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RESEARCH ARTICLE

The determinants and mechanisms of residents' green consumer behavior in Dongguan city under the carbon peak target

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ABSTRACT

Under the carbon peaking target, residents' green consumption behavior plays a crucial role in reducing carbon emissions. This study takes Dongguan as a case to investigate the influencing factors and mechanisms of residents' green consumption behavior, aiming to provide evidence for formulating targeted emission reduction strategies in high-carbon regions. Based on the Theory of Planned Behavior (TPB) and the Attitude-Behavior-Context (ABC) theory, the research adopts a quantitative approach, conducting a questionnaire survey among 500 residents through multi-stage stratified sampling and analyzing the data using structural equation modeling (SEM). The results indicate that green consumption awareness, perceived behavioral control, and external factors (economic, policy, and market) all have significant positive effects on green consumption behavior, while subjective norms show no significant impact. Green consumption attitudes mediate the relationship between most variables and behavior. It is recommended that the government establish a "cognition-attitude-behavior" full-chain guidance mechanism, optimize policy tools and market supply, while enterprises should develop differentiated green products for diverse consumer groups to collaboratively advance regional carbon peaking goals.

Keywords: Green consumption behavior; structural equation modeling; mediating effect

1. Introduction

Climate change stands as one of the most pressing environmental challenges globally, with carbon dioxide emissions identified as a primary driver. The United Nations Conference on Environment and Development's Agenda 21 explicitly states that ecological degradation, including climate change, stems from long-term unsustainable human production and consumption patterns. Masoud Rabbani et al.[1] similarly argue that excessive human consumption constitutes a root cause of environmental destruction and resource depletion. According to UNEP's 2020 Emissions Gap Report, household consumption now accounts for two-thirds of global greenhouse gas emissions, making lifestyle transformation an imperative for climate mitigation.

Regarding emission reduction efficacy, Christine Kreuzer et al.[2] likewise emphasize sustainable consumption's pivotal role in maintaining climate equilibrium. Consequently, Liu & Zhang[3] pointed that

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demand-side interventions have emerged as crucial climate strategies, positioning green consumption - as a carbon-conscious consumption paradigm - at the forefront of mitigation efforts.

As the world's largest developing country, China plays a significant role in global carbon emissions. Since 2006, China has surpassed the United States to become the world's largest carbon dioxide emitter. As shown in Figure 1, China's carbon emissions reached 11,397 million tons in 2022, 2.25 times that of the second-ranked United States and approximately 19 times that of South Korea, which ranked tenth. This highlights China's prominent position in the global carbon emissions landscape. To address climate change and fulfill its responsibilities as a major country, China has committed to "peaking carbon emissions by 2030 and achieving carbon neutrality by 2060" under the Paris Agreement. Furthermore, green development has been incorporated into the 14th Five-Year Plan and the report of the 20th National Congress of the Communist Party of China, making carbon emission reduction a national strategic priority.

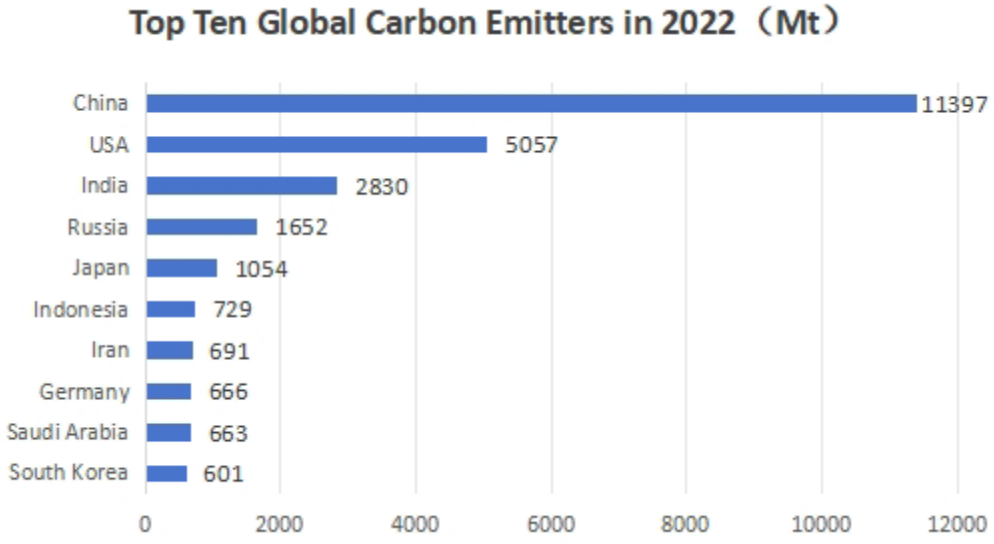

Figure 1. Top 10 carbon-emitting countries worldwide in 2022 (million metric tons)

Data source: Global Carbon Budget (2023)

At the regional level, Guangdong Province, as China's largest provincial economy, recorded a carbon emission growth rate of approximately 21.7% during 2012-2021, exceeding the national average growth rate of 15.92% for the same period. Dongguan City, the second-largest carbon emitter in Guangdong Province, faces particularly significant emission reduction pressures. As illustrated in Figure 2, Dongguan's carbon emissions accounted for about 12% of Guangdong's total emissions from 2011 to 2020, establishing it as a major contributor among the province's 21 prefecture-level cities.

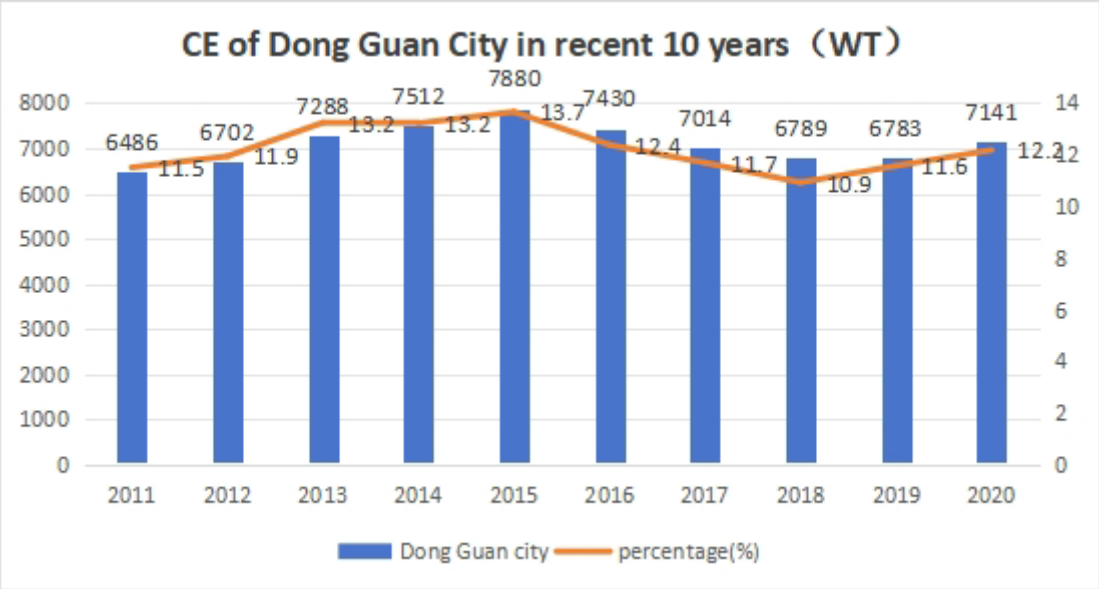

Figure 2. Carbon emissions (10,000 metric tons) and proportion of Dongguan City over the past decade

Data source: China Urban Greenhouse Gas Working Group

From the perspective of emission structure, the proportion of carbon emissions from the consumption end has been progressively increasing. While previous studies, such as that by Liu & Zhang[4], have predominantly focused on industrial sector emissions, the impact of household consumption has often been overlooked. In reality, the residential sector has emerged as the second-largest contributor to both energy consumption and carbon emissions, surpassed only by the industrial sector.Ivanova et al.[5] indicates that consumption-related carbon emissions account for over 50% of national total emissions in both developed and developing countries. Baiocchi et al.[6] found that in advanced economies such as the United States and United Kingdom, consumption-based CO_2 emissions may exceed 70% of the national total.Driven by rapid urbanization and a substantial population base, China's household consumption-related carbon emissions have experienced remarkable growth, as researched by Zhang & Li[7]. Per capita consumption-based emissions increased from 2,335 kg in 2012 to 4,145 kg in 2018, with total consumption-end emissions peaking at 9.894 billion metric tons in 2020—the highest globally. Under the modern demand-driven production system where consumption dictates production, emission reduction at the consumption end not only possesses significant potential but can also guide production-side mitigation, thereby creating a synergistic effect. In response, both the national government and Guangdong Province have introduced policies to promote green consumption, emphasizing the importance of collective low-carbon actions.

In summary, Pottier[8] argued that reducing household consumption-based carbon emissions is critical for achieving the carbon peak and neutrality goals. Investigating emission reduction pathways at the consumption end through the case study of Dongguan City carries substantial theoretical and practical significance.

2. Literature review

Green Consumption Behavior (GCB), as a critical pathway for addressing climate change and promoting sustainable development, has become a focal point in academic research. Existing studies have explored the influencing factors of GCB from multiple dimensions, providing rich perspectives for understanding consumers' green decision-making mechanisms. This paper systematically reviews

influencing factors across three major dimensions: individual internal psychological factors, external contextual factors, and personal demographic characteristics, while identifying theoretical gaps based on current research.

2.1. The influence of individual internal psychological factors on GCB

Individual internal psychological characteristics serve as core variables driving GCB. Scholars have primarily employed the Theory of Planned Behavior (TPB) and Attitude-Behavior-Context (ABC) theory to analyze their mechanisms. Environmental cognition, as a fundamental variable, influences behavior through mediators such as attitudes and intentions. Wuer'er & Zeng[9] found that environmental cognition can positively affect GCB through the chain mediation of green consumption attitudes, subjective norms, and perceived behavioral control. Xie et al.[10] further verified that the positive effects of environmental cognition on green consumption attitudes, subjective norms, and perceived behavioral control can directly translate into behavioral changes.

Values and responsibility constitute deeper drivers. Liang et al.[11] demonstrated that the indirect effect of environmental values on green apparel consumption significantly outweighs direct effects, with green consumption intention showing the strongest mediating effect. Based on environmental literacy theory, Wang & Dou[12] revealed that environmental responsibility and environmental behavior skills can promote GCB through goal intention and implementation intention, while environmental problem perception may exert negative impacts due to anxiety.

In terms of perception and motivation, perceived behavioral control and perceived efficacy play prominent roles. Li & Shao[13] discovered that perceived behavioral control directly influences eco-friendly apparel purchasing behavior, while perceived aesthetic risk negatively moderates the relationship between purchase intention and behavior. Studies by Nguyen et al. [14]and Sun et al.[15] consistently indicate that perceived consumer effectiveness serves as a crucial link connecting green consumption intention with actual behavior, with its strength directly affecting behavioral conversion efficiency.

In summary, individual internal psychological factors exhibit a "cognition-attitude-intention-behavior" transmission logic, with core variables including environmental cognition, values, responsibility, perceived behavioral control, and subjective norms.

2.2. The influence of external contextual factors on GCB

External contextual factors influence GCB through multiple pathways including policy, social, and market dimensions. The effectiveness of government policies exhibits boundary conditions: Yang et al.[16] found that subsidies are more effective than penalties in promoting green consumption, though their combination yields optimal results; Wang & Qiu[17] caution that excessive publicity or subsidies may paradoxically inhibit behavior when consumers' psychological benefits from green consumption are already high, suggesting the need for policy-psychology alignment.

Social and economic environments demonstrate heterogeneous effects. Wuer'er & Zeng [9]revealed that regional economic development positively influences green consumption intention, while environmental quality may suppress intention through the "broken window effect," with environmental cognition showing regional variability. Social interaction intensity emerges as equally crucial, with Yang et al.[16] demonstrating that strong social networks accelerate GCB diffusion, creating synergistic effects with policy instruments.

Market and technological factors primarily target supply-side optimization. Zhang et al. [18]identified product certification, pricing, and availability as key determinants of purchasing behavior. From a brand semiotics perspective, Xu[19] proposed that circular logos outperform angular designs in promoting green

consumption, though this effect diminishes among high-power-distance consumers. Collectively, external contextual factors encompass policy instruments, regional characteristics, social interaction, market supply, and technological applications, requiring dynamic evaluation in conjunction with individual psychological states.

2.3. The influence of demographic characteristics on GCB

Personal demographics affect GCB through resource endowment and cognitive differences. Age and education exert significant influence: Xiong et al.[20] and Dan[21] consistently demonstrate stronger green consumption tendencies among younger, highly-educated demographics, attributable to superior information access and environmental awareness.

Income and gender show differential impacts: Du [22] established positive income effects on GCB, while Ren & Cai[23]revealed that feminine traits enhance green consumption whereas masculine traits exhibit opposite effects, moderated by product gender attributes. Geographical location indirectly influences behavior through economic and cultural channels, exemplified by Sun et al.'s [15] finding of significant urbanization-GCB correlations.

2.4. Research evaluation and gaps

While existing studies have established a multidimensional GCB framework, two critical gaps persist:

First, behavioral completeness remains neglected. Zhang et al.[18] found that current research predominantly focuses on purchasing behavior but lacks an integrated analysis of the usage and disposal phases.As GCB constitutes a closed-loop "purchase-use-disposal" process, drivers may vary across stages, making single-phase studies inadequate for revealing systemic behavioral patterns.

Second, regional specificity requires attention. Nationally representative samples dominate existing research, with limited focus on high-emission regions. For instance, Dongguan - Guangdong's second-largest carbon emitter - likely exhibits unique GCB patterns influenced by its manufacturing-intensive economy and transient population structure, yet these regional particularities remain underexplored.

Addressing these gaps, this study examines Dongguan's complete green consumption cycle, integrating internal and external factors to develop tailored theoretical and practical insights for high-emission regions.

3. Aim, conceptual framework, and hypotheses

This study focuses on residents' green consumption behavior (GCB) in Dongguan under the "Dual Carbon" goals, aiming to integrate internal and external influencing factors to reveal their mechanisms and propose targeted strategies. The specific objectives include: (1) identifying core dimensions affecting Dongguan residents' GCB, encompassing internal psychological factors (green consumption cognition, subjective norms, etc.) and external contextual factors (economic, policy, and market factors); (2) determining key variables influencing GCB and clarifying their directional effects and magnitudes; (3) analyzing the mediating mechanism of green consumption attitudes between these factors and consumption behavior to elucidate transmission pathways; and (4) developing evidence-based green consumption guidance strategies tailored for Dongguan at governmental and market levels to support regional carbon reduction practices.

The conceptual framework integrates the Theory of Planned Behavior[24,25], the Attitude-Behavior-Context (ABC) theory[26], and PEST analysis to systematically categorize influencing factors for three types of green consumption behaviors, thereby establishing this study's conceptual model.

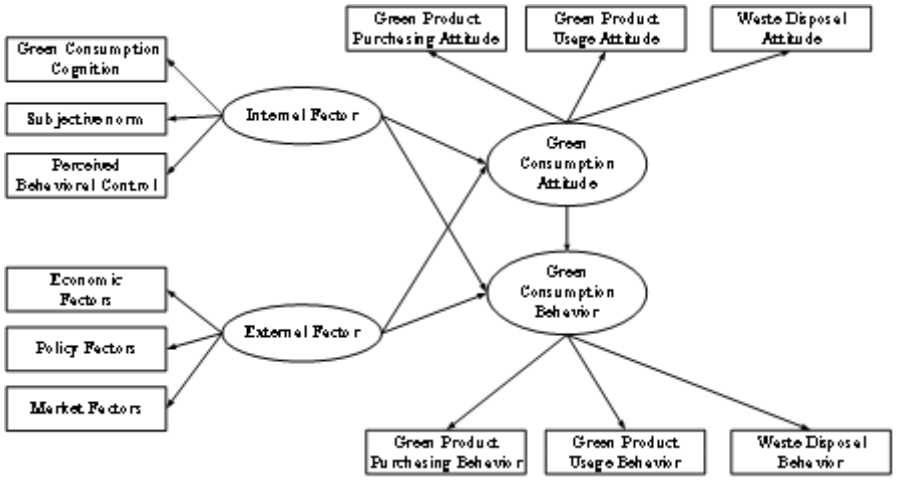

Figure 3. Conceptual framework

The study proposes the following hypotheses:

H1: Green consumption cognition has a significant positive effect on green consumption behavior.

H2: Subjective norms have a significant positive effect on green consumption behavior.

H3: Perceived behavioral control has a significant positive effect on green consumption behavior.

H4: Economic factors have a significant negative effect on green consumption behavior.

H5: Policy factors have a significant positive effect on green consumption behavior.

H6: Market factors have a significant positive effect on green consumption behavior.

H7: Green consumption attitude mediates the relationship between green consumption cognition and green consumption behavior.

H8: Green consumption attitude mediates the relationship between subjective norms and green consumption behavior.

H9: Green consumption attitude mediates the relationship between perceived behavioral control and green consumption behavior.

H10: Green consumption attitude mediates the relationship between economic factors and green consumption behavior.

H11: Green consumption attitude mediates the relationship between policy factors and green consumption behavior.

H12: Green consumption attitude mediates the relationship between market factors and green consumption behavior.

4. Research methodology

This study adopts a mixed research method that combines quantitative and qualitative approaches to comprehensively explore the green consumption behaviors of residents in Dongguan City and their influencing factors.

The quantitative research segment targets permanent residents aged 15-64 in Dongguan City as the research subjects. Based on Yamane's sampling formula[27]and accounting for a 20% nonresponse rate[28], a

final sample size of 520 was determined. A multi-stage mixed sampling method was adopted: (1)Stratified Sampling: The 32 towns/subdistricts of Dongguan were stratified by their 2024 GDP levels, with one representative town/subdistrict randomly selected from each economic tier (Chang'an, Humen, Dongcheng, Houjie, Liaobu). (2)Convenience Sampling: Approximately 100 samples were collected from each selected town/subdistrict through face-to-face questionnaire surveys.This approach ensures regional economic representativeness through stratification while addressing the lack of sampling frames in practical operations via convenience sampling.The study used a 5-point Likert scale to measure green consumption behavior and its influencing factors across three dimensions. Data analysis included reliability and validity tests conducted in SPSS 27.0, followed by structural equation modeling (SEM) in AMOS 28.0 to examine path relationships among variables.

For the qualitative research part, in-depth interview method is adopted, aiming to deeply explore the behavioral motivations and socio-cultural backgrounds behind the quantitative data. After completing the quantitative survey, 20 typical respondents were selected for semi-structured interviews using purposive sampling based on their green consumption behavior scores (high, medium, low) and demographic characteristics (age, occupation, income). The interview outline focuses on: (1) the specific contexts and considerations in green consumption decision-making; (2) the social mechanisms behind the failure of subjective norms to exert a significant impact; (3) the interaction between policy incentives and individual behaviors. All interview recordings were transcribed and then coded using thematic analysis (Braun & Clarke, 2006). Key thematic patterns were identified with the help of Nvivo 12.0 software, and triangulation verification was conducted with the quantitative results.

5. Results

5.1. Reliability test

The reliability of each variable was assessed using Cronbach's α coefficient, with results presented in Table 1. All variables exhibited α coefficients above 0.8 (except for subjective norms and perceived behavioral control, which were slightly below 0.83), indicating high internal consistency and meeting the reliability standards for social science research.

Table 1. summary of reliability test results

Variable Category	Dimension	Number of Items	Cronbach's α	Corrected Item-Total Correlation (CITC) Range	Cronbach's α if Item Deleted Range	Total α Coefficient
Green Consumption Behavior	Green Product Purchasing Behavior	5	0.864	0.646–0.799	0.848–0.882	0.888
	Green Product Usage Behavior	5	0.848	0.579–0.735	0.795–0.837	0.848
	Waste Disposal Behavior	5	0.859	0.592–0.800	0.797–0.853	0.859
Internal Factors	Green Consumption Cognition	5	0.862	0.562–0.822	0.797–0.861	0.862
	Subjective Norm	5	0.829	0.566–0.753	0.754–0.814	0.829
	Perceived Behavioral Control	4	0.827	0.563–0.718	0.751–0.820	0.827

Variable Category	Dimension	Number of Items	Cronbach's α	Corrected Item-Total Correlation (CITC) Range	Cronbach's α if Item Deleted Range	Total α Coefficient
Green Consumption Attitude	Green Product Purchasing Attitude	5	0.893	0.706–0.810	0.854–0.877	0.893
	Green Product Usage Attitude	5	0.886	0.667–0.820	0.841–0.876	0.886
	Waste Disposal Attitude	5	0.890	0.668–0.798	0.851–0.880	0.890
External Factors	Economic Factors	5	0.864	0.604–0.745	0.820–0.858	0.864
	Policy Factors	5	0.919	0.739–0.818	0.895–0.911	0.919
	Market Factors	5	0.864	0.570–0.741	0.821–0.863	0.864

5.2. Validity test

5.2.1. Exploratory Factor Analysis (EFA)

This study employed exploratory factor analysis to examine the construct validity of the measurement scales. As shown in Table 2, the Kaiser-Meyer-Olkin (KMO) values for all variables ranged between 0.770 and 0.894, and Bartlett's tests of sphericity were statistically significant ($p< 0.001$). These results confirm that the data were suitable for factor analysis.

Table 2. Results of KMO and Bartlett's Test

Variable Dimension	KMO Measure	Bartlett's Test Approximate χ^2	Significance (p-value)
Green Consumption Behavior	0.770	4359.705	<0.001
Internal Influencing Factors	0.820	3980.708	<0.001
Green Consumption Attitude	0.894	5756.710	<0.001
External Influencing Factors	0.871	4438.231	<0.001

(1) Factor Structure of Green Consumption Behavior

Three common factors were extracted (see Table 3), cumulatively explaining 65.80% of the total variance:

Factor 1 (Green Product Purchasing Behavior): Items GM1–GM5, with factor loadings ranging from 0.778 to 0.880

Factor 2 (Waste Disposal Behavior): Items CL1–CL5, with factor loadings ranging from 0.734 to 0.886

Factor 3 (Green Product Usage Behavior): Items SY1–SY5, with factor loadings ranging from 0.705 to 0.849

Table 3. Rotated Component Matrix

	Factor 1 (Green Purchasing Behavior)	Factor 2 (Waste Disposal Behavior)	Factor 3 (Green Usage Behavior)
GM1	0.813		
GM2	0.880		

	Factor 1 (Green Purchasing Behavior)	Factor 2 (Waste Disposal Behavior)	Factor 3 (Green Usage Behavior)
GM3	0.844		
GM5	0.800		
GM4	0.778		
CL4		0.886	
CL1		0.823	
CL5		0.813	
CL3		0.735	
CL2		0.734	
SY1			0.849
SY2			0.820
SY3			0.775
SY5			0.744
SY4			0.705
Eigenvalue	3.463	3.256	3.152
Variance Explained (%)	23.083	21.705	21.014
Cumulative Variance (%)	23.083	44.788	65.802

Table 3. (*Continued*)

(2) Factor Structure of Internal Influencing Factors

Three common factors with eigenvalues greater than 1 were extracted, accounting for 66.180% of the total variance. The rotated component matrix is presented in Table 4:

Table 4. Rotated component matrix of internal influencing factors

Measurement Item	Factor 1 (Consumption Cognition)	Factor 2 (Subjective Norm)	Factor 3 (Perceived Behavioral Control)
XF4	0.880		
XF5	0.777		
XF3	0.761		
XF1	0.718		
XF2	0.711		
ZG2		0.820	
ZG4		0.809	
ZG5		0.694	
ZG3		0.637	
GZ3			0.840
GZ1			0.819
GZ2			0.787
GZ4			0.705
Eigenvalue	3.729	2.817	2.719

Measurement Item	Factor 1 (Consumption Cognition)	Factor 2 (Subjective Norm)	Factor 3 (Perceived Behavioral Control)
Variance Explained (%)	26.636	20.125	19.419
Cumulative Variance (%)	26.636	46.761	66.180

Table 4. (*Continued*)

(3) Factor Analysis of Green Consumption Attitudes

Three common factors with eigenvalues greater than 1 were extracted, explaining a cumulative variance of 70.044%. The rotated component matrix is presented in Table 5:

Table 5. Rotated component Matrix of green consumption attitudes

Measurement Item	Factor 1 (Purchasing Attitude	Factor 2 (Disposal Attitude)	Factor 3 (Usage Attitude)
TD4	0.836		
TD5	0.781		
TD2	0.767		
TD1	0.672		
TD3	0.605		
CLT5		0.797	
CLT3		0.786	
CLT2		0.743	
CLT4		0.724	
CLT1		0.717	
SYT5			0.794
SYT3			0.762
SYT2			0.753
SYT4			0.603
SYT1			0.567
Eigenvalue	3.646	3.438	3.423
Variance Explained (%)	24.307	22.917	22.819
Cumulative Variance (%)	24.307	47.225	70.044

(4) Factor Analysis of External Influencing Factors

Three common factors with eigenvalues greater than 1 were extracted, cumulatively explaining 68.802% of the total variance. The rotated component matrix is presented in Table 6:

Table 6. Rotated component Matrix of external influencing factors

Measurement Item	Factor 1 (Policy Factors)	Factor 2 (Economic Factors)	Factor 3 (Market Factors)
ZZ1	0.873		
ZZ2	0.865		
ZZ3	0.862		
ZZ4	0.822		

Measurement Item	Factor 1 (Policy Factors)	Factor 2 (Economic Factors)	Factor 3 (Market Factors)
ZZ5	0.813		
JJ1		0.837	
JJ2		0.824	
JJ3		0.796	
JJ4		0.782	
JJ5		0.707	
SC1			0.858
SC3			0.834
SC5			0.811
SC4			0.797
SC2			0.673
Eigenvalue	3.761	3.287	3.273
Variance Explained (%)	25.071	21.914	21.817
Cumulative Variance (%)	25.071	46.985	68.802

Table 6. (*Continued*)

The exploratory factor analysis demonstrated good construct validity for all measurement scales in this study. Each dimension successfully extracted the theoretically hypothesized factor structure, with all items exhibiting factor loadings greater than 0.60 (range: 0.567-0.886) on their respective factors and no significant cross-loadings (all cross-loadings <0.40). The cumulative variance explained across dimensions ranged between 65.80% and 70.04%, all exceeding the standard threshold of 60%, confirming the scales' satisfactory explanatory power. Combined with the KMO values (0.770-0.894) and significant Bartlett's test results ($p < 0.001$), these findings robustly validate the structural validity of the measurement scales.

5.2.2. Confirmatory factor analysis

(1) Model Fit Indices

As shown in Table 7, the model demonstrated acceptable fit, with all indices meeting established standards and indicating relatively ideal results. This suggests a high degree of model fit and overall good adaptation.

Table 7. Confirmatory factor analysis model fit indices

Fit Index	Judgment Criteria	Actual Value
χ^2/df	<5 (Acceptable)	3.385
CFI	>0.8 (Acceptable); >0.9 (Ideal)	0.805
TLI	>0.8 (Acceptable); >0.9 (Ideal)	0.812
RMSEA	<0.08 (Acceptable)	0.068

(2) Convergent Validity Analysis

As shown in Table 8, all observed variables exhibited standardized factor loadings greater than 0.5 on their corresponding latent variables, indicating good representativeness. The composite reliability (CR) for each dimension exceeded the threshold of 0.7, and the average variance extracted (AVE) for each dimension

was above 0.5. These results confirm that all dimensions meet the validity criteria, demonstrating high convergent validity of the model.

Table 8. Convergent validity analysis

Path			Standardized Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
ZZ5	<---	PF	0.765	0.919	0.695
ZZ4	<---	PF	0.804		
ZZ3	<---	PF	0.863		
ZZ2	<---	PF	0.859		
ZZ1	<---	PF	0.871		
GM5	<---	GPPB	0.782	0.889	0.618
GM4	<---	GPPB	0.738		
GM3	<---	GPPB	0.795		
GM2	<---	GPPB	0.862		
GM1	<---	GPPB	0.749		
CLT1	<---	WDA	0.812	0.891	0.622
CLT2	<---	WDA	0.704		
CLT3	<---	WDA	0.869		
CLT4	<---	WDA	0.767		
CLT5	<---	WDA	0.782		
XF5	<---	GCC	0.811	0.869	0.575
XF4	<---	GCC	0.880		
XF3	<---	GCC	0.626		
XF2	<---	GCC	0.748		
XF1	<---	GCC	0.701		
ZG5	<---	SP	0.604	0.822	0.516
ZG4	<---	SP	0.489		
ZG3	<---	SP	0.904		
ZG2	<---	SP	0.539		
ZG1	<---	SP	0.874		
GZ4	<---	PBC	0.634	0.830	0.552
GZ3	<---	PBC	0.818		
GZ2	<---	PBC	0.737		
GZ1	<---	PBC	0.770		
SC5	<---	MF	0.722	0.863	0.563
SC4	<---	MF	0.697		
SC3	<---	MF	0.845		
SC2	<---	MF	0.578		
SC1	<---	MF	0.871		
SY5	<---	GPUB	0.643	0.849	0.533
SY4	<---	GPUB	0.602		
SY3	<---	GPUB	0.748		
SY2	<---	GPUB	0.814		
SY1	<---	GPUB	0.817		
CL5	<---	WDB	0.765	0.865	0.565
CL4	<---	WDB	0.875		
CL3	<---	WDB	0.669		

Path			Standardized Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
CL2	<---	WDB	0.646		
CL1	<---	WDB	0.782		
JJ5	<---	EF	0.657	0.867	0.568
JJ4	<---	EF	0.739		
JJ3	<---	EF	0.753		
JJ2	<---	EF	0.801		
JJ1	<---	EF	0.809		
TD1	<---	GPPA	0.801	0.895	0.631
TD2	<---	GPPA	0.753		
TD3	<---	GPPA	0.760		
TD4	<---	GPPA	0.786		
TD5	<---	GPPA	0.867		
SYT1	<---	GPUA	0.754	0.889	0.618
SYT2	<---	GPUA	0.753		
SYT3	<---	GPUA	0.877		
SYT4	<---	GPUA	0.749		
SYT5	<---	GPUA	0.791		

Table 8. (*Continued*)

5.3. Structural equation modeling analysis

(1) Model Goodness-of-Fit Test

As presented in Table 9, the model demonstrated acceptable fit with all indices meeting established measurement standards and showing relatively ideal results. This indicates a high level of model fit and overall good adaptation.

Table 9. Confirmatory factor analysis model fit indices

Fit Index	Judgment Criteria	Actual Value
χ^2/df	<5 (Acceptable)	4.696
CFI	>0.8 (Acceptable); >0.9 (Ideal)	0.814
TLI	>0.8 (Acceptable); >0.9 (Ideal)	0.815
RMSEA	<0.08 (Acceptable)	0.076

(2) Path Coefficients and Hypothesis Testing

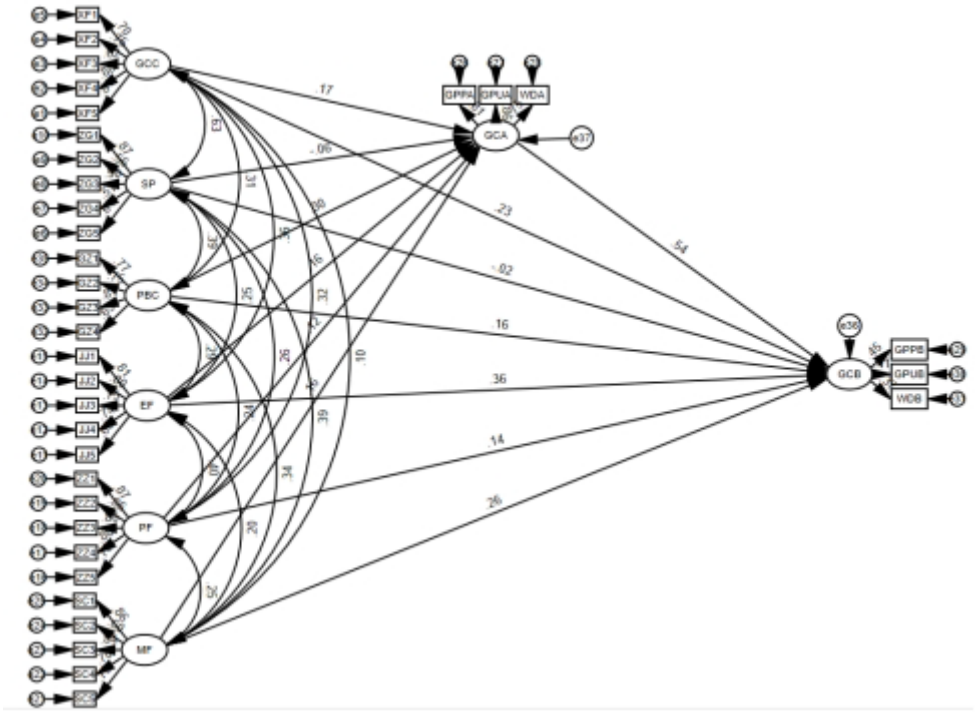

Figure 4. Model testing results

The path analysis of the structural equation model (Table 10) indicates that most hypotheses were supported:

Internal Factors：Green consumption cognition (β=0.230, p =0.009) and perceived behavioral control (β = 0.160, p = 0.030) had significant positive effects on green consumption behavior (H1, H3 supported).Subjective norms showed no significant effect (β=-0.017, p=0.844; H2 not supported).

External Factors：Economic factors (β = 0.363, p < 0.001), policy factors (β = 0.138, p = 0.034), and market factors (β = 0.256, p< 0.001) all positively influenced green consumption behavior (H5, H6 supported).The direction of economic factors' influence opposed H4 (which hypothesized a negative effect), thus H4 was rejected.

Mediating Role：Green consumption attitude exhibited a significant direct effect on behavior (β = 0.537, p < 0.001), establishing a foundation for testing mediation effects.

Table 10. Key path coefficients and significance

Path Relationship	Standardized Coefficient (β)	p-value	Hypothesis Verification
Green Consumption Cognition → GCB	0.230	0.009	Support H1
Subjective Norm → GCB	-0.017	0.844	Reject H2
Perceived Behavioral Control → GCB	0.160	0.030	Support H3
Economic Factors → GCB	0.363	<0.001	Reject H4
Policy Factors → GCB	0.138	0.034	Support H5
Market Factors → GCB	0.256	<0.001	Support H6

(3) Mediation Effect Test

The Bootstrap method was employed to examine the mediating role of green consumption attitude. Results are presented in Table 11:

Green consumption cognition, perceived behavioral control, economic factors, policy factors, and market factors all exerted significant indirect effects on green consumption behavior through green consumption attitude (all $p<0.05$, with 95% confidence intervals excluding zero), supporting H7, H9, H10, H11, and H12.The indirect effect of subjective norms was not significant (*p* = 0.395), failing to support H8.Observed for variables like green consumption cognition and economic factors, which maintained significant direct effects alongside indirect effects.Policy factors primarily operated through indirect effects (direct effect p= 0.069), suggesting a weaker direct pathway.

Table 11. Mediation effect test results (green consumption attitude)

Path	Indirect Effect	Direct Effect	Total Effect	Indirect p-value	Hypothesis Verification
Green Consumption Cognition→ GCB	0.043	0.111	0.154	0.019	Support H7
Subjective Norm→GCB	-0.025	-0.014	-0.039	0.395	Reject H8
Perceived Behavioral Control → GCB	0.143	0.140	0.283	0.000	Support H9
Economic Factors→GCB	0.075	0.321	0.396	0.005	Support H10
Policy Factors → GCB	0.045	0.094	0.139	0.021	Support H11
Market Factors → GCB	0.050	0.150	0.200	0.004	Support H12

5.4. Hypothesis testing summary

Integrating the path analysis and mediation effect results, 9 out of 12 hypotheses were supported, as detailed in Table 13:

Table 12. Summary of hypothesis testing

Hypothesis No.	Hypothesis Content	Verification Result
H1	Green consumption cognition has a significant positive effect on green consumption behavior.	Supported
H2	Subjective norms have a significant positive effect on green consumption behavior.	Not Supported
H3	Perceived behavioral control has a significant positive effect on green consumption behavior.	Supported
H4	Economic factors have a significant negative effect on green consumption behavior.	Not Supported
H5	Policy factors have a significant positive effect on green consumption behavior.	Supported
H6	Market factors have a significant positive effect on green consumption behavior.	Supported
H7	Green consumption attitude mediates the relationship between green consumption cognition and green consumption behavior.	Supported
H8	Green consumption attitude mediates the relationship between subjective norms and green consumption behavior.	Not Supported
H9	Green consumption attitude mediates the relationship between perceived behavioral control and green consumption behavior.	Supported
H10	Green consumption attitude mediates the relationship between economic factors and green consumption behavior.	Supported

Hypothesis No.	Hypothesis Content	Verification Result
H11	Green consumption attitude mediates the relationship between policy factors and green consumption behavior.	Supported
H12	Green consumption attitude mediates the relationship between market factors and green consumption behavior.	Supported

5.5. Results and analysis of interviews

After transcription, the interview content was coded and analyzed using thematic analysis, ultimately extracting four core themes, which are discussed in depth with representative interview quotes.

The study found that economic factors play a promotional role in green consumption behavior, contrary to expectations, which was further verified in the interviews. High-income groups generally regard green consumption as a "long-term investment" rather than an economic burden. For example, a 38-year-old engineer stated, "Although a first-class energy-efficient air conditioner is 2,000 yuan more expensive, the electricity bills saved in two years will cover the cost—it's very cost-effective." Another 45-year-old individual business owner mentioned, "The government's trade-in subsidy allowed me to replace my old refrigerator with a new, more energy-efficient one at almost no cost." These feedbacks indicate that Dongguan residents' economic evaluation of green products is distinctly oriented toward long-term benefits. Coupled with the synergy of local government subsidy policies, this jointly explains the anomalous positive impact of economic factors observed in the quantitative study.

Regarding the finding that subjective norms have no significant impact on green consumption behavior, interview data provide a deeper sociocultural explanation. As a city with a dense manufacturing sector, Dongguan has a highly mobile population, which has invalidated the behavioral constraint mechanisms of traditional "acquaintance societies." Many respondents noted that loose social relationships weaken the influence of others' opinions on their own consumption decisions. A 29-year-old delivery worker bluntly stated, "I don't even know who my neighbors are—who cares what appliances they buy?" Another 33-year-old factory worker mentioned, "Relatives back home often say environmental protection is important, but no one discusses it in Dongguan." These qualitative data effectively explain why subjective norms failed to emerge as a significant predictor in the quantitative model, highlighting the role of regional population structure in shaping consumption behavior.

In terms of policy factors, the interview results not only confirmed their overall positive impact but also revealed specific issues in policy implementation. Some respondents expressed high recognition of current environmental policies. For instance, a 50-year-old housewife noted, "The community promotes waste sorting every week, and now the whole family has formed a habit." However, other respondents pointed out practical obstacles in policy implementation. A 41-year-old driver complained, "Applying for energy-saving subsidies requires going to three departments; I eventually gave up because it was too troublesome." These feedbacks indicate that the effectiveness of policy tools is highly dependent on the convenience and accessibility of their implementation, providing clear directions for the government to further optimize environmental policies.

The analysis of market supply factors shows distinct regional differences. Although quantitative research indicates that market factors generally have a positive impact on green consumption behavior, interviews revealed that this impact is limited by uneven supply. A 26-year-old clerk noted, "Urban supermarkets have a wide range of environmental products, but stores in towns only offer traditional models." Another 55-year-old retiree stated, "I want to buy biodegradable garbage bags, but nearby stores

don’t have them, and online shopping feels too troublesome." These practical dilemmas suggest that improving the grassroots sales network for green products is crucial for promoting the transformation of residents’ green consumption behavior.

6. Discussion

This study examines the influencing factors and mechanisms of green consumption behavior among Dongguan residents within the context of carbon peak goals, providing new perspectives for understanding behavioral patterns in high carbon emission regions. The findings are discussed in relation to theoretical implications, practical applications, and research limitations.

6.1. Theoretical implications of research findings

6.1.1. Mechanisms of internal psychological factors

The study confirms the significant positive impact of green consumption awareness on green consumption behavior (H1 supported), which aligns with the core premise of the Theory of Planned Behavior that "cognition forms the foundation of attitude and behavior." Dongguan residents with deeper understanding of green consumption tend to adopt green purchasing, usage and disposal behaviors - a phenomenon potentially linked to the city's manufacturing-intensive environment that makes environmental issues more tangible for residents.

Contrasting with some existing studies, subjective norms showed no significant effect on green consumption behavior (H2 not supported). This discrepancy may be attributed to Dongguan's high proportion of migrant population and loose social networks, where traditional social norms exert weaker influence on individual consumption decisions, making consumers rely more on personal judgment than peer opinions.

The significant positive influence of perceived behavioral control (H3 supported) further expands the application scenarios of the Theory of Planned Behavior. The study reveals that when Dongguan residents feel greater control over green consumption behaviors (e.g., perceiving ease of purchasing energy-efficient appliances or accessing green information), they demonstrate higher likelihood of actual action. This underscores the critical role of enhancing consumption convenience in promoting green behaviors within manufacturing-intensive regions.

6.1.2. The influence mechanism of external contextual factors

Contrary to Hypothesis 4, economic factors demonstrated a significant positive effect, challenging the conventional wisdom that "cost inhibits green consumption." This counterintuitive finding may be attributed to Dongguan's relatively high income levels (57.4% of respondents reported monthly incomes between ¥6,001-12,000), which enable residents to prioritize long-term benefits of green products (e.g., energy savings from efficient appliances). Local subsidy programs (such as trade-in rebates) further mitigated short-term cost sensitivity. Additionally, Dongguan's robust manufacturing base and well-developed local supply chains for green products likely reduced the practical economic barriers to green consumption.

The significant positive impact of policy factors (H5 supported) confirmed the theoretical expectation of "policy-driven consumption transformation." As a key city for carbon emissions, Dongguan has implemented numerous environmental policies (e.g., Carbon Peak Action Plan, green consumption subsidies). These measures effectively lowered decision-making costs for residents through clear signaling (e.g., energy efficiency labeling) and financial incentives. Market factors (H6 supported) demonstrated that accessible

purchasing channels (both online and offline) and established recycling systems facilitate the conversion of intentions to actions, aligning with the market theory of "supply creates demand."

6.1.3. The mediating effect of green consumption attitude

The mediating role of green consumption attitude in most variable-behavior relationships (H7, H9-H12 supported) validated the classic "cognition-attitude-behavior" pathway. Specifically: (1) Green consumption cognition influenced behavior through attitude formation, suggesting knowledge dissemination alone is insufficient without fostering value identification; (2) Economic factors exhibited both direct effects and indirect effects through attitude, indicating financial incentives can simultaneously improve attitude favorability and reduce behavioral costs; (3) Policy factors primarily operated through attitude mediation, reflecting their fundamental role in establishing social consensus about the legitimacy of green consumption.

6.2. Practical implications

6.2.1. Recommendations for government agencies

To address Dongguan's high-emission characteristics, we recommend establishing a comprehensive "cognition-attitude-behavior" guidance system: (1) At the cognitive level, leverage Dongguan's manufacturing strengths to conduct coordinated "green factory-green product-green consumption" campaigns, using concrete methods like eco-factory tours and product carbon footprint analysis; (2) For attitude formation, utilize Dongguan's migrant population characteristics to link green consumption with social integration through community eco-point systems and corporate green benefits; (3) Regarding behavior, optimize policy instruments by expanding appliance subsidy programs while strengthening support for recycling enterprises to address disposal challenges.

6.2.2. Implications for market entities

Businesses should tailor offerings to Dongguan's consumption patterns: (1) Develop premium green products combining environmental performance with quality for high-income groups, emphasizing long-term cost benefits; (2) Introduce affordable green appliances (e.g., energy-saving fans, low-power washers) for factory workers; (3) E-commerce platforms could establish dedicated green product sections with door-to-door trade-in services, leveraging Dongguan's logistics advantages.

6.3. Limitations and future research directions

Three main limitations should be noted: (1) The sample covered only 5 of Dongguan's 32 townships, limiting geographical representation; (2) Behavioral measures focused on appliance consumption, excluding other categories like food and clothing; (3) Cultural factors (e.g., Lingnan consumption culture) were not considered.

Future research could: (1) Expand sampling across economic tiers of townships to examine industrial structure effects; (2) Investigate cross-category green consumption patterns; (3) Incorporate cultural perspectives by comparing local and migrant populations to refine emission-reduction policies for mobile demographics.

7. Conclusion

This study examines green consumption behavior among Dongguan residents within China's carbon peaking policy context, integrating the Theory of Planned Behavior and Attitude-Behavior-Context framework to analyze influencing mechanisms. Our findings reveal three critical insights. Firstly, internal psychological factors demonstrate that while green consumption awareness and perceived behavioral control significantly drive pro-environmental actions, social norms show limited influence - a phenomenon

particularly pronounced in Dongguan's migrant-dominated population where transient social networks weaken traditional normative pressures.

Secondly, external factors present counterintuitive results where economic conditions positively correlate with green consumption, contradicting conventional cost-barrier assumptions. This reflects Dongguan's unique socioeconomic context where higher disposable incomes (57.4% earning ¥6,001-12,000 monthly), coupled with robust local manufacturing ecosystems and subsidy programs, transform economic capacity into sustainable consumption. Policy instruments and market accessibility further amplify this effect through improved product availability and recycling infrastructure.

Thirdly, the research confirms green consumption attitude's pivotal mediating role, particularly in translating cognitive awareness and external enablers into concrete actions. This mediation effect varies across factors - while economic incentives operate through both direct cost reduction and indirect attitude improvement, policy measures predominantly work through shaping social perceptions of green consumption's legitimacy.

Fourth, this study provides important insights for high-emission industrial cities to promote residents' green consumption: First, it confirms that economic factors can be transformed into motivation for green consumption through the perception of long-term benefits and local subsidy policies. It is suggested that such cities should strengthen "cost-benefit" publicity and improve the subsidy mechanism. Second, it reveals that subjective norms are ineffective in areas with a concentration of floating populations due to loose social networks, indicating the need to build new environmental protection norms through community integration and enterprise linkage. Finally, the study verifies the "cognition-attitude-behavior" transmission mechanism and the synergy between policies and markets, providing empirical basis for industrial cities to formulate a trinity emission reduction strategy of "publicity-incentive-supply". In particular, it emphasizes the need to design differentiated green product promotion paths in combination with local industrial advantages (such as Dongguan's manufacturing foundation).

Conflict of interest

The authors declare no conflict of interest.

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