



Green Purchase Intention: Examining E-Commerce Sustainability, Green Marketing Innovation, Product Innovation, and Consumer Innovativeness

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ABSTRACT

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Changes in global consumption patterns encourage micro, small, and medium enterprises to adapt in an environmentally friendly manner. Therefore, this study aims to analyse the influence of e-commerce sustainability, green marketing innovation, green product innovation, and consumer innovativeness on green purchase intention, with consumer innovativeness as a mediating variable. A quantitative approach was employed in this study, utilising an accidental sampling technique, with 395 respondents from the Lake Toba area in Indonesia. Data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) through SEM-PLS software version 4, because this method is effective for analysing complex relationships between variables. The results show that e-commerce sustainability has a negative impact on green purchase intention but a positive effect on consumer innovativeness. Green marketing innovation has a positive impact on green purchase intention and consumer innovativeness, whereas green product innovation has no significant effect on green purchase intention but does have a positive impact on consumer innovativeness. In addition, consumer innovativeness has a positive effect on green purchase intention, and mediation analysis shows that e-commerce sustainability and green marketing innovation increase green purchase intention through consumer innovativeness. This study offers valuable insights for SMEs in developing green marketing strategies and leveraging consumer innovativeness to drive purchase intentions towards environmentally friendly products, while also emphasising the role of e-commerce sustainability and green innovation in shaping consumer behaviour.

1. INTRODUCTION

In an era of growing global awareness of environmental issues, consumers are increasingly concerned about environmentally friendly products. However, this concern has not yet fully translated into concrete actions. One prominent issue in this context is the low level of green purchase intention that converts into consistent green purchasing behaviour. Consumers often express an intention to purchase green products, but in reality, they still choose conventional products that are not necessarily environmentally friendly [1, 2]. This phenomenon is known as the attitude-behaviour gap, specifically the gap between positive attitudes towards sustainability and actual purchasing behaviour.

Low green purchase intention is a serious concern because it can hinder the progress of various sustainability initiatives at the producer and consumer levels. Green purchase intention is an early indicator of green marketing success and a key predictor of sustainable consumption behaviour [3, 4]. However, data shows that despite increasing consumer environmental awareness, the intention to purchase eco-friendly products remains relatively low. In Indonesia, a 2023 Nielsen survey revealed that 75% of respondents were more likely to choose products from companies with clear and

measurable sustainability programs, in response to growing concerns about societal, environmental, and social issues [5]. Meanwhile, Katadata Insight Centre [6] showed that although more than 70% of respondents stated that they support sustainability, only around 28% have ever consciously purchased green products. This disparity indicates an attitude-behaviour gap, where purchasing decisions do not necessarily follow awareness and positive attitudes toward the environment. Consumers often remain uncertain about the benefits, quality, or price of green products. Some even lack sufficient information about these products, resulting in unchanged preferences. This issue necessitates an in-depth study of factors that can positively influence green purchase intentions. One factor currently receiving attention is how sustainable e-commerce practices can influence consumer perceptions and purchase intentions. The concept of e-commerce sustainability emerged alongside the development of digital transformation, making online platforms the primary channel for consumption in modern society. E-commerce sustainability refers to integrating sustainable values into digital commerce, including product packaging, delivery, platform energy efficiency, and transparency of environmental information [7].

The growth of e-commerce has shown a very significant

trend. Over the past five years, Indonesia's e-commerce transactions have experienced rapid growth. Bank Indonesia data shows that transaction value increased from IDR 205.5 trillion in 2019 to IDR 487.01 trillion in 2024 [8]. However, increased attention to sustainability has not kept pace with this rapid growth. Many e-commerce companies focus primarily on operational efficiency, such as fast delivery and competitive pricing, while implementing environmentally friendly business practices has not yet become a top priority. However, companies that integrate sustainability principles into their digital business models have the potential to build consumer trust and loyalty, as well as drive purchase intentions for green products [9, 10]. In addition to sustainability factors in e-commerce operations, green innovation marketing is becoming an increasingly popular approach among companies. Green innovation marketing is a strategy that combines elements of innovation with sustainability messages, whether through products, production processes, or how the message is communicated to consumers [11-13]. Implementing a green innovation-based marketing strategy is believed to be able to change consumer perceptions of environmentally friendly products. Consumers who perceive a brand as innovating to support the environment are likelier to have a positive attitude and demonstrate stronger purchase intentions [14, 15]. However, the effectiveness of this strategy depends heavily on consumer characteristics. Not all consumers respond equally to innovative and sustainable messages.

Consumer innovativeness is a crucial psychological variable that enhances the impact of external factors on consumer decisions. Consumer innovativeness refers to an individual's tendency to adopt new ideas, products, or technologies earlier than others [16, 11]. Novel consumers tend to have high curiosity, are open to change, and appreciate new things that add value, including products that support sustainability.

In e-commerce and green marketing, consumers with high consumer innovativeness tend to be more open to receiving new messages that combine environmental aspects with technology. They adopt environmentally friendly products because they view it as part of a modern and progressive lifestyle, thereby playing a crucial role in accelerating the adoption of green innovation in the digital market [17, 18]. Thus, consumer innovativeness is not only a variable that directly influences the purchase decision, but can also act as a mediator between the company's sustainability practices and green purchase intentions. However, empirical studies that test the role of consumer innovativeness as a mediator in the relationship between e-commerce sustainability and green innovation marketing, influencing green purchase intention, are still minimal, especially in developing countries such as Indonesia. Most previous studies have placed consumer innovativeness as a predictor of technology adoption or customer loyalty, rather than as a psychological bridge that connects the message of sustainability with a green purchase decision [19, 20]. Furthermore, product innovations that incorporate green elements are also integral to the company's sustainability strategy. Products designed with environmentally friendly materials, utilising energy-efficient technology, and capable of natural decomposition are often perceived as more valuable by consumers. The study shows that exposure to this kind of product innovation not only increases quality perceptions but also encourages exploration and purchases by consumers who want to contribute to

environmental preservation [21]. Therefore, it is essential to consider green product innovation as a variable that influences green purchase intention.

Based on this description, the low green purchase intention is not solely caused by consumers who do not care about environmental issues. This problem needs to be analysed more comprehensively by paying attention to the contribution of company sustainability practices in e-commerce, the effectiveness of innovative marketing communication strategies, and the psychological characteristics of consumers, especially innovative tendencies. This study aims to fill the gap by developing a conceptual framework that integrates the effects of e-commerce sustainability, green innovation marketing, and green product innovation on green purchase intention, with consumer innovativeness as a mediating variable.

With a focus on Indonesian consumers in a developing digital ecosystem, this research is expected to make theoretical contributions to the green marketing literature and sustainable consumer behaviour, as well as provide practical insights for e-commerce companies in designing marketing strategies and product development that are not only business-oriented but also socially and ecologically responsible.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A comprehensive literature review is necessary to gain a deeper understanding of the relationship between e-commerce sustainability, green innovation marketing, and green purchase intention, as well as the role of consumer innovativeness in moderating this relationship. This literature review will explain the key concepts that form the basis of the research, summarise previous empirical findings, and identify open research gaps. Thus, this section will be a strong theoretical foundation for systematically formulating a conceptual frame and research hypothesis.

2.1 Green purchase intention

Green purchase intention refers to the tendency or intention of individuals to buy products that are environmentally friendly or have a minimal impact on environmental damage [2, 22]. This purchase intention is influenced by several factors, including environmental awareness, personal values, the perception of the product's benefits, and the belief that their actions can positively impact environmental sustainability [23].

The Theory of Planned Behaviour (TPB) is often used to explain the formation of green buying intentions [24]. In this study, the intention is influenced by attitudes towards behaviour (for example, positive views on environmentally friendly products), subjective norms (social pressure to purchase green products), and perceptions of behavioural control (the belief in the ability to buy these products) [25]. Several studies have shown that these three factors significantly influence green purchase intention across various cultural and demographic contexts [26, 27]. However, although the intention to purchase green products has increased in recent years, significant attitude gaps remain, specifically the discrepancy between the intention to purchase and actual purchasing actions of green products [28]. Some research results suggest that additional factors, such as trust in

green labels, price perceptions, and innovative motivation for consumers, need to be considered to bridge this gap [29, 30]. Therefore, a study that examines green purchase intention by considering the elements of digital sustainability and psychological characteristics of consumers has become increasingly relevant in the era of e-commerce today.

2.2 E-commerce sustainability, green marketing innovation and green product innovation on green purchase intention

E-commerce sustainability is the practice of managing and developing electronic commerce activities that aims to meet the needs of today's businesses and consumers without compromising the capabilities of future generations, through the implementation of environmentally friendly, socially responsible, and economically viable strategies while maintaining a balance between economic performance, environmental sustainability, and social responsibility in order to create long-term value for companies, consumers, and society [31, 32]. In practice, e-commerce companies that apply sustainability policies often gain greater trust than consumers because they are considered socially and environmentally responsible [33]. Previous studies show that sustainability in the e-commerce process contributes to increasing positive perceptions of the brand, encouraging consumers to be more loyal, and affecting their preferences and purchasing decisions [34, 35]. Green features such as sending neutral carbon, recycling information, and ethical production processes are also important in shaping consumer buying intentions [36]. Most previous research still focuses on sustainability in the traditional retail sector or manufacturing [37, 38]. Studies specifically examining the effect of e-commerce sustainability on the intention to buy green products are still limited, especially in developing countries such as Indonesia, which is experiencing rapid digitalisation growth. Therefore, this study is important for filling the literature gap and enriching the understanding of sustainability practices in the context of today's e-commerce.

Green marketing innovation is a marketing approach that combines innovative strategies with sustainable values in terms of products, processes, and communication to consumers [39]. The innovation in question can be in the form of environmentally friendly raw materials, energy efficiency in the production process, and the delivery of marketing messages that emphasise the positive impact on the environment [40]. Companies that implement green marketing innovation are considered capable of creating added value in the eyes of consumers, as they not only offer product advantages but also demonstrate social and ecological responsibility. The impact of the green marketing innovation was then reflected in the increase in green purchase intention, which refers to consumers' intention to buy environmentally friendly products. Green marketing innovation reinforces the notion that purchasing green products is a responsible choice and an action that aligns with the values of sustainability and a modern lifestyle. Previous studies confirm that marketing innovations that emphasise environmentally friendly aspects contribute significantly to encouraging consumers to purchase green products [41, 42]. Thus, the higher the level of innovation in green marketing, the stronger the encouragement of consumers to adopt environmentally friendly purchasing behaviour.

Green product innovation refers to a company's efforts in

developing environmentally friendly products through innovative approaches, such as the use of recycled materials, reducing waste, energy efficiency in the production process, and product design that is easily decomposed [43, 44]. Green product innovation is not only a corporate social responsibility strategy but also a source of relevant competitive advantage in an increasingly environmentally aware market [45]. Consumers respond positively to companies that commit to green innovation because the product is considered safer, of higher quality, and supports sustainability [46]. Innovations like this can form a higher value perception, increase trust, and strengthen the intention of buying the product [14]. In the context of consumer behaviour, green product innovation can influence purchasing decisions by reducing risk perceptions and increasing a sense of social responsibility [21]. The study of green product innovation is widely carried out in manufacturing and household products, but is still limited in digital commerce, SMEs, and developing markets. Therefore, it is essential to investigate how green product innovation can influence consumer buying intentions, particularly during the transition to sustainable consumption.

Based on the study of literature and the theoretical foundation that has been described, it can be formulated that e-commerce sustainability, green marketing innovation, and green product innovation have a connection to the green purchase intention; therefore, this study proposes the following hypotheses:

H1: *The higher the application of e-commerce sustainability, the greater the tendency of consumers to have green purchase intention.*

H2: *The company's green marketing innovation strategy positively affects increasing consumers' green purchase intention.*

H3: *Product innovation that is oriented to green product innovation contributes significantly to encouraging green purchase intention.*

2.3 E-commerce sustainability, green marketing innovation, and green product innovation on consumer innovativeness

Consumer innovativeness is a tendency for consumers to find, try, and adopt new products, services, or ideas that are considered superior or attractive compared to their previous choice [47]. Innovative consumers are usually open to change, adapt quickly to new technology, and show a high interest in alternative consumption solutions, including sustainability [48].

Furthermore, e-commerce sustainability has a strategic role in forming consumer innovativeness, which is the psychological tendency of consumers to adopt new ideas, products, or technologies. The e-commerce platform that highlights sustainability offers a distinct consumption experience and fosters the perception that adopting environmentally friendly products is part of a modern and progressive lifestyle. Thus, the higher the sustainability practice in e-commerce, the greater the chance of increasing consumer innovativeness, which encourages the formation of purchasing and green consumption intentions more broadly [49, 50]. Green marketing innovation, realised through creative communication strategies, eco-labels, and sustainable value-based promotions, plays a crucial role in stimulating consumer innovativeness, namely the tendency of consumers

to adopt new ideas or products more readily. Green marketing innovation offers psychological stimulation through progressive and environmentally friendly brand imagery, encouraging innovative consumers to view green products not only as functional necessities but also as a symbol of a modern and responsible lifestyle. Thus, the higher the level of green marketing innovation, the stronger the encouragement of consumer innovativeness contributes to accelerating the adoption of environmentally friendly products [47, 51]. In addition, the green marketing innovation also expands interactions between consumers and companies through digital campaigns, sustainability storytelling, and the use of social media. This strategy not only raises awareness but also triggers the curiosity of innovative consumers to explore green products as a potential solution for the future. This makes consumers more open to adopting new technology and products and strengthens their involvement in the co-creation process of sustainable value [52].

Green product innovation, which encompasses developing environmentally friendly designs, utilising sustainable materials, and enhancing product energy efficiency, is crucial in fostering consumer innovativeness. Consumers with a high level of innovative tendency are more interested in trying green products that offer added value not only in terms of function, but also in terms of sustainability. Green product innovation offers new experiences through innovative consumer orientation, emphasising novelty, thereby strengthening their interest in adopting and spreading environmentally friendly products in the broader market [22]. Green product innovation complements the role of green marketing innovation in forming consumer innovativeness. Green products, designed with environmentally friendly features, energy efficiency, and sustainable materials, provide consumers with both functional and emotional added value. Consumers with high levels of innovation are more likely to try green products because they perceive them as a symbol of renewal, modernity, and environmental concern. Thus, the higher the level of green product innovation, the greater the opportunity for innovative consumers to adopt, recommend, and even become opinion leaders for using green products in the market [47, 53]. Based on the study of literature and the theoretical foundation that has been described, it can be formulated that e-commerce sustainability, green marketing innovation, and green product innovation have a close relationship with consumer innovativeness; therefore, this study proposes the following hypotheses:

H4: *There is an influence of e-commerce sustainability on consumer innovativeness.*

H5: *There is an influence of green marketing innovation on consumer innovativeness.*

H6: *There is an influence of green product innovation on consumer innovativeness.*

H7: *There is an influence of consumer innovativeness on green purchase intention.*

2.4 The role of consumer innovativeness mediation

Consumer innovativeness is a mediating variable that bridges the influence of external factors, based on sustainability and innovation, on green purchase intention. The practice of e-commerce sustainability, green marketing innovation, and green product innovation provides external stimulus in the form of the company's information, experience,

and sustainability values. However, the influence of these factors on green buying intentions does not always occur directly, but through the psychological mechanisms of consumers. In this context, consumer innovativeness becomes an individual driving force, encouraging greater openness, acceptance, and adoption of environmentally friendly new products and ideas [54-56].

As a mediator, consumer innovativeness strengthens the attractiveness of external factors, influencing consumer perceptions and preferences for green products. Consumers with high innovativeness are faster to respond to sustainable marketing strategies and are more interested in trying green products as part of modern and progressive lifestyles. This aligns with the notion that innovative individuals serve as early adopters in the innovation diffusion process, thereby facilitating the accelerated adoption of new products in the market [57, 58]. Thus, the role of consumer innovativeless mediation ensures that the sustainability of e-commerce, green marketing innovation, and green product innovation can be translated into real green buying intentions.

Based on the theoretical description and previous research findings, it can be assumed that e-commerce sustainability, green marketing innovation, and green product innovation influence consumer innovativeness, thereby encouraging green purchase intentions. In addition, consumer innovativeness is viewed as a crucial mediating variable that links external factors, focusing on sustainability and innovation, with green buying intentions. Therefore, this research submitted the following hypothesis:

H8: *There is an influence of e-commerce sustainability on green purchase intention mediated by consumer innovativeness.*

H9: *There is an influence of green innovation marketing on green purchase intention mediated by consumer innovativeness.*

H10: *Green product innovation influences green purchase intention mediated by consumer innovativeness.*

Based on the identification of previous research gaps and the contextual urgency described, this study designs a conceptual model framework that integrates the effects of e-commerce sustainability, green marketing innovation, and green product innovation on green purchase intention, with consumer innovativeness as a mediating variable. This framework is designed to provide a more comprehensive explanation of how the elements of digital sustainability and green innovation influence consumer purchasing intentions by shaping their openness to new ideas and products within the context of sustainable e-commerce (Figure 1).

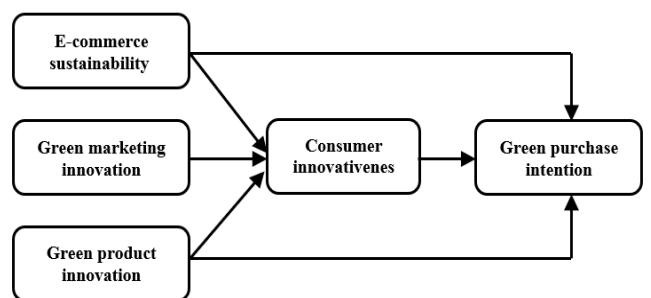


Figure 1. Conceptual framework of the relationships between variables

3. METHODOLOGY

3.1 Research design

This research is a quantitative study using a survey approach. This approach is used to collect data systematically from respondents through a questionnaire, aiming to measure and analyse the relationship between variables specified in the research model. The survey approach was chosen because it is suitable for collecting large quantities of primary data and allows for statistical analysis of the relationship between variables.

3.2 Population and sample

The population in this study was consumers who had purchased green products through e-commerce platforms in Indonesia. This population was selected because it aligned with the context of the research variables, specifically e-commerce sustainability, green marketing innovation, green product innovation, and green purchase intentions, which are mediated by consumer innovativeness. The sampling technique employed was non-probability sampling, specifically a accidental sampling technique, as not all members of the population had an equal opportunity to become respondents, given limitations in access and time efficiency during data collection.

The respondent criteria were: (1) at least 17 years old; (2) having visited the Lake Toba area, Indonesia, within the last six months; and (3) having purchased at least two environmentally friendly products through e-commerce platforms in Indonesia. These criteria emphasise that respondents are positioned not only as tourists but also as active consumers of green products within the digital ecosystem, thereby remaining relevant to the research objectives.

The selection of respondents in the Lake Toba area as the research object was based on consumer behaviour characteristics relevant to the objectives of this study, particularly in the context of purchasing environmentally friendly products through digital media. Respondents, both domestic and international, empirically have a higher tendency to purchase regional speciality products as souvenirs, including products based on local resources that are increasingly developed with sustainability and environmentally friendly principles. These products include natural-based handicrafts, organic coffee, traditional processed products with environmentally friendly packaging, and souvenirs that emphasise cultural and environmental sustainability values. In addition, modern respondents (tourists), especially those visiting ecotourism-based destinations such as Lake Toba, Indonesia, generally have a higher level of environmental awareness and openness to consumer innovativeness than consumers in general. This awareness makes them a potential market segment for green products and more responsive to green marketing strategies and green product innovations promoted through e-commerce. The selection of the Lake Toba area also has a strategic basis, as this region is one of Indonesia's Super Priority Tourism Destinations, which is being directed towards sustainable tourism development. This aligns with the efforts of the local government and SMEs to encourage the production and marketing of environmentally friendly products as part of green economy development. Therefore, tourists visiting this

area represent not only momentary consumers but also a potential market for green products from North Sumatran SMEs at the national and international levels through e-commerce channels.

Furthermore, tourists are characterised as "mobile customers" who have the potential to become diffusion agents for green developments. Their experiences of consuming and purchasing environmentally friendly products at Lake Toba can encourage digital repeat purchases after returning to their home regions or countries through e-commerce platforms. This pattern strengthens the relevance of tourists as a research sample, as it reflects the integration between direct consumption at tourist destinations and sustainable demand through long-term digital channels. Therefore, Lake Toba tourists were selected not merely as situational buyers, but as a strategic consumer segment that describes the market opportunity for green products based on e-commerce in Indonesia, while also contributing directly to increasing the competitiveness and economic growth of environmentally friendly SMEs in Indonesia.

The sample size was determined using the Isaac and Michael formula with a 5% margin of error. However, because the exact population size was unknown, the minimum sample size was also adjusted to SEM-PLS guidelines, which recommend a sample size of 5-10 times the number of indicators used. Therefore, 395 questionnaires were distributed to respondents who met the criteria, and the collected data were deemed suitable for analysis.

This approach did not compromise the credibility of the data, as it fully adhered to applicable quantitative research methodological principles, supported by clear inclusion criteria, a sampling technique appropriate to the research objectives, and a sample size that met the minimum standards for SEM-PLS analysis.

However, because the actual population size is uncertain, the researcher sets the minimum sample amount of 200 respondents, referring to the SEM -PLS analysis literature, which recommends a minimum of 5-10 times the number of variable indicators [59], thus, as many as 395 questionnaires were distributed to respondents who met the criteria, and data that are worth analysis.

Based on the indicators of each research variable. The questionnaire consists of two main parts, namely: (1) Demographic questions to find out the characteristics of the respondent, and (2) a closed-ended statement that measures the e-commerce sustainability variable, green innovation marketing, green product innovation, consumer innovativeness, and green purchase intention. The questionnaire format utilises a 5-point Likert scale, with the following response options: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree.

This scale is used to help respondents express their perceptions and attitudes towards each statement presented. Data was collected through two methods: direct survey (offline) and online survey (online). For direct surveys, questionnaires are printed and distributed face-to-face to respondents in public places such as shopping centres, campuses, and environmental lovers' communities. Meanwhile, for online surveys, the questionnaire was distributed via Google Forms with a link that was shared through social media platforms such as WhatsApp, Instagram, and Telegram.

Table 1 presents the measurement of the research variables along with the questionnaire items. Each variable in this study

was operationalised into several indicators used to measure respondents' perceptions regarding e-commerce sustainability, green marketing innovation, green product innovation,

consumer innovativeness, and green purchasing intentions. All items were measured using a Likert scale to ensure consistency and reliability.

Table 1. Research instrument

E-commerce Sustainability	
Economic Aspects	
E-commerce sustainability	<ol style="list-style-type: none"> 1. Online sales activities provide stable revenue for businesses. 2. The e-commerce business model implemented is able to adapt to market changes.
Social Aspects	
Green marketing planning	<ol style="list-style-type: none"> 1. Product information is conveyed honestly and transparently to consumers. 2. Encouraging consumers to engage in more responsible consumption behavior.
Environmental Aspects	
Green marketing mix	<ol style="list-style-type: none"> 1. This business strives to reduce waste from e-commerce activities. 2. The delivery system is designed to minimize environmental impact.
Green Marketing Innovation	
Functionally motivated consumer innovativeness	<p>Do you feel environmental issues are always important when planning marketing activities?</p> <p>The importance of considering future environmental needs in green marketing planning.</p>
Hedonically motivated consumer innovativeness	<p>Small and medium enterprises (SMEs) should allocate resources to respond to market changes related to green marketing activities.</p>
Cognitively motivated consumer innovativeness	<p>Visitors perceive that SMEs in Lake Toba carefully select content, raw materials, and product materials to ensure their products are environmentally friendly.</p>
Socially motivated consumer innovativeness	<p>Visitors believe that SMEs in the Lake Toba area always design and develop environmentally friendly products.</p>
Green Purchase Intention	<p>Visitors perceive that SMEs in Lake Toba conduct cost-benefit analyses related to the environment when pricing their products.</p> <p>Visitors are confident that SMEs in Lake Toba have environmental responsibilities.</p> <p>Visitors believe that SMEs in Lake Toba involve customers in green marketing activities.</p>
Green Product Innovation	
Do you think the eco-friendly products available in Lake Toba are of high quality?	
How important is it for you to support SMEs producing eco-friendly products in Lake Toba?	
How satisfied are you with the durability and functionality of eco-friendly products in Lake Toba?	
Do you think the eco-friendly products in Lake Toba offer interesting innovations?	
Do you feel that eco-friendly products in Lake Toba support long-term sustainability practices?	
Consumer Innovativeness	
Environmentally friendly SMEs products seem to offer fast service.	
Environmentally friendly SMEs products seem to be efficient.	
Using environmentally friendly SMEs products gives me personal enjoyment.	
Buying environmentally friendly SMEs products is more interesting and enjoyable.	
Using environmentally friendly SMEs products gives me a good feeling.	
I will use environmentally friendly SMEs products after comparing their advantages and disadvantages.	
Likely, environmentally friendly SMEs products will make me think logically about purchasing them.	
If I use environmentally friendly SMEs products, I can impress others.	
If I use environmentally friendly SMEs products, I can show that I am an early adopter.	
If I use environmentally friendly SMEs products, it can distinguish me from others.	
Green Purchase Intention	
I will consider purchasing environmentally friendly products because their pollution will decrease in the future.	
I will consider switching to environmentally friendly products for health reasons.	
I want to buy environmentally friendly products in the Lake Toba area soon.	
I will recommend others to buy environmentally friendly products in the Lake Toba area.	
I plan to switch to buying environmentally friendly products in the Lake Toba area.	
Do you feel that buying eco-friendly products in Lake Toba supports the development of local SMEs?	

Note: The questionnaire was modified and adopted from various sources [54, 60-62]

4. RESULTS

The picture of the respondents in this study provides information about the demographic characteristics and general profiles of the participants involved, who are active e-commerce consumers in Indonesia, particularly those with experience purchasing environmentally friendly products. These characteristics include age, gender, education level, online shopping frequency, and the level of concern regarding the sustainability issue. This information is crucial for understanding the context of consumer behaviour when evaluating the conceptual models submitted.

Based on the respondents' profile data (Table 2), the

majority of research participants were women, accounting for 65%, while men comprised 35%. The most extensive age range was among the 29–31-year age group, accounting for approximately 40% of the total respondents, followed by the 32–36-year age group at 25%. Regarding education, most respondents had a bachelor's degree (S1) education background, at 47%, followed by a diploma (S2) at 25%, and the rest held high school and master's degrees. Most respondents were also married, accounting for approximately 74.43%. Regarding employment, the largest group was entrepreneurs, comprising 45.86%, followed by private employees and teachers/lecturers, at approximately 18% and 15.69%, respectively. Regarding the respondents' origin, the

majority were domestic tourists (54.68%), followed by local tourists (23.29%), and international tourists (22.03%). These data indicate that the research sample is predominantly composed of young to early adult women who are highly educated, married, and work as entrepreneurs, with a background in domestic tourism. This profile provides a strong representative picture to support the analysis in this study.

Table 2. Respondent characteristics (N = 395)

Profile	Sample Size (%)
Gender	
Female	256 (65)
Male	139 (35)
	395 (100)
Age (Years)	
29 -31	158 (40)
32 - 36	99 (25)
37 - 41	71 (18)
42 - 46	47 (12)
47 - 51	16 (4.2)
> 52	4 (0.8)
	395 (100)
Educational Level	
Senior High School (SMA)	83 (21)
Associate Degree	99 (25)
S1 (Bachelor)	186 (47)
S2 (Magister)	27 (7)
	395 (100)
Marital Status	
Married	294 (74.43)
Single	101 (25.57)
	395 (100)
Employment Status	
BUMN/ State-Owned Enterprises	12 (3.03)
PNS/ASN / Civil Servants	10 (2.27)
Teacher / Lecturer	62 (15.69)
private employee	72 (18.22)
Student	59 (14.93)
Entrepreneur	181 (45.86)
	395 (100)
Country of Origin	
Local Tourists	92 (23.29)
Domestic Tourists	216 (54.68)
International Tourism	87 (22.03)
	395 (100)

4.1 Measurement model

This study used Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS version 4 to analyse the relationships between variables. This model employed a combination of first-order and second-order constructs, according to the characteristics of each latent variable.

Unidimensional variables were modelled as first-order constructs, while multidimensional variables were modelled as second-order constructs formed by several first-order constructs (dimensions). The formation of second-order constructs was carried out using a repeated indicator approach, where all indicators in the first-level dimensions were also used to form the second-level constructs.

The PLS-SEM analysis was conducted in two main stages: evaluation of the measurement model (outer model) and evaluation of the structural model (inner model).

In the evaluation stage, the outer loading value of each indicator was tested, with a criterion of ≥ 0.70 as the primary standard. However, indicators with values between 0.40 and

0.70 can still be retained if they do not significantly reduce the Average Variance Extracted (AVE) and Composite Reliability (CR) values. A construct is considered to have good convergent validity if the AVE value is ≥ 0.50 , and good reliability if the Cronbach's Alpha and Composite Reliability values are ≥ 0.70 . Discriminant validity is evaluated using the Heterotrait–Monotrait Ratio (HTMT) criterion with a value ≤ 0.90 .

In the structural model evaluation stage, path coefficients, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2) are tested. Significance tests for relationships between variables are conducted using a bootstrapping procedure with 5,000 subsamples at a 5% significance level. Furthermore, potential multicollinearity issues are assessed using the Variance Inflation Factor (VIF), with a VIF value below 5 indicating the absence of multicollinearity. A combination model of first-order and second-order constructs is employed to adjust the conceptual structure to the theoretical basis, thereby enhancing the accuracy of representing each latent variable and increasing the model's overall explanatory power.

Table 3 presents the analysis results for the constructs or variables related to the study, which include five constructs: e-commerce sustainability, green innovation marketing, product green innovation, consumer innovativeness, and green product intention. The following is an explanation for each column in the table.

Table 3. Model's validity and reliability (second order)

Construct	CA	Loading Factor	CR	AVE
E-commerce Sustainability	0.826	0.832	0.884	0.657
Green Marketing Innovation	0.898	0.902	0.918	0.585
Green Product Innovation	0.876	0.879	0.909	0.668
Consumer Innovativeness	0.929	0.932	0.941	0.614
Green Product Intention	0.826	0.830	0.885	0.657

All constructs in this study showed high reliability and validity. The Cronbach's Alpha value was above 0.7, with consumer innovativeness reaching 0.929, indicating excellent measurement consistency. The loading factors of all indicators were also adequate (> 0.5), with green innovation marketing recording the highest value of 0.902. In addition, all constructs' Composite Reliability (CR) values exceeded 0.7, indicating excellent reliability, especially green innovation marketing, with a CR value of 0.918. The AVE value was also above 0.5 for all constructs, indicating that each construct could explain more than half of the variance of its indicators, with green product innovation recording the highest AVE of 0.668. This study offers novelty by demonstrating how e-commerce sustainability, green innovation marketing, and green product innovation directly impact green product intention through the mediating effect of consumer innovation. These findings provide a new perspective on the importance of consumer innovation in increased purchase intentions for environmentally friendly products and emphasise the relevance of sustainability practices in marketing strategies that can influence consumer decisions.

4.2 Structural model

Table 4 presents the hypothesis test results obtained after completing the outer model evaluation stage. The Outer Model testing process ensures that the indicators used have met the validity and reliability criteria, allowing the results obtained to be used in forming a more accurate structural model. Thus, this table serves as the basis for testing the relationship between variables in research through structural models that have been developed.

Table 4 presents the results of these hypothesis tests, providing an in-depth examination of the relationships between the various variables in the context of Green Product Purchase Intention. Each hypothesis tested shows how e-commerce sustainability, green innovation marketing, and green product innovation can influence consumer innovation and, in turn, their intention to purchase green products.

H1 to H4 The results show a strong and statistically significant connection between e-commerce sustainability and green innovation marketing, influencing consumer innovation and the intention to purchase green products. This reinforces

the value of incorporating sustainability into marketing strategies, enhancing consumer trust in the potential of eco-friendly products.

On the other hand, the lack of support for H5 indicates that green product innovation does not directly impact consumer purchase intentions, which challenges businesses to develop more effective strategies to emphasise the advantages of green products. In contrast, the results of H6 and H7 confirm that consumer innovation significantly enhances the intention to purchase green products, encouraging companies to focus on innovative consumers for their eco-friendly products.

This finding is further strengthened by demonstrating that consumer innovation plays a crucial role as a mediator between various factors and purchase intention. This indicates that to increase the purchase intention of green products, companies must prioritise product innovation and how they communicate sustainability and innovation to consumers. Thus, the results of this study provide important insights for developing marketing and innovation strategies that focus on sustainability in the face of increasingly fierce market competition.

Table 4. Results of testing the path coefficient of the research model

Hypothesis	Hypothesis Path	β -Value	STDEV	T-Value	P Values	Results
H1	E-commerce Sustainability → Green Purchase Intention	-0.079	0.046	1.711	0.044	Accepted
H2	E-commerce Sustainability → Consumer Innovativeness	0.115	0.048	2.376	0.009	Accepted
H3	Green Marketing Innovation → Green Purchase Intention	0.140	0.057	2.441	0.007	Accepted
H4	Green Marketing Innovation → Consumer Innovativeness	0.155	0.044	3.551	0.000	Accepted
H5	Green Product Innovation → Green Purchase Intention	-0.002	0.068	0.030	0.488	Rejected
H6	Green Product Innovation → Consumer Innovativeness	0.670	0.036	18.654	0.000	Accepted
H7	Consumer Innovativeness → Green Purchase Intention	0.757	0.060	12.582	0.000	Accepted
H8	E-commerce Sustainability → Consumer Innovativeness → Green Purchase Intention	0.087	0.037	2.365	0.009	Accepted
H9	Green Marketing Innovation → Consumer Innovativeness → Green Purchase Intention	0.117	0.035	3.382	0.000	Accepted
H10	Green Product Innovation → Consumer Innovativeness → Green Purchase Intention	0.507	0.048	10.482	0.000	Accepted

Note: R²: Consumer Innovativeness (CI) = 0.756; Green Purchase Intention (GPI) = 0.660

5. DISCUSSION

The study results indicate that the sustainability of e-commerce has a negative but significant impact on the intention to purchase green products. In theory, the sustainability of e-commerce should encourage consumers to purchase environmentally friendly products, but several factors can have an adverse impact. Consumers may not fully understand the sustainability aspects of the platform, focusing more on prices, comfort, or product quality, and may struggle to distinguish between the sustainability of products and the sustainability of the platform itself [60]. Additionally, a lack of information and education regarding the sustainability of e-commerce can hinder the intention to purchase green products [61, 62]. This finding supports previous studies that highlighted challenges in sustainability education for consumers [63]. Therefore, a more substantial marketing strategy, more effective consumer education, and attractive incentives are needed to increase the intention to purchase green products [64].

In this study, the sustainability of e-commerce plays an important role in influencing the intention to purchase green products through various channels. Consumers are more motivated to purchase green products from platforms that

demonstrate environmental commitment, such as using recycled and environmentally friendly logistics packaging, which increases their perception of positive environmental contributions [65]. In addition, the sustainability of e-commerce enhances consumer confidence in the platform's transparency in managing environmental impacts, encouraging them to choose products based on their sustainability value [33].

The sustainability of e-commerce also fosters consumer innovation, making them more receptive to green product innovations, which aligns with the theory of innovation adoption, which states that consumers tend to choose new products that reflect their environmental values [66]. With increasing awareness of sustainability, consumers are becoming more mindful of a product's suitability in terms of ecological values and social responsibility. Therefore, e-commerce must integrate environmentally friendly practices to increase the intention of purchasing green products and build brand loyalty [9].

Sustainability in online business aims to create an economic, environmentally friendly, and socially responsible model that can adapt to future change. This approach increases long-term profitability, builds a positive reputation, and strengthens consumer confidence, prioritising sustainability in

purchasing decisions. By integrating sustainable practices, businesses can contribute to environmental preservation. Sustainability in e-commerce also encourages consumer innovation, inspiring them to be more creative in their interactions with technology and products, and to choose environmentally friendly options [67]. Although the sustainability of e-commerce can encourage consumer innovation, its effectiveness is highly dependent on how e-commerce SMEs communicate and implement sustainability initiatives [68].

The sustainability of e-commerce can encourage consumers to innovate in their interactions with technology and products, such as utilising environmentally friendly features like carbon tracking or green delivery options. This is in line with the findings of Sindakis et al. [69], which states that the sustainability of e-commerce stimulates consumer innovation, encouraging creativity and responsible product use. SMEs must effectively communicate their sustainability initiatives to consumers, which is crucial for ensuring their understanding and participation in the green value promoted [70].

Green innovation marketing has a significant impact on the intention to purchase green products, primarily through the adoption of eco-friendly technologies and campaigns that highlight sustainability benefits. Effective green innovation marketing aligns the brand with eco-conscious values [71], enhances consumer satisfaction [72], and boosts purchase intention [73]. Adopting this strategy for SMEs in Indonesia (Lake Toba) can significantly increase consumer interest in eco-friendly products. By focusing on green marketing innovation, such as sustainable technology and sustainability-driven campaigns, SMEs can meet the growing demand for sustainability from consumers, thereby strengthening their market position.

Green innovation marketing can enhance consumer satisfaction by fostering a deeper connection between consumers and brands, prioritising sustainability. This approach not only highlights a brand's environmental commitment but also resonates with consumers who value eco-friendly practices, leading to increased loyalty and a more positive brand perception [72]. In the context of SMEs in the Lake Toba area, the adoption of green innovation marketing is becoming increasingly relevant. When SMEs implement environmentally friendly technologies, such as specific technologies, in their production or distribution processes, this creates a positive perception among consumers regarding their commitment to the environment. In addition, marketing campaigns that educate and emphasise the benefits of sustainability, both in terms of the environment and consumer health, can significantly increase purchasing interest, as supported by the findings of Gelderman et al. [72].

Green product innovation in this study did not show a significant direct influence on purchase intention, not solely because consumers did not understand its benefits, but rather due to the characteristics of the study location's consumers, who are predominantly tourists with a short-term and experience-based purchasing orientation. Tourists generally make purchases based on their immediate needs, convenience, and the appeal they experience during their visit, rather than considering the long-term environmental benefits inherent in green product innovation. As a result, even though the product has innovative, eco-friendly features, these aspects are not a top priority in shaping purchase intention. Thus, the low influence of green product innovation on purchase intention is more influenced by the situational and temporal nature of

purchasing decisions, rather than solely due to a failure to convey the product's environmental benefits. Therefore, marketing strategies should focus on linking green product features with practical value and direct experiences relevant to tourists, in order to increase purchase intention at tourist destinations. Thus, all SMEs must enhance their marketing and educational strategies to effectively communicate the environmental benefits of green products, thereby making them more appealing and encouraging purchases [74, 75].

Although innovative products can attract consumers' attention, this study shows that they do not significantly influence green product purchase intentions. This suggests that green product innovation, although attractive and environmentally friendly, needs to be more robust to encourage consumers to make a purchase. One of the primary factors contributing to this phenomenon is the need for increased consumer education on the specific benefits of innovation. This lack of understanding creates a gap between the value of innovation and the intention to purchase. Research by Borah et al. [42] highlights that ineffective communication can reduce the impact of green product innovation on purchasing decisions. Therefore, SMEs must develop more innovative and comprehensive marketing strategies to increase consumer awareness. Educating consumers about the benefits of green products, including their positive environmental and health impacts, can strengthen purchase intentions.

This study found that green products introduced with innovative features, such as green technology or energy efficiency, motivate consumers to adopt innovative behaviour. People who come across products with eco-friendly innovations are generally more open to new ideas and inclined to try different usage methods. This fosters greater engagement in adopting more sustainable products, while also enhancing awareness and responsibility toward the environment, and encourages the support or purchasing of these products. This study supports previous findings that show that Green Product Innovation can improve consumer attitudes towards innovation [57]. SMEs in the Lake Toba area should consider how their product design and features can influence and inspire consumers to innovate how they use and support green products.

The significant influence of consumer innovation on the intention to purchase environmentally friendly products indicates that individuals who are more receptive to new ideas and open to change tend to prefer products that support their desires as part of their efforts to contribute to environmental conservation. This finding supports the theory that emphasises the crucial role of consumer innovativeness in shaping consumer behaviour and purchasing decisions. It implies that companies can tap into this innovativeness by creating products that appeal to forward-thinking consumers, thus fostering a more robust demand for sustainable alternatives [76]. Consumers are more interested in products that offer environmental benefits and are more willing to adopt lifestyle changes for sustainability [77].

Additionally, a positive attitude towards green innovation enhances consumers' desire to purchase products that align with their sustainability values [54, 67]. SMEs in the Lake Toba region, Indonesia, must focus on consumer innovation to increase the intention to buy environmentally friendly products. Innovative consumers tend to have a higher tendency to buy green products, so companies must highlight the innovative features and environmental benefits of products produced by SMEs. Additionally, providing a deeper

understanding of the benefits of eco-friendly products and their impact on ecological sustainability can enhance the appeal of these products to consumers.

Furthermore, research shows that consumers with a positive attitude towards green innovation are more likely to explore and try new products that offer environmental benefits [78]. Thus, SMEs in the Lake Toba area should introduce green products and communicate their innovative value and environmental benefits. Utilising social media and e-commerce platforms to convey this message can be an effective strategy, as consumers are increasingly seeking information actively. The importance of sustainability and how its products contribute to environmental conservation is becoming increasingly relevant. This approach will strengthen the relationship between consumers and environmentally friendly products, thereby increasing consumers' intention to choose green products.

Mediation by consumer innovativeness occurs because consumer innovation is a major factor in linking sustainability and innovation factors with green product purchase intentions. Innovative consumers tend to be more open to new ideas, technologies, and environmentally friendly products. When e-commerce focuses on sustainability or creative marketing, consumers with an innovative nature are more likely to respond and adapt to the product, thereby increasing their intention to purchase green products. Consumers who possess a high level of innovation are generally more open to new ideas and products, including sustainable and environmentally friendly products, because they have the drive to try new things and contribute to environmental preservation through more responsible consumption choices [14, 51]. Furthermore, Prieto-Sandoval et al. [51] also found that innovative consumers are more easily influenced by green marketing messages. This finding confirms that the mediating role of consumer innovation helps explain how consumer innovation can enhance the impact of e-commerce Sustainability and green marketing innovation on Green Product Purchase Intention.

The Mediating Influence of consumer innovativeness bridges the gap between sustainability and green product purchase intentions. When e-commerce adopts sustainable practices, innovative consumers will respond more to this approach. Research shows that innovative consumers are more easily influenced by communications that highlight the environmental benefits of products, thereby strengthening the influence of sustainability on their purchasing decisions [54, 79]. Thus, SMEs that want to increase green product purchase intentions should leverage consumers' innovative nature as a mediating tool to establish a stronger relationship between sustainability and purchasing decisions.

6. CONCLUSION

The indicator "supporting environmentally friendly products" remains relevant in the context of green product innovation, not only as an expression of attitude but also as a form of acceptance of and differentiation among sustainability-based products offered to consumers. This support reflects the extent to which consumers recognise the novelty and uniqueness of green products compared to conventional products. Meanwhile, the statement "using environmentally friendly products gives me personal enjoyment" in the consumer innovation construct does not

solely represent an affective response, but rather indicates a positive experience that arises when individuals interact with something new and different. This experience is part of the innovation adoption process, where satisfaction and pleasure serve as internal indicators of consumer openness to innovative, sustainability-oriented products. Thus, both indicators retain conceptual significance in measuring responses to environmentally based innovations, while reinforcing the understanding that innovation adoption is driven not only by functional aspects but also by consumers' acceptance of the value and subjective experience of the novelty of green products.

The results of the study indicate that e-commerce sustainability has an adverse effect on green purchase intention (H1), e-commerce sustainability has a positive effect on consumer innovativeness (H2), green innovation marketing has a positive effect on green purchase intention (H3), green innovation marketing has a positive effect on consumer innovativeness (H4), green product innovation has no significant effect on green purchase intention (H5), green product innovation has a positive effect on consumer innovativeness (H6), consumer innovativeness has a positive effect on green purchase intention (H7), Indirect effect shows that e-commerce sustainability has a positive effect on green purchase intention through the mediation of consumer innovativeness (H8), green innovation marketing has a positive effect on green purchase intention through the mediation of consumer innovativeness (H9), green innovation marketing has a positive effect on green purchase intention through the mediation of consumer innovativeness (H10). These findings serve as the basis for developing green innovations that increase consumer interest in purchasing environmentally friendly products.

This study presents a novel approach by placing consumer innovativeness as a mediator in the relationship between e-commerce sustainability, green innovation marketing, and green product innovation, and their impact on green purchase intention. This finding enriches the literature with an integrated approach that connects digital aspects and consumer innovation in the context of sustainability. The practical implication is that SMEs need to encourage consumer innovation through innovative product design and marketing strategies to sustainably increase the purchase intention of green products.

This study has several limitations that can be opportunities for future studies. First, this study only examines consumers in the context of green e-commerce without considering cultural factors that may influence consumer innovation and green purchase intentions. Future studies can investigate how cultural differences and social norms influence preferences for green products. Second, the approach used in this study is quantitative, so it has not explored the motivations and perceptions of consumers in-depth. Therefore, future studies can consider additional variables to provide a more comprehensive understanding of effective strategies for encouraging sustainable consumption at the global level.

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