of the respondents are presented in Table 1. The Malays formed the largest ethnic group with 53.2% of the sample, followed by the Chinese (22.6%) and Indians (7.5%). Muslims made up 57.5%

of the sample, Christians 17.7% and Buddhists 9.7%. 51.1% of the respondents were women and 48.9% were men. Most responses were aged 18–24 years (73.1%) Thus, the sample was mainly composed of young consumers, which is consistent with the purpose of this study to explore the digital engagement of younger consumers. Regarding education, 57.0% of the respondents had a bachelor's degree and 17.7% had a diploma. In addition, 15.1% had a high school qualification or below. The majority of the respondents (81.2%) had a monthly income of RM 2,000 or less.

Table 1. Demographic profile of respondents

Variable	Category	Frequency	Percentage (%)
Race	Malay	99	53.2
	Chinese	42	22.6
	Indian	14	7.5
	Others	31	16.7
Religion	Muslim	107	57.5
	Christian	33	17.7
	Buddhist	18	9.7
	Hindu	12	6.5
	Chinese folk-religions	4	2.2
	Others	12	6.5
Gender	Female	95	51.1
	Male	91	48.9
Age	18–24	136	73.1
	25–35	32	17.2
	35–49	8	4.3
	50+	1	0.5
Education	Bachelor	106	57.0
	Diploma	33	17.7
	High school or less	28	15.1
	Postgraduate	19	10.2
Monthly Income (RM)	≤ 2000	151	81.2
	2001–4000	17	9.1
	4001–6000	8	4.3
	6001–8000	6	3.2
	8001–10000	1	0.5
	>10000	3	1.6
Marital Status	Single	170	91.4
	Married	13	7.0
	Divorced	3	1.6

3.4. Common method bias

Since all responses were obtained using a single survey instrument, we assessed for common method bias prior to hypothesis testing. Harman's single-factor test was performed following the procedure suggested by Podsakoff et al. [46]. The analysis showed that the first factor explained 33.1% of the total variance. Common method bias was not considered a serious concern in the present study given that this value was well below the commonly accepted cut-off values reported in the literature.

4. Results and analysis

Descriptive statistics were analyzed using JASP (Version 0.19.2) and PLS-SEM analysis was performed using SmartPLS. The analysis was conducted in two stages: (1) Assessment of the measurement model for reliability and validity and (2) Assessment of the structural model and hypothesis testing.

4.1. Measurement model

The measurement model was assessed using factor loadings, composite reliability (CR), and average variance extracted (AVE) following Hair et al. [41]. Factor loadings >0.50 were accepted as appropriate, in keeping with earlier recommendations [47]. Indicators that did not reach this threshold were eliminated to improve the convergent validity and overall reliability of the measurement model (see Table 2).

The final model consisted of three items for gain framing and three items for loss framing, four items for digital marketing and seven items for consumer behavior across its two dimensions. All retained items demonstrated satisfactory factor loadings above the recommended threshold.

The composite reliability values for all constructs exceeded the recommended level of 0.70, indicating acceptable internal consistency reliability [41]. In addition, all AVE values were above 0.50, confirming adequate convergent validity.

Discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT) and the Fornell–Larcker criterion [48]. The results indicated that all constructs met the recommended thresholds, confirming satisfactory discriminant validity, as shown in Table 3.

Table 2. Measurement model

Construct	Item	FL	CR	AVE
GM-FG	GFG1	0.876	0.893	0.737
	GFG2	0.911		
	GFG3	0.783		
GM-FL	GFL2	0.943	0.940	0.840
	GFN1	0.885		
	GML3	0.921		
DM	DM2	0.786	0.904	0.703
	DM3	0.888		
	DM4	0.880		
	DM5	0.795		
CB-I	CB-I1	0.881	0.860	0.674
	CB-I2	0.866		
	CB-I3	0.703		
CB-P	CB-P1	0.745	0.849	0.585
	CB-P2	0.820		
	CB-P3	0.790		
	CB-P4	0.698		
HOC CB	—	—	0.883	0.520

Note: GM-FG = Green Marketing Framing (Gain Framing); GM-FL = Green Marketing Framing (Loss Framing); DM = Digital Marketing; CB-I = Consumer Behavior (Purchase Intention); CB-P = Consumer Behavior (Pro-environmental Behavior); HOC CB = Higher-Order Construct of Consumer Behavior

Table 3. Discriminant validity

	GM-FG	GM-FL	DM	CB-I	CB-P
GM-FG	—				
GM-FL	0.490	—			
DM	0.466	0.167	—		
CB-I	0.720	0.350	0.515	—	
CB-P	0.690	0.292	0.503	0.881	—

Note: GM-FG = Green Marketing Framing (Gain Framing); GM-FL = Green Marketing Framing (Loss Framing); DM = Digital Marketing; CB-I = Consumer Behavior (Purchase Intention); CB-P = Consumer Behavior (Pro-environmental Behavior)

4.2. Structural model

The structural model was evaluated by examining path coefficients (β), t-values, p-values, coefficient of determination (R^2), and effect sizes (f^2), following the recommendations of Hair et al. [41]. The proposed relationships among the study constructs are presented in Figure 2. Before testing the hypotheses, collinearity was assessed using variance inflation factor (VIF) values. The results showed that VIF values ranged from 1.181 to 1.386, which are below the recommended threshold of 5, indicating that multicollinearity was not a concern in this study [41]. Table 4 presents the results of the structural model assessment and hypothesis testing.

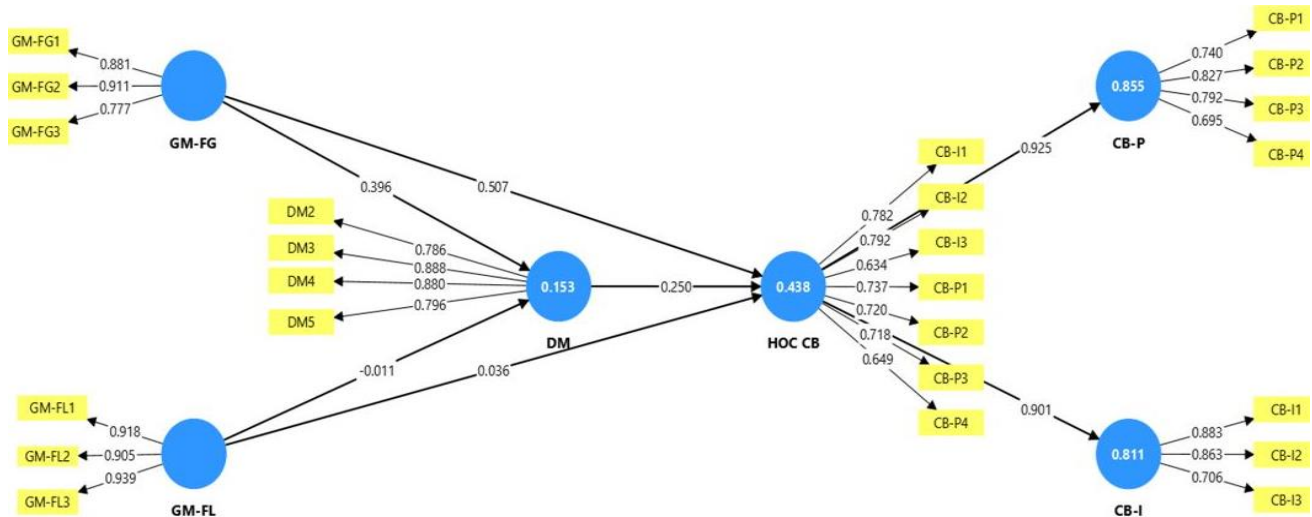


Figure 2. Assessment of structural model

The findings indicate that green marketing gain framing has a significant positive effect on consumer behavior ($\beta = 0.504$, $t = 7.718$, $p < 0.001$), supporting H1. This result suggests that positively framed environmental messages are more effective in influencing consumer behavioral responses. In contrast, green marketing loss framing does not have a significant effect on consumer behavior ($\beta = 0.042$, $t = 0.713$, $p = 0.476$). Therefore, H2 is not supported.

The results also show that digital marketing utilization has a significant positive effect on consumer behavior ($\beta = 0.249$, $t = 3.591$, $p < 0.001$), supporting H3. Although not directly hypothesized, the relationships between green marketing framing and digital marketing were also examined to assess the mediation model. The findings reveal that gain framing has a significant positive effect on digital marketing ($\beta = 0.395$, $t = 5.204$, $p < 0.001$). However, loss framing does not show a significant effect on digital marketing ($\beta = -0.010$, $t = 0.158$, $p = 0.875$).

Table 4. Structural model results

Hypothesis	Path	β	t-value	p-value	f^2	R^2	Result
H1	GM-FG $\rightarrow$ CB	0.504	7.718	<0.001	0.325	0.436	Supported
H2	GM-FL $\rightarrow$ CB	0.042	0.713	0.476	0.003	0.436	Not Supported
H3	DM $\rightarrow$ CB	0.249	3.591	<0.001	0.093	0.436	Supported
—	GM-FG $\rightarrow$ DM	0.395	5.204	<0.001	0.154	0.153	Significant
—	GM-FL $\rightarrow$ DM	-0.010	0.158	0.875	0.000	0.153	Not Significant

Note: GM-FG = Green Marketing Framing (Gain Framing); GM-FL = Green Marketing Framing (Loss Framing); DM = Digital Marketing; CB = Consumer Behavior

In addition to the direct relationships, the mediating role of digital marketing was examined using bootstrapping procedures following the recommendations of Hair et al. [41]. Table 5 presents the results of the indirect effect analysis.

The findings indicate that digital marketing significantly mediates the relationship between green marketing gain framing and consumer behavior ($\beta = 0.099$, $t = 2.744$, $p = 0.006$), supporting H4. This result suggests that

gain-framed environmental messages influence consumer behavior both directly and indirectly through digital marketing, indicating a partial mediation effect. The results show that the model explains 43.6% of the variance in consumer behavior, indicating a moderate level of explanatory power. In contrast, the model explains 15.3% of the variance in digital marketing, indicating a relatively lower explanatory ability.

In contrast, the indirect effect of digital marketing on the relationship between green marketing loss framing and consumer behavior is not significant ($\beta = -0.003$, $t = 0.150$, $p = 0.880$). Therefore, H5 is not supported. The findings suggest that loss-framed environmental messages do not significantly influence consumer behavior through digital marketing.

Table 5. Mediation analysis (indirect effects)

Hypothesis	Path	β	t-value	p-value	Result
H4	GM-FG $\rightarrow$ DM $\rightarrow$ CB	0.099	2.744	0.006	Supported
H5	GM-FL $\rightarrow$ DM $\rightarrow$ CB	-0.003	0.150	0.880	Not Supported

Note: GM-FG = Green Marketing Framing (Gain Framing); GM-FL = Green Marketing Framing (Loss Framing); DM = Digital Marketing; CB = Consumer Behavior

5. Discussion and conclusion

Clear differences emerged between the effects of gain- and loss-framed environmental messages among younger consumers in Malaysia. The results suggest that positive environmental appeals are more effective than negative appeals to encourage sustainable consumer behavior based on the framing theory with the support of the Consumption Value Theory.

Gain framing had a significant positive effect on consumer behavior. This is in line with the core proposition of framing theory [49] and prior research demonstrating that messages highlighting environmental benefits tend to elicit stronger pro-environmental responses [50]. Gain-framed messages have also been found to be more persuasive in sustainability-related contexts [10]. One reason could be that positive environmental messages are more congruent with the consumers' environmental goals and value perceptions, as they are framed around desirable personal and social outcomes.

Loss framing, however, did not significantly affect consumer behavior. This result is in line with studies that have found mixed or limited effects for negatively framed environmental appeals in voluntary consumption settings [51]. Hartmann and Apaolaza-Ibáñez [52] suggested that fear-based environmental communication can create psychological resistance and reduce message effectiveness. In sum, these results suggest that consumers are more favorable to messages focusing on the benefits of the environment rather than those focusing on risks or negative consequences. The results suggest that positive environmental appeals are more effective than negative appeals in encouraging sustainable consumer behavior based on the framing theory with the support of Consumption Value Theory.

Gain framing was found to have a significant positive effect on consumer behavior. This finding is consistent with the key tenet of framing theory, [49] and previous studies that have shown messages that highlight environmental benefits are more likely to elicit stronger pro-environmental responses [50]. In the context of sustainability, gain-framed messages have also been found to be more persuasive [10]. One possible reason is that positive environmental messages are more consistent with the consumers' environmental goals and value perceptions because they are framed in terms of the desirable personal and social outcomes.

Loss framing, however, did not have a significant effect on consumer behavior. This result is consistent with studies that have reported mixed or limited effects for negatively framed environmental appeals in voluntary consumption contexts [51]. As Hartmann and Apaolaza-Ibáñez [52] suggested, environmental communication based on fear can trigger psychological resistance and reduce the effectiveness of the message. In summary, the

results suggest that consumers are more favorable to messages highlighting environmental benefits than messages highlighting risk or negative consequences [8].

The results indicate that the effectiveness of green marketing communication depends not only on the message content, but also on the way environmental messages are framed and communicated through digital channels. Generally, positive sustainability messages are more effective than negatively framed messages in today's digital environments, confirming the importance of digital communication in promoting sustainable consumer behavior.

To sum up, the findings of the study show that gain-framed environmental messages are more effective than loss-framed environmental messages in promoting sustainable consumer behavior among young consumers in Malaysia. The findings also suggest that digital marketing can increase the impact of positively framed sustainability communication. The present study contributes to the literature by combining the ideas of framing theory and Consumption Value Theory to understand the role of green marketing messages in shaping the consumers behavior in digital contexts. The research also offers some practical suggestions for organizations that are interested in developing more successful digital marketing strategies with a sustainability orientation.

6. Implications

6.1. Theoretical implications

This study leads to some theoretical implications. The findings lend support to the framing theory [49] by providing evidence that consumer behavior is more affected by gain-framed environmental messages than loss-framed messages. These results contradict previous research that provided inconsistent support to the role of message framing in sustainability contexts [51]. The current findings suggest that positive environmental messages may be more effective especially in voluntary consumption contexts among younger consumers. This interpretation is consistent with the observations of Hartmann and Apaolaza-Ibañez [52] who questioned the effectiveness of fear-based environmental communication.

The study also contributes to literature by connecting insights from Consumption Value Theory to the green marketing framing [21]. The results support the assumptions of the Consumption Value Theory, according to which gain-framed messages might increase the perceived value of engaging in environmentally responsible behavior. In this sense, the effectiveness of environmental communication is not only a matter of how the message is framed, but also of the value that consumers give to environmentally responsible behavior.

Another contribution is the role of digital marketing in the proposed framework. The findings suggest that digital marketing serves as an important channel through which gain-framed environmental messages influence consumer behavior. On the other hand, loss framing did not have a similar effect. These findings suggest that digital communication channels play an important role in shaping consumers' responses to sustainability-related marketing messages.

Finally, this study adds to the growing body of literature on sustainable consumption in emerging economies on younger consumers in Malaysia. The findings offer context specific evidence of how digitally engaged consumers interpret and respond to green marketing communication and messages related to sustainability.

6.2. Practical implications

The results have practical implications for organizations, marketers and policymakers. The results suggest that gain-framed environmental messages more effective than loss-framed messages in stimulating sustainable consumer behavior. Thus, in marketing sustainable products and services, organization should highlight the positive environmental impacts. The results suggest that messages which highlight environmental improvement, personal benefits and social responsibility could be more effective in garnering consumer interest and promoting sustainable consumption.

The results further highlight the importance of digital marketing for communicating sustainability. Digital platforms can be used to disseminate environmental messages and to engage consumers in content related to sustainability. This is especially important with the young consumers who are very active on digital platforms to get information and to interact with the brands.

The results also suggest that message framing should be considered together with the communication channel. The study did not find significant effects for loss-framed messages, suggesting that organizations may be better off focusing on positive environmental benefits rather than environmental risks and negative consequences.

The study also has implications for policy makers and public institutions. Digital platform can be used to deliver positive messages of sustainability to improve the effectiveness of environmental awareness campaigns. Digital communication in Malaysia can be used to raise environmental awareness and promote sustainable behavior among young consumers.

7. Limitations and future research

In interpreting the results, several limitations of this study should be considered. The study was conducted only in Malaysia and the reaction of the consumers towards green marketing communication may differ in various cultural and geographical settings. Environmental message framing effectiveness may be affected by differences in environmental awareness, cultural values, and market environments. Thus, replication of the proposed model in other countries would help in assessing the generalizability of the findings.

The study had 186 respondents. The sample size was sufficient for the PLS-SEM analysis. Future research with larger and more diverse samples may give more confidence in the generalizability and stability of the results. A further limitation is related to the demographic composition of the sample. Most respondents were younger, which is consistent with the study's focus but may limit generalizability of the findings to older consumers. Moreover, comparative studies between generations may provide some further insights into age-related differences in responses towards green marketing communication.

Another limitation is the cross-sectional design. Longitudinal research could help to clarify the development of responses to framed environmental messages over time, as consumer attitudes, digital engagement and environmental awareness may change. The study was based on Consumption Value Theory, but emotional, social and functional values were not modeled as separate constructs. Future research could also investigate these dimensions of value to better understand how they influence sustainable consumer behavior.

Finally, digital marketing was examined as a mediating mechanism between green marketing framing and consumer behavior. The model did not include other factors such as trust, environmental knowledge, perceived value and green skepticism. The inclusion of these variables in further research may lead to a more holistic explanation of sustainable consumer behavior.

Competing interests

The authors have no competing interests to declare.

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Author contributions

Conceptualization: Ahmed Al-Saedi, Asmaul Husna Bin Haris Fadzilah, methodology: Ahmed Al-Saedi, Asmaul Husna Bin Haris Fadzilah, formal Analysis: Ahmed Al-Saedi, investigation: Ahmed Al-Saedi, data Curation: Ahmed Al-Saedi, validation: Asmaul Husna Bin Haris Fadzilah, supervision: Asmaul Husna Bin Haris Fadzilah, writing – Original Draft Preparation: Ahmed Al-Saedi, writing – Review & Editing: Ahmed Al-Saedi, Asmaul Husna Bin Haris Fadzilah.

Ethical approval and accordance

Study was conducted according to the ethical guidelines of University Malaysia Sarawak (UNIMAS). The participation was voluntary and the respondents were informed about the purpose of the study before answering the questionnaire. No personally identifiable information was collected, and all responses were kept confidential and used for research purposes only.

Informed consent

Informed consent was obtained from all participants prior to their participation in the survey. All responses were collected anonymously and used solely for academic research purposes.

Declaration of use of AI in the writing process

During the preparation of this manuscript, the author used ChatGPT for language refinement, grammar improvement, and text organization. All generated content was carefully reviewed and edited by the author. The author takes full responsibility for the accuracy, interpretation, and final content of the manuscript.

Data availability declaration

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Consent to publish

The authors affirm that the participants provided informed consent for the publication of the research results. All data are presented in an aggregated and anonymized format, ensuring that no individual participant can be identified.

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Appendix A. Measurement items

The appendix presents the complete list of measurement items used in this study. All items were adapted from previously validated scales to ensure content validity. Respondents were asked to indicate their level of agreement using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Construct	Code	Measurement Item
Green Marketing – Gain Framing (GM-FG)	GM-FG1	Buying green products gives me a sense of social acceptance.
	GM-FG2	Buying green products leaves a positive impression on me and my peers.
	GM-FG3	Buying green products improves my social status.
Green Marketing – Loss Framing (GM-FL)	GM-FL2	Not buying green products leaves a negative impression on me and my peers.
	GM-FL3	Not buying green products creates negative perceptions about me.
	GM-FL4	Not buying green products makes me feel socially unacceptable.
Consumer Behavior – Pro-environmental Behavior (CB-P)	CB-P1	Using my own food containers and water bottles when eating out gives me a sense of environmental responsibility.
	CB-P2	I use a personal bag when shopping instead of buying plastic bags.
	CB-P3	I use green products until they are completely consumed to avoid waste.
	CB-P4	Throwing away products before fully using them makes me feel wasteful.
Consumer Behavior – Purchase Intention (CB-I)	CB-I1	I would buy green products because they contribute to environmental improvement.
	CB-I2	I would buy green products because their performance is environmentally friendly.
	CB-I3	I would buy green products due to my concern about environmental damage.
Digital Marketing (DM)	DM2	Advertisements, blogs, and social media pages influence me to try new products or services.
	DM3	Reviews on digital platforms influence my purchasing decisions.
	DM4	The Internet and digital platforms help me find and compare product information.
	DM5	I often purchase products and services online.

Note: Some items were removed during the measurement model assessment due to low factor loadings