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The impact of the brand's green marketing strategy on consumers' environmental awareness

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Abstract: Against the backdrop of increasingly severe global environmental issues and the rise of green consumption trends, this study focuses on the effect of brand green marketing strategies on enhancing consumers' environmental awareness. Based on Planned Behavior and Consumer Behavior Theory, this study adopts a quantitative research approach to develope a theoretical model with hypotheses to assess the impact of green product, promotion, and channel strategies on environmental awareness. The results show that all three green marketing strategies—green product, green promotion, and green channel strategies —have significant positive effects on consumers' environmental awareness. Among them, green channel strategies exhibit the strongest influence (β= 0.407, p< 0.01), followed by green promotion strategies (β= 0.193, $p\beta$= 0.081, p< 0.05), collectively explaining 34.9% of the variation in consumers' environmental awareness. The study provides empirical support for enterprises to optimize their green marketing mix, effectively enhancing consumers' environmental awareness and promoting the development of the green consumption market.

Keywords: green product strategy, green promotion strategy, green channel strategy, consumers' environmental awareness, enhancement effect

1. Introduction

In the context of increasingly severe global environmental issues, problems such as ecological imbalance, resource shortages, and environmental pollution continue to emerge, posing a serious threat to human survival and development. Against this backdrop, the concept of environmental protection has gradually taken root in people's minds, and green consumption has become an inevitable trend. Consumers' attention to and demand for environmentally friendly products and services have been rising, prompting enterprises to adjust their marketing strategies, and green marketing has emerged as a result. Internationally, many enterprises in developed countries have actively practiced the concept of green marketing, launching a large number of environmentally friendly products and gaining advantages in market competition. With the awakening of public environmental awareness and the government’s support, the green consumption market is also developing rapidly. Brand green marketing covers various aspects such as green product research and development, green promotion activities, and green channel construction, which is vital to the sustainable development of enterprises. However, brand green marketing still faces many challenges in the implementation process, among which the uneven level of consumers' environmental awareness has become a key restrictive factor. In addition, enterprises still have many problems in using green marketing strategies to enhance consumers' environmental awareness, making in-depth research on the relationship between the two particularly urgent. This study focuses on the effect of brand green marketing strategies on improving consumers' environmental awareness, aiming to reveal the specific impact mechanisms of different green marketing strategies (green products, green promotion, green channels) on consumers' environmental awareness. This study contributes to helping enterprises enhance consumers' environmental awareness and promoting the prosperity and development of the green consumption market.

2. Literature review

2.1. Underpinning theory

The Theory of Planned Behavior (TPB) is a key framework in social psychology for predicting individual behaviors. It posits that behavioral intention is influenced by three core factors: Attitude, Subjective Norm, and Perceived Behavioral Control.

Attitude refers to an individual's positive or negative evaluation of a certain behavior; Subjective Norm reflects the individual's perception of social expectations or social pressure from others; while Perceived Behavioral Control represents an individual's subjective judgment on the difficulty or feasibility of performing a behavior. In the context of green marketing, TPB provides a theoretical basis for explaining consumers' environmental behaviors. Asadi S further pointed out that individual behaviors are influenced by social psychology and also depend on the environmental convenience and resource availability for behavior execution [1]. Zhou Huiling found that TPB model can significantly predict consumers' green purchase intentions, especially the dimensions of behavioral attitude and perceived behavioral control, which play a leading role in environmental behaviors [2].

Consumer behavior theory focuses on consumers' psychological and behavioral responses in the process of product selection, information processing, and purchase decision-making. According to Ameer M W, consumer behavior is jointly influenced by external stimuli (such as marketing strategies) and personal characteristics [3]. In the context of green marketing, the environmental attributes of products, the credibility of promotional information, and the convenience of channels will significantly affect consumers' cognition and attitudes, and ultimately shape their environmental awareness and green purchase intentions. This theory helps this study analyze how brands stimulate consumers' environmental awareness through different marketing strategies.

2.2. Research hypotheses

Starting from the three dimensions of green marketing strategies (green products, green promotion, and green channels), this paper explores their direct impact on consumers' environmental awareness.

2.2.1. The influence of green products on consumers' environmental awareness

Green products are one of the core components of green marketing strategies, emphasizing the environmental friendliness of products at the functional level and the brand's commitment to sustainable development. Abualigah A pointed out that green products can arouse consumers' awareness of environmental issues through reducing pollution, saving energy and reducing consumption, and adopting recyclable designs, thereby triggering their environmental behaviors [4]. This impact is not only reflected in consumers' purchase decisions but also extends to their habits of resource conservation and waste management in daily life. Adongo R stated that consumer goods using biodegradable packaging can subtly strengthen consumers' environmental awareness and prompt them to reduce the use of disposable plastics [5]. Agag G believes that the existence of green products helps form consumers' cognitive paths towards environmental friendliness and enhances their sense of environmental responsibility [6]. Salnikova pointed out that when consumers choose green products, their behavior itself becomes an expression of environmental attitude, and this attitude will be continuously strengthened with the accumulation of usage experience [7]. Especially in high-involvement product categories (such as electric vehicles and energy-saving home appliances), the usage experience of green products can significantly enhance consumers' environmental identity. Tian Bingqiang found that the certification labels of green products (such as Energy Star, organic certification, etc.), as an external clue, can reduce consumers' information search costs, making it easier for them to identify and choose environmentally friendly products, thereby further consolidating their environmental awareness [8]. Sun et al. also found that the more credible and practically feasible green products are, the easier it is for consumers to identify with corporate environmental protection concepts, thereby stimulating their environmental awareness [9]. Zhou pointed out that among young groups, green products are not only consumer goods but also a symbol of environmental protection values [2]. Young consumers tend to express their personal values and social responsibility through green consumption, and this symbolic meaning further strengthens the role of green products in shaping their environmental awareness. In addition, Zeng stated that the rise of social media and online communities has provided a platform for word-of-mouth communication of green products, and in the process of sharing usage experiences, consumers will further deepen their understanding and attention to environmental issues [10]. Hao pointed out that the impact of green products on consumers' environmental awareness is also restricted by product prices, functional performance, and market popularity [11]. Some consumers may be deterred by the premium of green products or doubt their actual environmental protection effects. Aljarah A found that enterprises need to reduce the cost of green products through technological innovation and scale effects, while strengthening consumer education to maximize the positive impact of green products on environmental awareness [12]. Based on the above analysis, this paper puts forward the following hypothesis:

H1: Green products have a significant positive impact on consumers' environmental awareness.

2.2.2. The influence of green promotion on consumers' environmental awareness

Adongo R found that green promotion is an important medium for brands to spread environmental protection concepts, which includes forms such as environmental protection-themed advertisements, carbon neutrality promotion, and recycling discount incentives [12]. Agag G pointed out that effective green promotion can not only convey the functional value of products but also educate consumers to form awareness of environmental behaviors [6]. Salnikova stated that publicizing the carbon footprint

reduction effect of products through advertisements, or combining brand promotion with environmental protection actions through public welfare activities (such as tree planting to offset carbon), can enhance consumers' sense of participation in environmental issues [7]. Aljarah A's research shows that the higher the quality and credibility of the information conveyed by green promotion, the easier it is to improve consumers' awareness of environmental issues [12]. Vega-Zamora M pointed out that when promotional information contains specific environmental protection data (such as "purchasing one product reduces X kilograms of carbon emissions") or third-party certification, consumers' trust will be significantly improved, making them more willing to accept environmental protection concepts [13]. Qi X found that green promotion often stimulates consumers' intrinsic motivation through "action participation". For example, through forms such as trade-in and environmental protection point accumulation, consumers can form positive feedback in the process of participation [14]. This interactivity not only enhances consumers' environmental awareness but also promotes them to internalize environmental behaviors into habits. Arici H E pointed out that green promotion strategies can enhance consumers' sense of environmental responsibility and promote behavioral changes under long-term influence [15]. Huang found that brands can guide consumers to gradually form sustainable consumption patterns by encouraging them to choose environmentally friendly packaging through limited-time promotions, or launching "green consumption points" activities during shopping festivals [16]. Jia et al. proposed that green challenges on social media platforms (such as "zero-waste life check-in") have further amplified the influence of green promotion, enabling consumers to strengthen their environmental awareness in social interactions [17]. The effectiveness of green promotion also faces challenges. Wu found that some consumers may consider enterprises' environmental protection publicity as "greenwashing", especially when enterprises' environmental protection commitments are inconsistent with their actual actions [18]. Therefore, brands need to ensure the authenticity and consistency of green promotion and establish consumer trust through long-term and transparent communication. Based on the above analysis, this paper puts forward the following hypothesis:

H2: Green promotion has a significant positive impact on consumers' environmental awareness.

2.2.3. The impact of green channels on consumers' environmental awareness

Green channel strategies, including green supply chains, environmental logistics systems, and sustainable store operations, are important manifestations of enterprises' implementation of environmental protection concepts in marketing communication and product delivery. Aljarah A believes that green channels not only improve enterprise operational efficiency but also convey their environmental commitments, which is a crucial factor affecting consumers' environmental identity [12]. Adopting new energy transportation tools or logistics methods that reduce packaging can convey to consumers the brand's emphasis on reducing carbon emissions, thereby enhancing consumers' environmental awareness. The "process transparency", "environmental certification", and "carbon footprint labeling" emphasized by green channels all play a role in strengthening consumers' information processing and behavioral judgment. When consumers learn that the product distribution process complies with environmental standards (such as the use of recyclable packaging or carbon-neutral logistics), their recognition of the brand's environmental image will be significantly improved. In addition, the practice of green channels in offline retail scenarios (such as energy-saving lighting and waste recycling stations) can provide consumers with an intuitive environmental protection experience, further deepening their understanding of the concept of sustainable development. Zhou found that when consumers are exposed to green channel information during shopping, their evaluation of the brand's overall environmental image is significantly improved, and they have a stronger sense of environmental identity and willingness to take action [2]. For example, the energy consumption data or supply chain traceability information displayed in retail stores can enhance consumers' trust in the brand's environmental efforts, thereby stimulating their own sense of environmental responsibility. In addition, the digital application of green channels (such as querying the environmental impact of a product's entire life cycle through an APP) provides consumers with a convenient way to obtain environmental information, further promoting the popularization of environmental awareness. The construction and maintenance costs of green channels are relatively high, which may limit their popularization speed. Enterprises need to balance short-term costs and long-term benefits, and improve the efficiency and credibility of green channels through technological innovation (such as blockchain traceability technology). Based on the above analysis, this paper puts forward the following hypothesis:

H3: Green channels have a significant positive impact on consumers' environmental awareness.

2.3. Diagram of research model

Based on the above analysis and combined with the research purpose of this paper, a theoretical research model is constructed with the impact of brand green marketing strategies on consumers' environmental awareness as the main line. In the model, brand green marketing strategies are taken as independent variables and consumers' environmental awareness as dependent variables to explore the differential regulatory role of different group characteristics in this impact path. This model helps to systematically reveal how green marketing strategies affect consumers' cognition and attitudes towards environmental issues through different dimensions (green products, green promotion, and green channels), and further analyze the differences in behavioral responses of different consumer groups in the process of responding to green marketing strategies.

3. Methodology

3.1. Research design

This study adopts a quantitative research paradigm, collecting data through a questionnaire survey and verifying hypotheses with statistical analysis methods. The specific design is as follows: A self-designed structured questionnaire is used, consisting of 25 items. Among them, items 1-4 are about demographic variables (covering gender, age, educational background, monthly average income, etc.); items 5-9 measure the independent variable (green product strategy scale); items 10-14 measure the independent variable (green promotion strategy scale); items 15-19 measure the independent variable (green channel strategy scale); items 20-24 measure the dependent variable (consumers' environmental awareness); and item 25 is a lie-detection question. In terms of sampling design, the target population is people aged 18 to 60 in mainland China who have certain consumption capacity and environmental awareness. The sampling method is convenience sampling. Online, friends, colleagues, classmates, etc., are invited to participate through the researchers' social networks and personal connections, and the invited participants are encouraged to secondary spread the survey within their own social circles to expand the sample coverage. Offline, random intercept interviews are conducted with relevant personnel in places such as green-themed exhibition halls, public welfare environmental protection lectures, and garbage classification publicity activities. Finally, 504 valid questionnaires are recovered, meeting the minimum sample requirement for structural equation models ($n \geq 200$). Samples with uncompleted items, obvious regular answering patterns, or non-serious responses screened out by item 25 are excluded. The exclusion criteria are as follows: questionnaires with uncompleted items or obvious regular answering patterns, while serious response samples can be screened out after filling in the answer to item 25.

Table 1. Variable dimensions and details [5, 9, 14]

DA Variable	easurement index	operational definition
Green product strategy	Five items including green product assessment, comparison of traditional products, and willingness to purchase and pay	The score ranges from 1 to 5, with a high score indicating strong product recognition
Green promotion strategy	Five items including the impact of green promotion, promotion response, and green information transmission	The score ranges from 1 to 5, with a high score indicating high promotional effectiveness
Green channel strategy	Five items: green marketing, environmental protection channels, credibility promotion influence, and green supply chain	The score ranges from 1 to 5. A high score indicates a strong channel influence

As shown in Table 1, while this study did not conduct formal pilot testing for three distinct variable dimensions, multiple measures were implemented to ensure questionnaire validity: First, sociologists and professors specializing in green economics were invited to conduct expert reviews, including semantic validation of items and refinement of ambiguous expressions (e.g., merging duplicate cultural dimension questions). Second, a pre-test was conducted with 50 questionnaires distributed in a small sample to verify Cronbach's α coefficient (all reliability values > 0.8), with items having CR values < 0.4 being removed. Third, logical branching was established – specifically linking income to purchase frequency through conditional transitions – to minimize invalid responses.

3.2. Data collection and analysis

From June to August 2024, this study distributed questionnaires via the Wenjuanxing platform using anonymous responses with explicit data usage commitments for academic research. Quality control measures included IP address restrictions (one submission per device), time monitoring (eliminating quick-response surveys completed within < 2 minutes), and logical validation (e.g., age and occupation compatibility). Ethical compliance was ensured by adhering to China's Personal Information Protection Law and obtaining participants' informed consent.

The reliability and validity test results demonstrate that the research scale exhibits good reliability. The Cronbach's α values for three dependent variable dimensions are all above 0.8 (Green Product Strategy: 0.873; Green Promotion Strategy: 0.880; Green Channel Strategy: 0.883). Additionally, one independent variable dimension (Consumer Environmental Awareness) has a Cronbach's α value exceeding 0.8. Regarding the CITC values, all analysis items show CITC values greater than 0.4, indicating strong correlations between items and confirming good reliability levels. In summary, the research data reliability coefficients exceed 0.8, comprehensively demonstrating high data reliability quality suitable for further analysis.

Table 2 showed that the commonality values corresponding to all research items are higher than 0.4, indicating that the information of the research items can be effectively extracted; the KMO value is 0.918 (greater than 0.8), and Table 3 is significant ($p < 0.001$), indicating that the research data is very suitable for information extraction. In terms of hypothesis verification, multiple regression analysis showed that price ($\beta = -0.209$, $p < 0.001$), culture ($\beta = 0.165$, $p < 0.001$), quality ($\beta =$

0.128, p = 0.002), and income (β = 0.232, p < 0.001) all have significant impacts on purchase intention, with a cumulative explained variance of 39.4%; correlation analysis showed that price is significantly negatively correlated with purchase intention (r= -0.500), and income is significantly positively correlated with culture (r = 0.518).

Table 2. Validity of questionnaire questions

Name	Factor Loading Coefficient	Factor Loading Coefficient	Factor Loading Coefficient	Factor Loading Coefficient	Communality (Common Factor Variance)
	Factor 1	Factor 2	Factor 3	Factor 4	
6. I am willing to pay an additional fee for environmentally friendly products.	0.153	0.128	0.134	0.772	0.653
7. I will prioritize products with environmental certification labels.	0.116	0.102	0.199	0.767	0.652
8. I think the quality of green products is usually better than that of traditional products.	0.111	0.126	0.125	0.805	0.691
9. I think brands' green products can effectively improve environmental problems.	0.065	0.133	0.129	0.790	0.663
5. Brands' green products are more attractive than ordinary products.	0.110	0.111	0.155	0.783	0.661
10. Brands' green promotion activities make me more inclined to purchase environmentally friendly products.	0.177	0.154	0.767	0.170	0.673
11. I will increase the purchase frequency of environmentally friendly products due to green promotion activities.	0.109	0.151	0.768	0.181	0.657
12. Through green promotion activities, the environmental protection information conveyed by brands has deepened my attention to environmental protection.	0.116	0.137	0.788	0.178	0.685
13. When I see brands' green promotion activities on social media, I am willing to participate.	0.161	0.108	0.786	0.147	0.677

14. If brands highlight environmental protection characteristics in promotion activities, I will be more willing to purchase their products.	0.164	0.176	0.794	0.100	0.699
15. I tend to purchase products from retailers with clear green channel support.	0.153	0.769	0.071	0.155	0.644
16. If brands' green products are sold through environmental protection channels (such as green transportation, green packaging), I am more willing to purchase them.	0.137	0.798	0.159	0.102	0.691
17. I am more inclined to purchase brand products with clear green supply chains.	0.159	0.792	0.194	0.101	0.700
18. If brands use green logistics, I will consider their environmental protection commitments more credible.	0.145	0.806	0.125	0.090	0.694
19. Green channel strategies (such as green e-commerce platforms, green warehousing, etc.) make me more willing to choose the brand's products.	0.121	0.784	0.175	0.175	0.691
20. I think individual environmental protection behaviors are crucial for improving environmental problems.	0.795	0.137	0.132	0.111	0.681
21. I am willing to pay a higher price for environmentally friendly products than ordinary products.	0.797	0.178	0.134	0.090	0.693
22. I will actively pay attention to whether brands have environmental certification (such as green labels).	0.813	0.146	0.114	0.149	0.717

23. I often practice daily environmental protection behaviors (such as garbage classification, reducing disposable items).	0.774	0.120	0.179	0.120	0.660
24. I will refuse to purchase products from brands that are not environmentally friendly.	0.775	0.128	0.145	0.093	0.647
Eigenvalue (before rotation)	7.146	2.335	2.100	1.948	-
Variance explanation rate% (before rotation)	35.732%	11.677%	10.501%	9.739%	-
Cumulative variance explanation rate% (before rotation)	35.732%	47.409%	57.909%	67.648%	-
Eigenvalue (after rotation)	3.406	3.404	3.377	3.343	-
Variance explanation rate% (after rotation)	17.030%	17.019%	16.883%	16.717%	-
Cumulative variance explanation rate% (after rotation)	17.030%	34.048%	50.932%	67.648%	-
KMO value	0.918	0.918	0.918	0.918	-
Bartlett's sphericity value	5235.123	5235.123	5235.123	5235.123	-
df	190	190	190	190	-
p value	0.000	0.000	0.000	0.000	-
Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.		

Table 3. KMO and Bartlett's test

KMO and Bartlett's Test	KMO and Bartlett's Test	KMO and Bartlett's Test
KMO value	KMO value	0.918
Bartlett's Test of Sphericity	Approx. Chi-Square	5,235.123
	df	190
	p value	0.000

4. Results and discussion

4.1. Demographic profile of respondents

A total of 504 valid questionnaires were collected in this "Questionnaire on the Impact of Green Marketing Strategies on Consumers' Environmental Awareness". As can be seen from Table 4: In terms of gender, more than 50% of the samples are

"female". In addition, the proportion of male samples is 48.21%. In terms of age, the "26-30" group accounts for the highest proportion at 41.87%. In terms of education, more than 20% of the samples chose "junior high school or below". In terms of monthly average income distribution, most samples are in the "6,000-10,000 yuan" range, accounting for 37.90%. The proportion of samples with 3,000-6,000 yuan is 32.54%.

Table 4. Statistical overview of respondents

Respondent Statistics	Respondent Statistics	Respondent Statistics	Respondent Statistics	Respondent Statistics
Name	Option	Frequency	Percentage (%)	Cumulative Percentage (%)
Gender	Male	243	48.21	48.21
	Female	261	51.79	100.00
Age	18-25	46	9.13	9.13
	26-30	211	41.87	50.99
	31-40	140	27.78	78.77
	41-50	49	9.72	88.49
	51-60	58	11.51	100.00
Education	Junior high school or below	121	24.01	24.01
	Senior high school/vocational school	118	23.41	47.42
	Junior college	118	23.41	70.83
	Bachelor's degree	121	24.01	94.84
	Postgraduate or above	26	5.16	100.00
Monthly Average Income	Below 3,000 yuan	93	18.45	18.45
	3,000-6,000 yuan	164	32.54	50.99
	6,000-10,000 yuan	191	37.90	88.89
	10,000-15,000 yuan	27	5.36	94.25
	Above 15,000 yuan	29	5.75	100.00
Total	Total	504	100.0	100.0

4.2. Descriptive analysis of variables

Descriptive analysis is used to study the overall situation of quantitative data, such as the overall average score; first: the average score of overall descriptive analysis items; second: focus on explaining items with significantly higher or lower averages; third: if the standard deviation is large, the median can be considered to represent the overall scoring situation; fourth: summarize the analysis.

Table 5. Descriptive analysis of variables

Name	Sample Size	Minimum Value	Maximum Value	Mean	Standard Deviation	Median
Consumers' Environmental Awareness	504	1.471	4.994	3.320	0.856	3.299
Green Channel Strategy	504	1.383	5.000	3.353	0.857	3.378
Green Promotion Strategy	504	1.467	5.000	3.307	0.873	3.267
Green Product Strategy	504	1.200	5.000	3.306	0.928	3.200

Descriptive analysis describes the overall situation of data through mean or median. As can be seen from Table 5: There are no outliers in the current data, and descriptive analysis can be directly conducted on the mean.

4.3. Main data analysis results

Reliability analysis is used to study the reliability and accuracy of answers to quantitative data (especially attitude scale questions); first: analyze the α coefficient. If this value is higher than 0.8, it indicates high reliability; if it is between 0.7-0.8, it

indicates good reliability; if it is between 0.6-0.7, it indicates acceptable reliability; if it is less than 0.6, it indicates poor reliability; second: if the CITC value is lower than 0.3, consider deleting the item; third: if the "alpha if item deleted" value is significantly higher than the α coefficient, consider deleting the item and re-analyzing; fourth: summarize the analysis.

Table 6. Cronbach reliability analysis of green product strategy

Green Product Strategy Cronbach Reliability Analysis	Green Product Strategy Cronbach Reliability Analysis	Green Product Strategy Cronbach Reliability Analysis	Green Product Strategy Cronbach Reliability Analysis
Name	Corrected Item-Total Correlation (CITC)	Alpha if Item Deleted	Cronbach's α Coefficient
5. Brands' green products are more attractive than ordinary products.	0.699	0.846	0.873
6. I am willing to pay an additional fee for environmentally friendly products.	0.693	0.847	
7. I will prioritize products with environmental certification labels.	0.691	0.848	
8. I think the quality of green products is usually better than that of traditional products.	0.721	0.841	
9. I think brands' green products can effectively improve environmental problems.	0.694	0.847	
Note: Standardized Cronbach's α coefficient = 0.873	Note: Standardized Cronbach's α coefficient = 0.873	Note: Standardized Cronbach's α coefficient = 0.873	Note: Standardized Cronbach's α coefficient = 0.873

As can be seen from Table 6: The reliability coefficient value is 0.873, which is greater than 0.8, thus indicating high reliability of the research data.

Table 7. Cronbach reliability analysis of green promotion strategies

Green Promotion Strategy Cronbach Reliability Analysis	Green Promotion Strategy Cronbach Reliability Analysis	Green Promotion Strategy Cronbach Reliability Analysis	Green Promotion Strategy Cronbach Reliability Analysis
Name	Corrected Item-Total Correlation (CITC)	Alpha if Item Deleted	Cronbach's α Coefficient
10. Brands' green promotion activities make me more inclined to purchase environmentally friendly products.	0.713	0.855	0.880
11. I will increase the purchase frequency of environmentally friendly products due to green promotion activities.	0.699	0.858	
12. Through green promotion activities, the environmental protection information conveyed by brands has deepened my attention to environmental protection.	0.715	0.854	
13. When I see brands' green promotion activities on social media, I am willing to participate.	0.713	0.855	
14. If brands highlight environmental protection characteristics in promotion activities, I will be more willing to purchase their products.	0.728	0.851	
Note: Standardized Cronbach's α coefficient = 0.880	Note: Standardized Cronbach's α coefficient = 0.880	Note: Standardized Cronbach's α coefficient = 0.880	Note: Standardized Cronbach's α coefficient = 0.880

As can be seen from Table 7, the reliability coefficient value is 0.880, which is greater than 0.8, thus indicating high reliability of the research data.

Table 8. Cronbach's reliability analysis of green channel strategy

Green Channel Strategy Cronbach Reliability Analysis	Green Channel Strategy Cronbach Reliability Analysis	Green Channel Strategy Cronbach Reliability Analysis	Green Channel Strategy Cronbach Reliability Analysis
Name	Corrected Item-Total Correlation (CITC)	Alpha if Item Deleted	Cronbach's α Coefficient
15. I tend to purchase products from retailers with clear green channel support.	0.682	0.866	0.883
16. If brands' green products are sold through environmental protection channels (such as green transportation, green packaging), I am more willing to purchase them.	0.724	0.857	
17. I am more inclined to purchase brand products with clear green supply chains.	0.734	0.854	
18. If brands use green logistics, I will consider their environmental protection commitments more credible.	0.725	0.856	
19. Green channel strategies (such as green e-commerce platforms, green warehousing, etc.) make me more willing to choose the brand's products.	0.727	0.856	
Note: Standardized Cronbach's α coefficient = 0.883	Note: Standardized Cronbach's α coefficient = 0.883	Note: Standardized Cronbach's α coefficient = 0.883	Note: Standardized Cronbach's α coefficient = 0.883

As can be seen from Table 8, the reliability coefficient value is 0.883, which is greater than 0.8, thus indicating high reliability of the research data.

Table 9. Cronbach reliability analysis of consumers' environmental awareness

Consumers' Environmental Awareness Cronbach Reliability Analysis	Consumers' Environmental Awareness Cronbach Reliability Analysis	Consumers' Environmental Awareness Cronbach Reliability Analysis	Consumers' Environmental Awareness Cronbach Reliability Analysis
Name	Corrected Item-Total Correlation (CITC)	Alpha if Item Deleted	Cronbach's α Coefficient
20. I think individual environmental protection behaviors are crucial for improving environmental problems.	0.716	0.856	0.881
21. I am willing to pay a higher price for environmentally friendly products than ordinary products.	0.726	0.853	
22. I will actively pay attention to whether brands have environmental certification (such as green labels).	0.744	0.849	
23. I often practice daily environmental protection behaviors (such as garbage classification, reducing disposable items).	0.701	0.859	
24. I will refuse to purchase products from brands that are not environmentally friendly.	0.689	0.862	
Note: Standardized Cronbach's α coefficient = 0.881	Note: Standardized Cronbach's α coefficient = 0.881	Note: Standardized Cronbach's α coefficient = 0.881	Note: Standardized Cronbach's α coefficient = 0.881

As can be seen from Table 9, the reliability coefficient value is 0.881, which is greater than 0.8, thus indicating high reliability of the research data.

Validity analysis is used to study the design rationality of quantitative data (especially attitude scale questions); first: analyze the KMO value. If this value is higher than 0.8, it indicates that the research data is very suitable for information extraction

(indirectly indicating good validity); if it is between 0.7-0.8, it indicates that the research data is suitable for information extraction (indirectly indicating good validity); if it is between 0.6-0.7, it indicates that the research data is relatively suitable for information extraction (indirectly indicating general validity); if it is less than 0.6, it indicates that the data is not suitable for information extraction (indirectly indicating general validity) (if there are only two questions, the KMO value is 0.5 regardless); second: analyze the correspondence between items and factors. If the correspondence is basically consistent with the research expectation, it indicates good validity; third: if the validity is poor, or the correspondence between factors and items is seriously inconsistent with expectations, or the commonality value corresponding to an analysis item is lower than 0.4 (sometimes 0.5 as the standard), consider deleting the item; fourth: common standards for deleting items: first, commonality value lower than 0.4 (sometimes 0.5 as the standard); second, serious deviation in the correspondence between analysis items and factors; fifth: repeat steps 1-4 until the KMO value meets the standard and the correspondence between items and factors is basically consistent with expectations, and finally indicate good validity; sixth: summarize the analysis.

Table 10. Validity analysis results

Validity Analysis Results	Validity Analysis Results	Validity Analysis Results	Validity Analysis Results	Validity Analysis Results	Validity Analysis Results
Name	Factor Loading Coefficient	Factor Loading Coefficient	Factor Loading Coefficient	Factor Loading Coefficient	Communality (Common Factor Variance)
	Factor 1	Factor 2	Factor 3	Factor 4	
5. Brands' green products are more attractive than ordinary products.	0.110	0.111	0.155	0.783	0.661
6. I am willing to pay an additional fee for environmentally friendly products.	0.153	0.128	0.134	0.772	0.653
7. I will prioritize products with environmental certification labels.	0.116	0.102	0.199	0.767	0.652
8. I think the quality of green products is usually better than that of traditional products.	0.111	0.126	0.125	0.805	0.691
9. I think brands' green products can effectively improve environmental problems.	0.065	0.133	0.129	0.790	0.663
10. Brands' green promotion activities make me more inclined to purchase environmentally friendly products.	0.177	0.154	0.767	0.170	0.673

11. I will increase the purchase frequency of environmentally friendly products due to green promotion activities.	0.109	0.151	0.768	0.181	0.657
12. Through green promotion activities, the environmental protection information conveyed by brands has deepened my attention to environmental protection.	0.116	0.137	0.788	0.178	0.685
13. When I see brands' green promotion activities on social media, I am willing to participate.	0.161	0.108	0.786	0.147	0.677
14. If brands highlight environmental protection characteristics in promotion activities, I will be more willing to purchase their products.	0.164	0.176	0.794	0.100	0.699
15. I tend to purchase products from retailers with clear green channel support.	0.153	0.769	0.071	0.155	0.644
16. If brands' green products are sold through environmental protection channels (such as green transportation, green packaging), I am more willing to purchase them.	0.137	0.798	0.159	0.102	0.691

17. I am more inclined to purchase brand products with clear green supply chains.	0.159	0.792	0.194	0.101	0.700
18. If brands use green logistics, I will consider their environmental protection commitments more credible.	0.145	0.806	0.125	0.090	0.694
19. Green channel strategies (such as green e-commerce platforms, green warehousing, etc.) make me more willing to choose the brand's products.	0.121	0.784	0.175	0.175	0.691
20. I think individual environmental protection behaviors are crucial for improving environmental problems.	0.795	0.137	0.132	0.111	0.681
21. I am willing to pay a higher price for environmentally friendly products than ordinary products.	0.797	0.178	0.134	0.090	0.693
22. I will actively pay attention to whether brands have environmental certification (such as green labels).	0.813	0.146	0.114	0.149	0.717
23. I often practice daily environmental protection behaviors (such as garbage classification, reducing disposable items).	0.774	0.120	0.179	0.120	0.660

24. I will refuse to purchase products from brands that are not environmentally friendly.	0.775	0.128	0.145	0.093	0.647
Eigenvalue (before rotation)	7.146	2.335	2.100	1.948	-
Variance explanation rate% (before rotation)	35.732%	11.677%	10.501%	9.739%	-
Cumulative variance explanation rate% (before rotation)	35.732%	47.409%	57.909%	67.648%	-
Eigenvalue (after rotation)	3.406	3.404	3.377	3.343	-
Variance explanation rate% (after rotation)	17.030%	17.019%	16.883%	16.717%	-
Cumulative variance explanation rate% (after rotation)	17.030%	34.048%	50.932%	67.648%	-
KMO value	0.918	0.918	0.918	0.918	-
Bartlett's sphericity value	5,235.123	5,235.123	5,235.123	5,235.123	-
df	190	190	190	190	-
p value	0.000	0.000	0.000	0.000	-
Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	Note: Colored numbers in the table: blue indicates factor loading coefficient absolute value > 0.4; red indicates communality (common factor variance) < 0.4.	

As can be seen from Table 10, the commonality values corresponding to all research items are higher than 0.4, indicating that the information of the research items can be effectively extracted. In addition, the KMO value is 0.918, which is greater than 0.6, so the data can be effectively used for information extraction. In addition, the variance explanation rates of the four factors are 17.030%, 17.019%, 16.883%, and 16.717% respectively, and the cumulative variance explanation rate after rotation is 67.648% > 50%. This means that the information of the research items can be effectively extracted. Finally, please combine the factor loading coefficients to confirm whether the correspondence between factors (dimensions) and research items is consistent with expectations. If consistent, it indicates validity; otherwise, adjustments are needed. A factor loading coefficient absolute value greater than 0.4 indicates a correspondence between the option and the factor.

Correlation analysis is used to study the relationship between quantitative data, whether there is a relationship, and the degree of closeness; first: specifically analyze the relationship between each Y and each X, whether there is a significant relationship between Y and X; second: analyze whether the correlation is positive or negative; the correlation coefficient can also indicate the degree of closeness; third: summarize the analysis. Before correlation analysis, scatter plots can be used to observe and display the correlation between data, and normal plots can be used to observe and display the normal distribution of data.

Table 11. Pearson correlation test

Pearson Correlation Test	Pearson Correlation Test	Pearson Correlation Test	Pearson Correlation Test	Pearson Correlation Test
	Consumers' Environmental Awareness	Green Channel Strategy	Green Promotion Strategy	Green Product Strategy
Consumers' Environmental Awareness	1			
Green Channel Strategy	0.553	1		
Green Promotion Strategy	0.472	0.557	1	
Green Product Strategy	0.361	0.406	0.547	1
$p< 0.05$ $p< 0.01$	$p< 0.05$ $p< 0.01$	$p< 0.05$ $p< 0.01$	$p< 0.05$ $p< 0.01$	$p< 0.05$ $p< 0.01$

As can be seen from Table 11, correlation analysis was used to study the correlation between consumers' environmental awareness and three variables: green channel strategy, green promotion strategy, and green product strategy, using Pearson correlation coefficient to indicate the strength of the correlation. Specifically, the correlation coefficient between consumers' environmental awareness and green channel strategy is 0.553, which is significant at the 0.01 level, indicating a significant positive correlation between them. The correlation coefficient between consumers' environmental awareness and green promotion strategy is 0.472, significant at the 0.01 level, indicating a significant positive correlation. The correlation coefficient between consumers' environmental awareness and green product strategy is 0.361, significant at the 0.01 level, indicating a significant positive correlation.

Regression analysis is used to study the impact of X (quantitative or categorical) on Y (quantitative), whether there is an impact, the direction and degree of impact; first: analyze the model fitting situation, i.e., analyze the model fitting situation throughR-squared value, and analyze the VIF value (or tolerance value, tolerance = 1/VIF, VIF > 5 indicates multicollinearity, tolerance < 0.2 indicates multicollinearity) to judge whether there is multicollinearity in the model [multicollinearity can be solved by ridge regression or stepwise regression]; second: write the model formula (optional); third: analyze the significance of X. If significant ($p < 0.05$ or 0.01), it indicates that X has an impact on Y, and then specifically analyze the direction of the impact; fourth: compare and analyze the impact degree of X on Y combined with the regression coefficient B value (optional); fifth: summarize the analysis. Before regression analysis, box plots can be used to check for abnormal data, or scatter plots can be used to visually display the correlation between X and Y ; after regression analysis, normal plots can be used to observe and display the normality of the saved residual values; or scatter plots can be used to observe and display the heteroscedasticity of the regression model [no heteroscedasticity if the scatter of residuals and X is completely irrelevant].

Table 12. Linear regression analysis results and details (n=504)

Linear Regression Analysis Results (n =504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)	Linear Regression Analysis Results (n=504)
	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	p	Collinearity Diagnostics VIF	Collinearity Diagnostics Tolerance
Constant	1.052	0.146	-	7.225	0.000	-	-
Green Channel Strategy	0.407	0.044	0.407	9.281	0.000	1.482	0.675
Green Promotion Strategy	0.193	0.047	0.197	4.105	0.000	1.765	0.566
Green Product Strategy	0.081	0.040	0.087	2.006	0.045	1.458	0.686
R^2	0.349	0.349	0.349	0.349	0.349	0.349	0.349
Adjusted R^2	0.346	0.346	0.346	0.346	0.346	0.346	0.346
F	F (3,500) = 89.521, p= 0.000	F (3,500) = 89.521,p= 0.000	F (3,500) = 89.521, p= 0.000	F (3,500) = 89.521, p= 0.000	F (3,500) = 89.521, p= 0.000	F (3,500) = 89.521,p= 0.000	F (3,500) = 89.521, p= 0.000
D-W value	2.130	2.130	2.130	2.130	2.130	2.130	2.130

As shown in Table 12, the linear regression analysis was conducted with green channel strategies, green promotion strategies, and green product strategies as independent variables, and consumer environmental awareness as the dependent variable. The model equation derived from the table is: Consumer Environmental Awareness = 1.052 + 0.407 Green Channel Strategies + 0.193 Green Promotion Strategies + 0.081 Green Product Strategies. The R^2 value of 0.349 indicates that these three strategies collectively account for 34.9% of the variance in consumer environmental awareness. The F-test (F= 89.521, $p < 0.05$) confirms the model's validity, demonstrating that at least one of these strategies significantly influences environmental awareness. Additionally, multicollinearity tests revealed that all Variance Inflation Factors (VIF) values were below 5, indicating no significant multicollinearity issues. The D-W value is close to the critical threshold of 2, indicating that the model demonstrates no autocorrelation and shows no significant correlation between sample data points, suggesting a robust model. The final analysis reveals: The regression coefficient for the green channel strategy is 0.407 (t =9.281, p = 0.000 < 0.01), indicating a significant positive correlation between the green channel strategy and consumers 'environmental awareness. The regression coefficient for the green promotion strategy is 0.193 (t =4.105, p= 0.000 < 0.01), demonstrating a significant positive impact on environmental consciousness. The green product strategy has a regression coefficient of 0.081 (t= 2.006, p = 0.045 < 0.05), showing a notable positive correlation with environmental awareness. The comprehensive analysis confirms that all three strategies—green channel, green promotion, and green product strategies—exhibit significant positive correlations in enhancing consumers' environmental consciousness.

5. Conclusion

This study identifies three core dimensions of brand green marketing—green products, promotional strategies, and distribution channels—all demonstrating significant positive impacts on consumer environmental awareness. These findings align with both the Theory of Planned Behavior and consumer behavior theory, indicating that corporate green marketing initiatives can effectively guide public environmental consciousness. Notably, the effectiveness varies significantly across dimensions: channel-based green initiatives show the most pronounced impact, followed by promotional and product-based approaches, with statistically significant differences observed. The green aspects communicated through specific, tangible channels carry greater persuasive power for target users. Transparent channel operations, eco-friendly minimalist delivery methods, and convenient access points directly reduce barriers to implementing green consumption behaviors. This process reinforces the TPB model's "perceived behavioral control" component, transforming environmental concepts into actionable steps that ultimately cultivate sustainable awareness among target audiences.

As an effective communication and incentive tool, green promotions demonstrate moderate influence, indicating that eco-conscious campaigns and experiential activities (such as recycling incentives) remain crucial for awakening environmental awareness. While green product strategies have limited impact, businesses must recognize that the market presents dual challenges: consumers may overlook authenticity concerns about "greenwashing", while prioritizing traditional factors like price and quality. Alternatively, products might fail to effectively communicate their environmental benefits. This reality suggests that corporate promotion of eco-friendly products should not only strengthen information credibility and certification but also emphasize the alignment between green values and consumer priorities (rather than focusing solely on brand marketing strategies). Furthermore, it is emphasized overall that green activities are a systematic project, and green marketing should promote green concepts rather than merely highlighting the green characteristics of certain types of products. That is to say, making products green at the marketing or channel level may have a more profound impact on users' cognition than simply emphasizing the green attributes of products.

The research limitations of this study include the concentration of samples in online channels (insufficient offline coverage) and the failure to subdivide regional differences. In the future, mixed methods (such as interviews and case studies) can be used to explore psychological mechanisms; conduct longitudinal tracking to observe changes in users' psychological awareness, as well as the speed, breadth, and intensity of its diffusion; expand the coverage of representative samples; introduce more moderating variables (such as culture and values) and mediating variables (such as trust and perceived value) for more detailed characterization; and make horizontal comparisons of the influence among different industries or product categories.

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