

Article

Perceived Policy Effectiveness and Bamboo Product Consumption: Evidence from a Field Investigation with Urban Residents

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Abstract

Advancing urban sustainability transitions through effective environmental policies requires understanding how residents perceive and respond to policies. While perceived policy effectiveness (PPE) has been studied in waste management and recycling programs, its role in shaping demand for bio-based materials remains underexplored. This study investigates whether and how PPE is associated with bamboo product consumption among 1121 urban residents in Zhejiang Province, China. Drawing on an extended Theory of Planned Behavior (TPB) framework, we use ordinary least squares estimators to examine the direct and interactive associations between PPE and actual bamboo consumption behavior. Results show that PPE is significantly and positively associated with bamboo product consumption. Interaction analysis reveals heterogeneous effects: PPE shows a weak positive interaction with environmental knowledge, but a negative interaction with environmental values. This suggests that policy signals may complement cognitive preparedness while partly compensating for low value-based motivation. A supplementary analysis indicates that this conditioning extends to economic resources, with the association concentrated among lower-income, more price-sensitive consumers. This study extends PPE research from post-consumption management to the purchasing stage of sustainable products. It highlights the role of policy perceptions in shaping demand-side adoption of lower-impact materials, with implications for urban sustainability transitions and city-level policies promoting bio-based alternatives.

Keywords: perceived policy effectiveness; bamboo products; sustainable consumption; urban residents; theory of planned behavior



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1. Introduction

The global community faces an unprecedented challenge as carbon dioxide concentrations reach record levels. This crisis necessitates an urgent and systemic transition toward carbon neutrality. To mitigate these escalating emissions, promoting green consumption has emerged as a critical strategy to foster sustainable development [1]. Green consumption encompasses three stages: product purchase, use, and disposal [2]. Within these stages, it is imperative to adopt sustainable alternative materials at the production source rather than relying on end-of-pipe solutions. Bamboo stands out as a promising nature-based solution due to its rapid growth and exceptional carbon sequestration capacity [3]. Globally, Asia dominates bamboo resources with 21.2 million hectares, accounting for 70% of the world's

total, and China alone contributes 8.53 million hectares [4]. Leveraging these abundant bamboo forest resources, China possesses world-class bamboo processing technologies and well-developed markets for bamboo products. In recent years, China has actively promoted bamboo as a sustainable alternative through significant institutional efforts. In November 2022, China and the International Bamboo and Rattan Organization (INBAR) launched the “Bamboo as a Substitute for Plastic” (BASP) Initiative. By 2024, the BASP Special Standard System was released to establish national standards for main bamboo products such as daily necessities, furniture, and handicrafts [5]. These milestones provide a robust supply-side foundation for the diffusion of bamboo-based alternatives, while leaving open the demand-side question of how residents adopt such products in everyday consumption.

Despite this strong institutional momentum, academic inquiry into bamboo remains heavily skewed toward material science, manufacturing techniques, and life cycle assessments [6,7]. These technical perspectives establish the ecological legitimacy of bamboo; however, from the demand side, the drivers of actual bamboo consumption among residents are not yet fully understood. As bamboo products represent a category of sustainable goods, their adoption can be interpreted through the lens of green consumption behavior. To date, the Theory of Planned Behavior (TPB) has served as the foundational framework, emphasizing the roles of attitude, subjective norms, and perceived behavioral control in green consumption [8,9]. In the specific context of bamboo, initial studies have explored how environmental awareness and multi-dimensional consumption values shape purchase intentions [10]. More recent evidence using eye-tracking technology further suggests that green consumption values significantly direct consumer attention and intentions toward bamboo alternatives [11]. To enhance the TPB’s explanatory power, scholars also incorporate environmental knowledge and values as distal motivators that provide the cognitive and ethical basis for action [12,13]. However, these psychology-centered models can offer an incomplete narrative. Green consumption does not occur in a vacuum. Instead, it is embedded within a governance context characterized by price premiums and information asymmetry [14]. While external interventions like subsidies [15], eco-labels [16], and plastic bans [17] aim to reshape the market, their efficacy is ultimately filtered through Perceived Policy Effectiveness (PPE).

PPE reflects an individual’s evaluative judgment of whether a policy is clear, adequate, and capable of facilitating behavioral change [18]. Despite growing scholarly interest in this construct, several critical limitations persist. First, research is disproportionately concentrated in post-consumption domains, such as waste management and recycling [19–24]. The role of PPE in the purchasing stage remains underexplored [25], particularly for bio-based products like bamboo. This domain bias risks distorting our understanding of policy impact: unlike recycling, which is often perceived as a low-cost civic duty, purchasing involves immediate financial trade-offs and market risks. Neglecting the purchase stage thus obscures how policy perceptions influence the market entry of sustainable alternatives from the demand side. Second, findings regarding the interaction between PPE and psychological drivers remain inconsistent. Evidence suggests that policy perceptions may heterogeneously amplify or attenuate specific motivational pathways [19,21], yet these interactive mechanisms are rarely examined in the emerging bamboo market. The lack of consensus on these boundary conditions limits our ability to predict which consumer segments respond most strongly to institutional support. Finally, many studies measure behavioral intention rather than actual consumption. Given the documented “attitude-behavior gap” [26], focusing on intention alone limits the practical validity of PPE research. Relying on intention data can result in an overestimation of policy efficacy, creating an issue where high public support for an initiative does not translate into the tangible market share required to meet carbon neutrality goals.

To address these identified gaps, this study investigates whether and how PPE is associated with the consumption behavior of bamboo products among urban residents in Zhejiang Province, China. Based on face-to-face survey data from three representative municipalities (Hangzhou, Taizhou, and Lishui; $n = 1121$), we seek to answer two primary research questions: (1) To what extent is PPE directly associated with actual bamboo purchasing behavior in a market-based context? (RQ1) and (2) whether this association is moderated by consumers' environmental knowledge and environmental values, alongside the core TPB constructs, including attitudes, subjective norms, and perceived behavioral control (RQ2)? We employ ordinary least squares (OLS) estimators with heteroskedasticity-robust standard errors to analyze multi-dimensional indicators of bamboo consumption, including purchase quantity and frequency across various product categories. By integrating institutional perceptions with the TPB, this study aims to provide an understanding of how policy signals are processed by diverse consumer segments in the bamboo products market. Our findings aim to offer insights into the study of nature-based solutions from the demand side and help clarify the conditions under which external policy support can promote actual green consumption behavior.

2. Literature Review and Conceptual Framework

2.1. Extended TPB in Green Consumption

The theory of planned behavior (TPB) saw considerable use in the green consumption landscape. Its applications span diverse domains, including organic food [27], energy conservation [28], recycling [29], and sustainable transportation [30]. Cumulative evidence from these studies has established the TPB as a baseline model for predicting green consumption intention and behaviors [1,9,31]. Crucially, the TPB's open architecture permits the integration of additional predictors, enabling researchers to enhance the model's explanatory power while retaining its core structural logic [8]. Within the TPB framework, behavioral intention is shaped by three types of beliefs: Attitude reflects an individual's overall evaluation of a behavior based on their underlying convictions. Subjective norm captures the perceived social pressure from peers and family to perform or abstain from the behavior. Perceived behavioral control describes an individual's perceived ease or difficulty in carrying out behavior, which includes both personal internal capacities and external constraints [8,32]. These constructs collectively explain green consumption, though their relative weights often vary with market maturity and product accessibility [1,31].

To provide a more comprehensive understanding of consumer decision-making, scholars augment the TPB with environmental knowledge and environmental values. Environmental knowledge functions as a cognitive resource. It enables consumers to interpret environmental issues and evaluate the ecological benefits of specific products, acting as a prerequisite for rational pro-environmental choices [33]. Environmental values, in contrast, represent more stable motivational orientations. Typically categorized into egoistic, altruistic, and biospheric orientations, these values serve as guiding principles that shape beliefs and attitudes toward environmental protection [34,35]. Integrating these variables addresses the limitation of the TPB, which focuses on proximal determinants but may overlook the distal cognitive and motivational foundations of behavior.

2.2. The Role of Perceived Policy Effectiveness

The theories and perspectives discussed above focus on individuals' own motivations and abilities. Obviously, human pro-environmental behavior does not merely depend on these factors. Public policy can also promote or constrain pro-environmental behavior, especially when facing severe constraints and motivations become negligible in the environmental outcome [14]. In markets characterized by price premiums and information

asymmetry, external factors can be more important in predicting green consumption decisions. For example, implementing subsidies or penalties can offset the price disadvantages of green products and steer consumer preferences toward sustainable options [15]. In parallel, information-based instruments alleviate the challenge of information asymmetry. Eco-labels function as trusted external signals that verify environmental claims, thereby reducing cognitive search costs and building consumer trust [16]. Furthermore, broader market interventions, such as plastic bans and corporate eco-advertising, create a supportive environment that constrains unsustainable habits while stimulating green purchasing behavior [17]. Consequently, relying solely on the traditional TPB-based framework is insufficient. Incorporating external intervention is essential to bridge the gap between individual motivation and the institutional environment.

However, a further question is that the mere existence of policy interventions does not guarantee public compliance or engagement. The actual success of policies depends on whether individuals perceive these measures as effective and actionable. Perceived policy effectiveness (PPE) refers to an individual's subjective evaluation of whether government measures are clear, adequate, and capable of facilitating the intended behavioral outcomes [18]. According to the institutional trust perspective, individuals are more likely to cooperate with collective goals when they believe the governing institutions have the competence to solve the problem [36]. In the context of environmental management, PPE functions as a key psychological lever. Empirical studies across waste separation and carbon reduction consistently demonstrate that PPE is a proximal predictor of pro-environmental behavior [21,24]. For instance, when residents believe that recycling policies are effectively implemented and monitored, they exhibit higher intentions to participate in waste classification [19,23].

Extending this logic to the consumption of bamboo products, PPE becomes particularly salient due to the market uncertainties often associated with green alternatives. Consumers may hesitate to adopt bamboo products due to concerns about quality standards, price premiums, or the legitimacy of environmental claims. Effective policy perceptions can mitigate these barriers. When consumers perceive that the government is actively promoting the sector through robust mechanisms, their confidence in the market environment increases [25]. This perception of institutional support reduces the perceived risk and transaction costs associated with behavior change, thereby directly fostering consumption.

Drawing on the above arguments and evidence, we propose the following hypothesis:

H1. *Perceived policy effectiveness is positively associated with bamboo product consumption behavior.*

Beyond its direct impact, PPE also acts as a boundary condition that influences how psychological antecedents translate into actual behavior. The gap between environmental intention and pro-environmental behavior is a well-documented phenomenon, often attributed to the lack of facilitating external conditions [22]. Conceptual frameworks in behavioral science suggest that the predictive power of individual motives is not static but contingent upon the perceived external context [37].

Existing literature provides evidence that PPE interacts with psychosocial predictors, although the nature of these interactions can vary. One perspective suggests a synergistic effect, where a supportive policy environment amplifies the positive influence of individual motivations. For example, Fu et al. (2020) found that environmental awareness translates into behavior more effectively when individuals perceive high policy efficacy [38]. In this view, high perceived effectiveness of policy provides the necessary “green light” for individuals with high environmental knowledge or values to act on their beliefs [19]. Conversely, other scholars propose a compensatory effect or a crowding-out effect. Xu et al. (2017) observed that strong policy perceptions might substitute for internal moral motiva-

tion, suggesting that effective external governance can drive behavior even among those with weaker personal environmental ethics [39]. Similarly, distinct interactions have been observed regarding subjective norms and perceived behavioral control, where the strength of social pressure or self-efficacy depends on the perceived clarity and enforceability of the policy [40,41].

In the specific context of bamboo product consumption, it is plausible that PPE conditions the behavioral relevance of environmental knowledge, environmental values, attitude, subjective norms, and perceived behavioral control. However, given the complexity of these mechanisms and the mixed findings in prior research regarding the direction of interaction (amplifying versus attenuating), we adopt an open-ended approach regarding the specific nature of these effects.

Therefore, we propose the following hypothesis:

H2. *Perceived policy effectiveness interacts with environmental knowledge, environmental values, attitude, subjective norms, and perceived behavioral control in predicting bamboo product consumption behavior.*

3. Method

3.1. Research Area

Zhejiang Province was selected as the research area because it combines aggressive sustainability governance and an active bamboo economy (Figure 1). As an economy located in the Yangtze River Delta, Zhejiang provides a mature market with diverse consumption patterns [42]. Meanwhile, it is the birthplace of the “Two Mountains” concept, a foundational policy discourse in China that frames ecological protection as a primary driver of economic growth [43]. This institutional climate ensures that residents are exposed to and interact with environmental regulations and incentives, providing a baseline for investigating how PPE translates into tangible behavioral outcomes. Furthermore, Zhejiang is characterized by abundant bamboo forest resources and a sophisticated industrial infrastructure that encompasses cultivation, deep processing, and global market distribution [44]. This foundation ensures that bamboo products are not merely hypothetical alternatives but can be integrated into the local market fabric in practice.

3.2. Sampling and Data Collection

The target population was urban residents in Zhejiang Province, China. Data were collected through face-to-face, on-site questionnaire administration to improve response quality. Trained investigators provided standardized instructions and retrieved completed questionnaires immediately. A five-stage sampling design was implemented (Figure 2). First, three of Zhejiang’s eleven municipalities were selected through stratified sampling to reflect differences in economic development and physical geography: Hangzhou, Taizhou, and Lishui. Second, administrative districts within each municipality were selected using probability proportional to size (PPS) sampling. Third, sampled districts were used to select sub-districts through systematic interval sampling. Fourth, communities were randomly selected from each sampled sub-district. Finally, residents were recruited within selected communities through quota-based on-site recruitment to achieve the target number of respondents per community. A pre-survey ($n = 50$) was conducted from 26 to 30 June 2025 in Qiantang district, Hangzhou, to assess the clarity, comprehensibility, and completion burden of the questionnaire. Based on this feedback, we made three sets of refinements. First, to improve readability, we enlarged the font size and changed the page format from A4 to A3. Second, we simplified the wording of items that respondents found ambiguous.

Third, for the bamboo-consumption items, we placed illustrative images of representative products (e.g., a bamboo sofa and a bamboo fiber towel) next to the corresponding items so that respondents could identify the product categories more accurately. The formal survey was conducted from 1 to 20 July 2025, and 1176 questionnaires were collected in total. After excluding questionnaires with logical inconsistencies or substantial missing information, 1121 valid responses were retained. The effective rate of questionnaires was 95.32%. Remaining item-level missing values in the retained sample were handled using nearest-neighbor imputation.

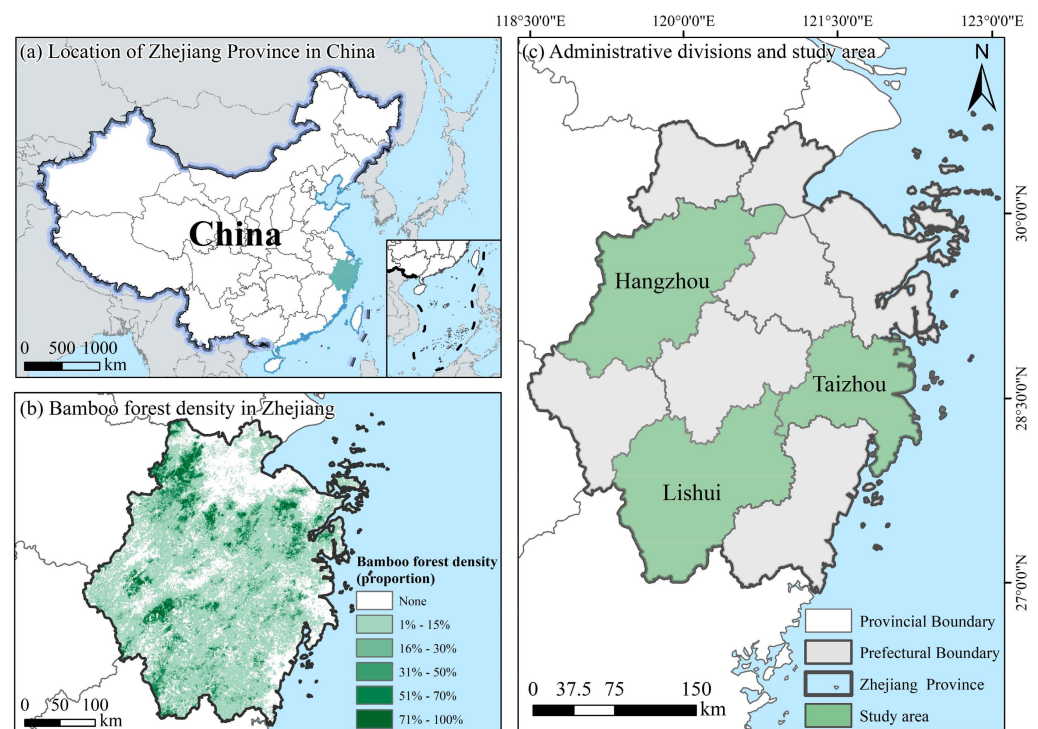


Figure 1. Overview of the study area. Note: Data source (panel (b)): Zhang et al. (2023) [45].

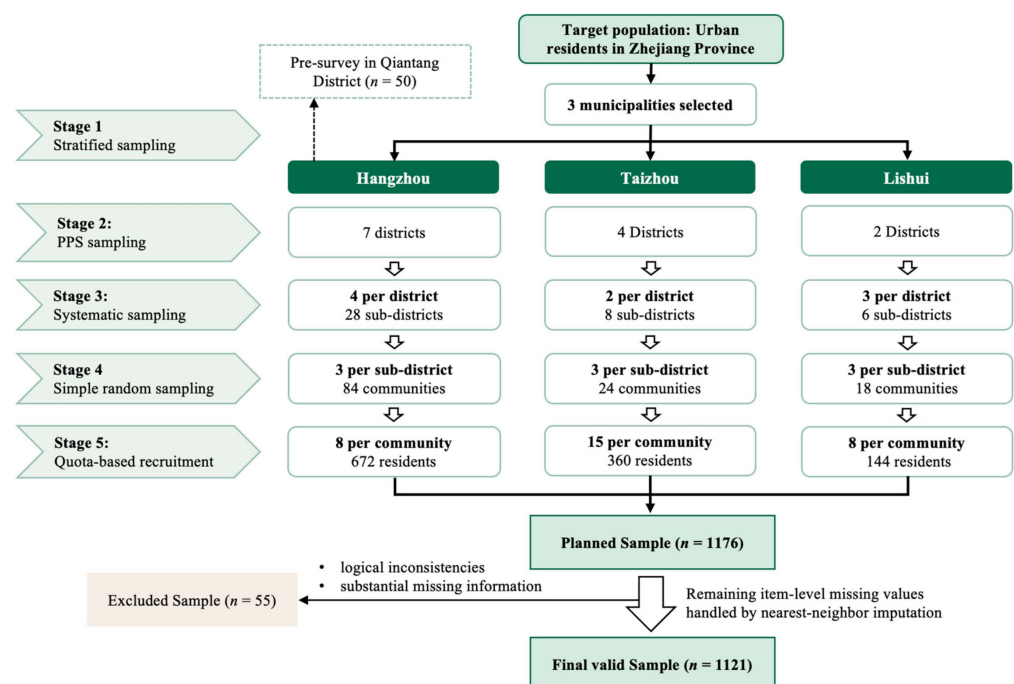


Figure 2. Five-stage sampling design and survey implementation.

3.3. Variable Measurement

3.3.1. Dependent Variable: Bamboo Product Consumption Behavior

Bamboo product consumption behavior (BC) was operationalized as a multi-faceted behavioral construct capturing both product-category breadth and overall purchasing frequency. Following the categories defined by China's BASP Special Standard System [5], we measured BC using four indicators that reflect major consumption domains of bamboo products in everyday life: (1) the number of bamboo-based daily necessities items the respondent owned (e.g., bamboo fiber tissues, towels, bowls, chopsticks), (2) the number of bamboo furniture items the respondent owned (e.g., bamboo sofas, chairs, mats, dining tables), (3) the number of bamboo handicraft items the respondent owned (e.g., bamboo carvings), and (4) the overall frequency of purchasing bamboo products. This design allows the measure to reduce the risk that a single product type dominates the behavioral assessment, and to capture both flow (i.e., purchase activity) and stock (i.e., household possession). Bamboo consumption manifests in both forms: a stock-only measure would understate the repeated purchasing of consumables, and a flow-only measure would understate the breadth of adoption across durable categories. This combined measure, therefore, captures the behavioral domain more completely, and because its indicators tap complementary facets, it functions as a composite index of bamboo consumption.

For BC1–BC3, respondents selected an ordered category describing the quantity owned, using a five-point scale (1 = 0 items, 2 = 1–2 items, 3 = 3–5 items, 4 = 6–8 items, 5 = more than 8 items). The category cut-offs were chosen to provide sufficient discrimination at low ownership levels while limiting respondent burden and recall error when quantities become large. For BC4, respondents reported their overall purchase frequency on a five-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, 5 = very frequently). Higher scores indicate stronger bamboo product consumption.

3.3.2. Independent Variable of Interest: Perceived Policy Effectiveness

PPE was measured as respondents' evaluations of whether relevant policy measures are effective in facilitating greener consumption choices. Following a widely applied policy-instrument typology, we considered three broad categories: information-based instruments ("sermons"), economic instruments ("carrots"), and regulatory instruments ("sticks") [46]. Here, these categories correspond to information provision (e.g., product-level carbon information), incentive-based measures (e.g., reward points or subsidies for greener purchases), and constraint-based measures (e.g., charges or restrictions on plastic products). This approach is consistent with prior research that treats PPE as a policy-context perception that can shape pro-environmental intentions and behaviors [19]. Specifically, PPE was measured with three items, each rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). The items were phrased as follows: (1) Information-based PPE: "Providing product-level carbon-emissions information (e.g., carbon labeling) helps me to choose greener products." (2) Incentive-based PPE: "If green-consumption reward points could be used to offset spending, I would be more willing to purchase greener products." (3) Constraint-based PPE: "Charging for plastic carrier bags encourages me to reduce my use of plastic products." Item scores were averaged to form the PPE construct, with higher values indicating stronger perceived effectiveness of policy measures.

3.3.3. Other Independent Variables

Other psychological predictors were measured using established constructs from the TPB and related environmental psychology research. Specifically, attitude, subjective norms, and perceived behavioral control were measured as core TPB determinants [8]. In addition, environmental knowledge and environmental values were included as complementary

antecedents reflecting individuals' cognitive understanding of environmental issues and their value-based orientation towards pro-environmental consumption [33,47]. All items were assessed on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), and the corresponding construct score was computed as the mean of its items.

- Environmental knowledge (EK) captured respondents' understanding of climate and plastic-related environmental impacts and bamboo's environmental attributes: (EK1) "I understand how greenhouse gases such as carbon dioxide affect the global climate system." (EK2) "I am aware of the negative impacts of plastic waste on marine carbon sinks and ecosystem functioning." (EK3) "I understand that bamboo is regarded as an environmentally friendly material because of its rapid growth and carbon-sequestration capacity."
- Environmental values (EV) reflected the extent to which respondents prioritize health, intergenerational responsibility, and ecological protection in consumption: (EV1) "Using greener products can make me healthier." (EV2) "To leave a better living environment for future generations, we should choose greener products." (EV3) "Protecting ecosystems should take priority over the convenience of human consumption."
- Attitude (AT) assessed respondents' evaluations of greener products in terms of functionality and affect: (AT1) "Greener products generally meet my usage needs." (AT2) "Using greener products makes me feel pleased." (AT3) "Choosing greener products is a responsibility I should fulfill to support sustainable social development."
- Subjective norms (SN) measured perceived social pressure and community influence: (SN1) "My family and friends tend to prioritize greener products when they shop." (SN2) "My family and friends encourage and support me to purchase greener products." (SN3) "Environmental publicity and campaigns in my community make me aware of the importance of green consumption."
- Perceived behavioral control (PBC) captured perceived barriers and constraints relevant to green consumption: (PBC1) "Compared with conventional products, I consider greener products to be relatively expensive." (PBC2) "There is still little publicity and information about green consumption." (PBC3) "Purchasing greener products is inconvenient for me." We conducted reverse scoring for the PBC in the follow-up analysis.

The questionnaire also collected demographic information, including gender, age, education level, occupation, monthly income, and city of residence, which were included as control variables in the regression models. Detailed distribution was shown in Table 1.

Table 1. Demographic profile of respondents.

Demographic Characteristics	Total (<i>n</i> = 1121)		Hangzhou (<i>n</i> = 633)		Taizhou (<i>n</i> = 351)		Lishui (<i>n</i> = 137)	
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Gender								
Male	476	42.46	251	39.65	161	45.87	64	46.72
Female	645	57.54	382	60.35	190	54.13	73	53.28
Age								
<18	103	9.19	48	7.58	41	11.68	14	10.22
18–25	310	27.65	195	30.81	89	25.36	26	18.98
26–35	317	28.28	155	24.49	115	32.76	47	34.31
36–45	216	19.27	120	18.96	65	18.52	31	22.63
46–55	104	9.28	80	12.64	16	4.56	8	5.84
>55	71	6.33	35	5.53	25	7.12	11	8.03

Table 1. Cont.

Demographic Characteristics	Total (n = 1121)		Hangzhou (n = 633)		Taizhou (n = 351)		Lishui (n = 137)	
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Education level								
Junior high school and below	161	14.36	95	15.01	47	13.39	19	13.87
High school	191	17.04	101	15.96	67	19.09	23	16.79
College	214	19.09	79	12.48	100	28.49	35	25.55
Undergraduate	465	41.48	284	44.87	122	34.76	59	43.07
Graduate and above	90	8.03	74	11.69	15	4.27	1	0.73
Occupation								
Government organization	22	1.96	12	1.90	3	0.85	7	5.11
Civil servants	121	10.79	72	11.37	37	10.54	12	8.76
Company business	257	22.93	146	23.06	67	19.09	44	32.12
Students/researchers	304	27.12	173	27.33	101	28.77	30	21.90
Retired	52	4.64	20	3.16	21	5.98	11	8.03
Self employed	242	21.59	134	21.17	89	25.36	19	13.87
Workers/farmers	36	3.21	20	3.16	11	3.13	5	3.65
Others	87	7.76	56	8.85	22	6.27	9	6.57
Monthly income (in Chinese yuan)								
<2000	233	20.79	127	20.06	75	21.37	31	22.63
2000–5000	352	31.40	175	27.65	128	36.47	49	35.77
5001–10,000	342	30.51	166	26.22	124	35.33	52	37.96
10,001–15,000	109	9.72	89	14.06	18	5.13	2	1.46
15,001–20,000	34	3.03	30	4.74	3	0.85	1	0.73
>20,000	51	4.55	46	7.27	3	0.85	2	1.46

Note: Freq. means Number of respondents, Pct. means the proportion of the total number of respondents (%).

3.4. Model Specification

To test the proposed hypotheses, we estimated a series of ordinary least squares (OLS) regression models with bamboo product consumption behavior as the dependent variable. OLS provides a transparent and widely used approach for examining both direct associations and interaction effects in behavioral research [48]. Studies have shown that when the scale is a multi-item aggregation with many categories, the parametric method is quite robust to deviation from normal or rank measurements [49]. Specifically, the baseline model for the direct effect of PPE was specified as:

$$BC_i = \alpha + \beta_1 PPE_i + \beta_2 EK_i + \beta_3 EV_i + \beta_4 AT_i + \beta_5 SN_i + \beta_6 PBC_i + \gamma' Controls_i + \varepsilon_i \quad (1)$$

where EK , EV , AT , SN , and PBC denote environmental knowledge, environmental values, attitude, subjective norms, and perceived behavioral control, respectively, and $Controls$ include demographic characteristics.

To examine interaction effects (H2), we augmented the baseline specification by adding the product terms between PPE and each psychological predictor:

$$BC_i = \alpha + \beta PPE_i + \sum_k \theta_k X_{ki} + \sum_k \delta_k (PPE_i \times X_{ki}) + \gamma' Controls_i + \varepsilon_i \quad (2)$$

where $X_k \in \{EK, EV, AT, SN, PBC\}$. Following standard practice for interaction models, continuous predictors were z-standardized before constructing interaction terms to mitigate nonessential multicollinearity and facilitate interpretation of lower-order coefficients [48]. All models were estimated with heteroskedasticity-robust standard errors.

4. Results

4.1. Descriptive Statistics

The demographic characteristics of 1121 respondents are shown in Table 1. Respondents included 42.46% males and 57.54% females, with 27.65% and 28.28% of them in the age groups of 18–25 and 26–35, respectively. 161 (14.36%) respondents had junior high school and below education, 191 (17.04%) had high school education, 214 (19.09%) had a college diploma, 465 (41.48%) held a bachelor's degree, and 90 (8.03%) had a postgraduate degree or higher. 27.12% respondents were students, and 22.93% were employed by private companies. A majority (61.91%) of respondents had a monthly income between 2000 and 10,000 Chinese yuan. Respondents living in Hangzhou, Taizhou, and Lishui accounted for 56.47%, 31.31%, and 12.22%, respectively.

4.2. Common Method Bias Test

To address common method bias (CMB), we implemented the following procedural and statistical remedies. First, during survey administration, we randomized the order of scale items and included reverse-coded items (i.e., Perceived Behavioral Control) to reduce response patterns. Second, we psychologically separated predictor and outcome measures by placing consumption behavior questions in a different survey section with distinct instructions. Third, we conducted Harman's one-way test. All 22 items were included in the factor analysis, and only one common factor was extracted. Results showed that this single factor only explained 29.91% of the total variance (<50% threshold). In addition, the correlation coefficient between the constructs was less than 0.85, indicating that there was no serious CMB issue in this study [50].

4.3. Construct Reliability and Convergent Validity

This study uses Stata software, version 18, to conduct reliability and validity tests. As shown in Table 2, the standardized Cronbach's alphas for BC, PPE, EK, EV, AT, SN, and PBC were above 0.7 (range = 0.702–0.825), suggesting that all constructs are acceptable. We further test convergent validity through Average Variance Extracted (AVE) and Composite Reliability (CR). Results show the AVE by each construct was larger than 0.5, suggesting that the explanatory variables can explain 50% of the variance. And CR values were larger than 0.7, with high internal consistency. Therefore, constructs in this study passed the convergent validity test.

Table 2. Reliability and validity test results.

Constructs	Indicators	Factor Loading	Average Variance Extracted	Composite Reliability	Cronbach's Alpha
Bamboo Product Consumption Behavior (BC)	BC1	0.722	0.532	0.820	0.702
	BC2	0.774			
	BC3	0.700			
	BC4	0.719			
Perceived Policy Effectiveness (PPE)	PPE1	0.840	0.660	0.853	0.735
	PPE2	0.830			
	PPE3	0.765			
Environmental Knowledge (EK)	EK1	0.783	0.665	0.856	0.743
	EK2	0.846			
	EK3	0.816			
Environmental Values (EV)	EV1	0.856	0.691	0.869	0.761
	EV2	0.882			
	EV3	0.749			

Table 2. Cont.

Constructs	Indicators	Factor Loading	Average Variance Extracted	Composite Reliability	Cronbach's Alpha
Attitude (AT)	AT1	0.758	0.651	0.848	0.725
	AT2	0.868			
	AT3	0.791			
Subjective Norms (SN)	SN1	0.897	0.744	0.897	0.825
	SN2	0.909			
	SN3	0.775			
Perceived Behavioral Control (PBC)	PBC1	0.756	0.626	0.834	0.702
	PBC2	0.808			
	PBC3	0.810			

Note: This study adopted the evaluation criteria proposed by Chin (1998) [51] and Fornell & Larcker (1981) [52]: (1) All indicator factor loadings should be sufficiently high and above 0.5; (2) CR should exceed 0.7; (3) AVE for each construct should be greater than 0.5.

4.4. Discriminant Validity

Table 3 presents the discriminant validity test results. Of these, the highlighted diagonal values were the square root values of the AVE for each construct. We can find that the diagonal values were higher than the correlation coefficient among the different variables that were not on the diagonal, indicating good discriminant validity for the scale.

Table 3. Discriminant validity test results.

	Mean	SD	PPE	EK	EV	AT	SN	PBC	BC
PPE	4.046	0.702	0.812						
EK	3.993	0.700	0.452 **	0.815					
EV	4.129	0.713	0.625 **	0.509 **	0.831				
AT	3.870	0.714	0.637 **	0.485 **	0.547 **	0.807			
SN	3.612	0.784	0.507 **	0.419 **	0.439 **	0.617 **	0.862		
PBC	3.415	0.718	0.170 **	0.316 **	0.151 **	0.141 **	0.194 **	0.792	
BC	2.254	0.575	0.129 **	0.077 **	0.065	0.123 **	0.156 **	−0.031	0.729

Note: ** indicates significance at the level of 0.01; the diagonal value is $\sqrt{\text{AVE}}$; SD is the abbreviation for standard deviation.

4.5. Hypothesis Testing

4.5.1. Hypothesis 1: The Direct Effects

Table 4 presents the baseline OLS regression results. Across model specifications, perceived policy effectiveness (PPE) is positively associated with bamboo product consumption behavior (BC). In the full specification (Column 6), PPE remains statistically significant ($\beta = 0.097$, $p < 0.01$), supporting H1. Among the psychological predictors, subjective norms (SN, $\beta = 0.082$, $p < 0.01$) and perceived behavioral control (PBC, $\beta = 0.078$, $p < 0.01$) are positively related to BC. Environmental values (EV) exhibit a negative association but are only significant at the 10% level ($\beta = -0.054$, $p < 0.10$). By contrast, we do not find evidence that environmental knowledge (EK) or attitude (AT) is associated with BC in the baseline model ($p > 0.10$).

Table 4. Baseline regression results.

Dependent Variable: BC						
	(1)	(2)	(3)	(4)	(5)	(6)
PPE	0.120 *** (4.76)	0.115 *** (4.07)	0.133 *** (4.10)	0.107 *** (2.93)	0.092 ** (2.47)	0.097 *** (2.63)
EK		0.011 (0.38)	0.021 (0.70)	0.008 (0.28)	0.000 (0.00)	0.023 (0.73)
EV			−0.037 (−1.19)	−0.048 (−1.49)	−0.051 (−1.59)	−0.054 * (−1.70)
AT				0.060 * (1.76)	0.024 (0.68)	0.019 (0.54)
SN					0.076 ** (2.46)	0.082 *** (2.67)
PBC						0.078 *** (2.83)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.060	0.060	0.061	0.064	0.069	0.077
N	1121	1121	1121	1121	1121	1121

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; t statistics in parentheses.

4.5.2. Hypothesis 2: The Interactive Effects

Table 5 reports interactive effect results. After introducing the interaction terms (Model 2), PPE remains positively associated with BC ($\beta = 0.059$, $p < 0.05$), indicating that the direct association between PPE and BC is robust to the inclusion of conditional specifications. With respect to H2, the results suggest that the behavioral relevance of PPE is contingent on residents' environmental knowledge and environmental values. Specifically, the interaction term $EK \times PPE$ is positive and marginally significant ($\beta = 0.032$, $p < 0.10$), whereas the $EV \times PPE$ interaction is negative and significant at 5% level ($\beta = -0.038$, $p < 0.05$). These results suggest that the association between PPE and BC varies across levels of environmental knowledge and environmental values. However, the remaining interaction terms ($AT \times PPE$, $SN \times PPE$, and $PBC \times PPE$) are not statistically significant. These findings provide partial support for H2: PPE interacts with environmental knowledge and environmental values, whereas its interactions with attitude, subjective norms, and perceived behavioral control are not statistically significant. Following recommended practice for interpreting interactive effects [53], we calculated conditional relationships using marginal effects and predictive margins and visualized the corresponding slopes (Figures 3 and 4).

Table 5. Interactive effect results.

	Model 1			Model 2		
	β	t-Value	Sig.	β	t-Value	Sig.
PPE	0.097	2.63	***	0.059	2.17	**
EK	0.023	0.73		0.020	0.92	
EV	−0.054	−1.70	*	−0.051	−2.11	**
AT	0.019	0.54		0.013	0.49	
SN	0.082	2.67	***	0.068	2.82	***
PBC	0.078	2.83	***	0.059	3.05	***
$EK \times PPE$				0.032	1.84	*
$EV \times PPE$				−0.038	−2.26	**
$AT \times PPE$				−0.022	−1.22	
$SN \times PPE$				0.017	0.79	

Table 5. Cont.

	Model 1			Model 2		
	β	t-Value	Sig.	β	t-Value	Sig.
PBC $\times$ PPE				0.005	0.29	
Controls	Yes			Yes		
R ²	0.077			0.086		
N	1121			1121		

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. As an exploratory check, we disaggregated PPE into its three policy-instrument types and re-estimated these two interactions. The patterns are consistent with the composite results and are reported in Appendix A (Table A1).

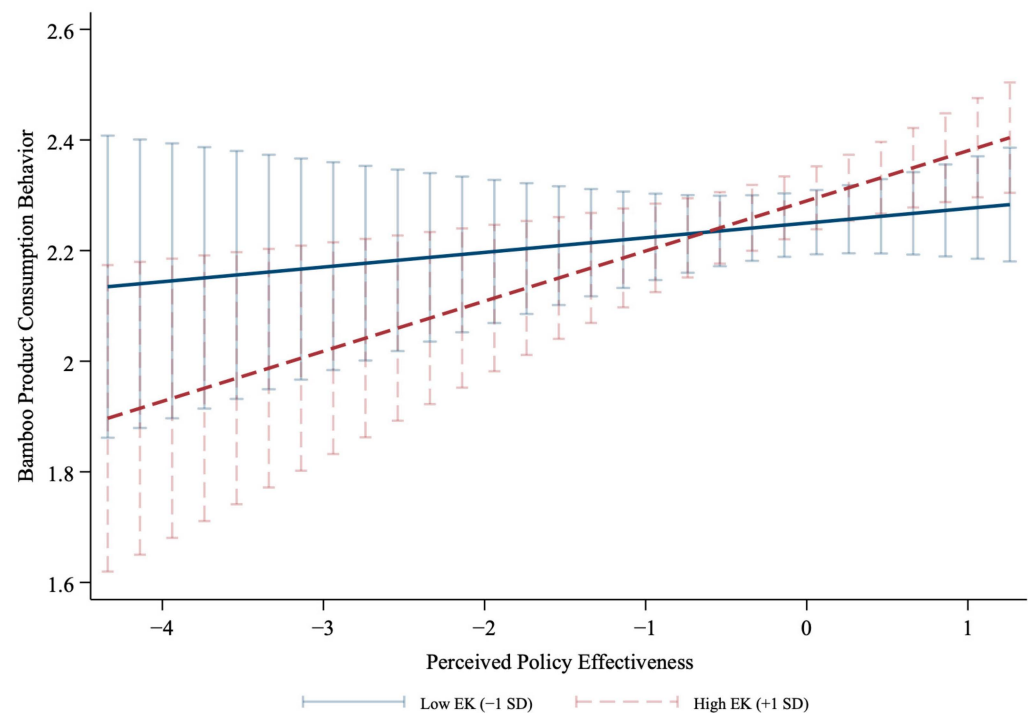


Figure 3. Interaction effects of EK on the relationship between PPE and BC. Note: Solid blue line = low EK (−1 SD); dashed red line = high EK (+1 SD). Error bars indicate 95% confidence intervals.

Figure 3 plots predictive margins of BC across PPE at low ($M - 1$ SD) versus high ($M + 1$ SD) environmental knowledge (EK), holding other covariates constant. The slope is relatively flat for the low-knowledge group but steeper for the high-knowledge group. The marginal effect estimates show that PPE is not significantly associated with BC when EK is low ($dy/dx = 0.027$, $t = 0.83$, $p > 0.10$). However, when EK is high, PPE exhibits a positive and significant association with BC ($dy/dx = 0.091$, $t = 2.82$, $p < 0.01$). These results suggest that PPE translates into bamboo consumption behavior primarily among respondents with higher environmental knowledge.

Figure 4 shows that the association between PPE and BC varies across levels of environmental values (EV). The slope for low EV ($M - 1$ SD) is steeper than that for high EV ($M + 1$ SD), indicating that environmental values weaken the association. According to the marginal effects, there is a strong and positive association between PPE and BC at low EV ($dy/dx = 0.096$, $t = 3.10$, $p < 0.01$). While at high EV, the marginal effect of PPE becomes small and statistically insignificant ($dy/dx = 0.021$, $t = 0.64$, $p > 0.10$). That means PPE is behaviorally consequential mainly for respondents with weaker environmental values, whereas respondents with stronger environmental values display relatively stable consumption behavior.

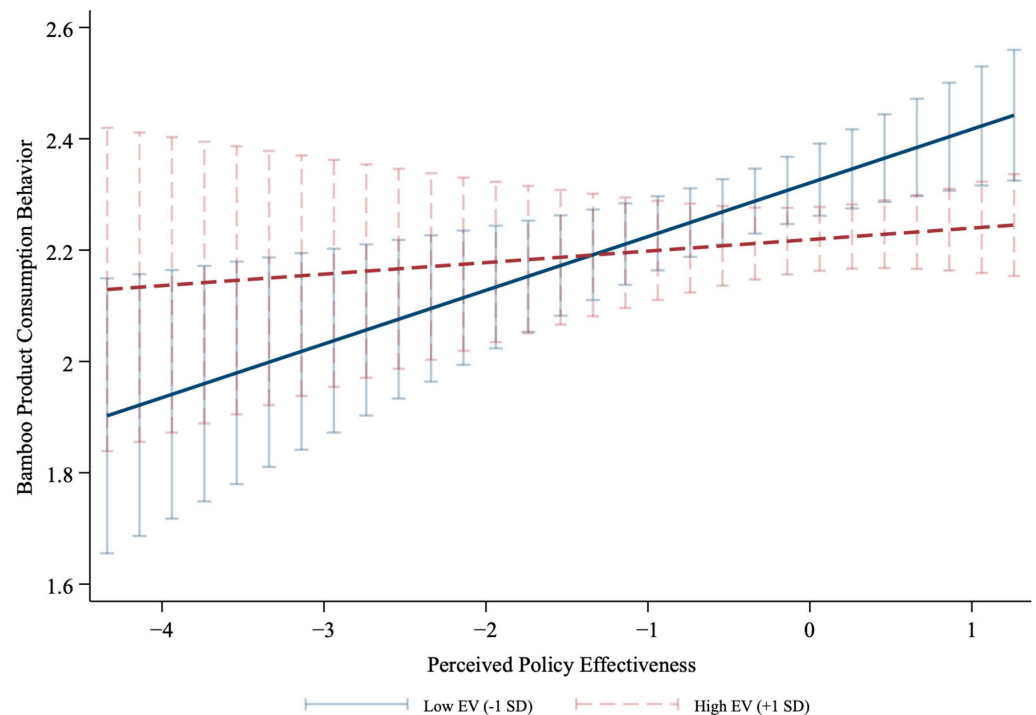


Figure 4. Interaction effects of EV on the relationship between PPE and BC. Note: Solid blue line = low EV (−1 SD); dashed red line = high EV (+1 SD). Error bars indicate 95% confidence intervals.

4.6. Supplementary Analysis: The Moderating Role of Residents' Income

Considering the price premium that bamboo products may carry, we conducted a supplementary analysis to explore whether residents' income conditions the association between two constructs (i.e., PPE, PBC, which are theoretically closely related to individual economic conditions) and consumption behavior. We augmented the baseline model with income $\times$ PPE and income $\times$ PBC interaction terms, operationalizing income as a binary indicator (split at a monthly income of 10,000 yuan). As shown in Table 6 (Panel A), income moderated the association between PPE and consumption, but not that between PBC and consumption. In the focused model (Model 3), the income $\times$ PPE interaction was negative and marginally significant ($\beta = -0.086, p < 0.10$). It remained virtually unchanged when the full set of PPE $\times$ psychological interactions was included (Model 4: $\beta = -0.085, p < 0.10$). The marginal effect results indicate that PPE was positively and significantly associated with consumption among lower-income respondents ($dy/dx = 0.085, p < 0.01$) but was statistically indistinguishable from zero among higher-income respondents ($dy/dx = -0.002, p > 0.10$). In addition, the income $\times$ PBC interaction was non-significant throughout ($p > 0.10$), and the previously reported PPE $\times$ EK and PPE $\times$ EV interactions retained their sign and significance. To probe the mechanism, we disaggregated PPE into its three policy-instrument types and interacted each with income (Table 6, Panel B). The income difference was concentrated in the Incentive-based PPE (interaction $\beta = -0.109, p < 0.05$), whose function is to offset spending, and was absent for the information-based PPE ($p > 0.10$) and the constraint-based PPE ($p > 0.10$). Notably, the information-based PPE showed the strongest average association with consumption ($\beta = 0.092, p < 0.01$) yet did not vary with income.

Table 6. The moderating role of residents' income.

Panel A. Moderation by Residents' Income (Dependent Variable: BC)						
	Model 3 (Focused Model)			Model 4 (Full Interaction Model)		
	β	t-Value	Sig.	β	t-Value	Sig.
Income $\times$ PPE	−0.086	−1.87	*	−0.085	−1.91	*
Income $\times$ PBC	−0.030	−0.62		−0.021	−0.42	
Income	0.032	0.56		0.035	0.63	
PPE	0.085	3.16	***	0.075	2.67	***
PBC	0.057	2.57	**	0.058	2.73	***
EK $\times$ PPE				0.033	1.94	*
EV $\times$ PPE				−0.036	−2.14	**
Other Interactions	No			Yes		
R ²	0.076			0.084		

Panel B. PPE disaggregated by policy-instrument type (Models 5–7)		
	Effect at Lower Income (β)	$\times$ Income (β)
Information-based PPE	0.092 ***	−0.060
Incentive-based PPE	0.052 **	−0.109 **
Constraint-based PPE	0.025	−0.040

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. $N = 1121$. All models control for the psychological variables (EK, EV, AT, SN, PBC) and demographic characteristics, with robust standard errors. In Panel A, other interactions include AT $\times$ PPE, SN $\times$ PPE, and PBC $\times$ PPE. In Panel B, each PPE subitem is standardized and entered in a separate model, so its coefficient is the instrument's association at the lower-income reference group.

5. Discussion

5.1. Findings Interpretation

This study examines how residents' perceived policy effectiveness (PPE) is associated with their consumption of bamboo products as a nature-based solution. The empirical results support H1: PPE has a significant and positive direct relationship with bamboo product consumption behavior. These findings resonate with studies showing that higher PPE is associated with stronger engagement in green consumption behavior. While most existing evidence on PPE concerns the post-consumption stage [19–24], our results indicate that PPE also operates as a proximal determinant at the purchasing stage of bio-based products. In this sense, PPE should be treated as a factor that shapes green product purchasing and be incorporated into frameworks that would otherwise consider only policy design or individual psychological traits.

In a different decision setting, related work reports an opposite sign. Using a discrete choice experiment on bioplastic medical masks, Zeng et al. (2025) find that perceived policy effectiveness is negatively associated with consumers' willingness to pay [25]. This difference is plausible because the outcome and the context differ. Their study focuses on stated preferences and on the willingness to pay a premium, where strong policy effectiveness may reduce consumers' perceived need to pay extra. Our study examines actual consumption behavior in an emerging bamboo market in which lower-impact alternatives typically command a price premium and face functional uncertainties [54,55]. Here, PPE likely serves as a market signal that reduces perceived risk through expectations of regulation and quality assurance, thereby facilitating adoption.

The interaction analysis indicates that PPE does not influence all consumers uniformly. Across the two interactions, PPE appears to work differently depending on the type of resource a consumer already has: it complements cognitive resources but substitutes for motivational ones. Knowledge equips consumers to act on policy signals, whereas strong values reduce the need for them. Consistent with this complementarity, we find

preliminary evidence of a synergistic effect between PPE and environmental knowledge ($\beta = 0.032$, $p < 0.10$). Knowledge appears to give consumers the capacity to act on policy signals: those with higher environmental knowledge are more proficient at interpreting complex information and appraising specific product claims [33], so institutional cues are more readily linked to concrete choices. Mechanistically, knowledge may enhance the behavioral value of these signals through two related channels. It can directly reduce information asymmetry, enabling consumers to verify policy-backed environmental claims independently, and it can raise the perceived credibility and usability of specific instruments such as carbon labels [16,56]. We treat this synergy as suggestive given its marginal significance, although it is corroborated by the simple slopes: PPE is significantly associated with consumption at high knowledge ($dy/dx = 0.091$, $p < 0.01$) but not at low knowledge. This pattern also helps explain why environmental knowledge was not significant in the baseline model. Knowledge provides the necessary capacity to act, while PPE provides the confidence to do so [57]; for consumers who lack basic environmental knowledge, the specific utility of green consumption remains unclear, so even a belief that the policy environment is effective does not readily translate into concrete choices.

In contrast, we find a significant substitution effect between PPE and environmental values ($\beta = -0.038$, $p < 0.05$). This indicates that the behavioral impact of PPE is most pronounced among individuals with lower environmental values. Self-Determination Theory (SDT) offers an account of this attenuation [58]. SDT distinguishes autonomous motivation, which is rooted in internalized values and personal conviction, from controlled motivation, which responds to external contingencies. For consumers with strong environmental values, choosing bamboo is largely autonomously motivated, so perceived policy effectiveness, as an external signal of institutional support, adds little incremental motivation. For consumers with weaker values, behavior relies more on controlled motivation, and credible policy signals supply the external justification needed to convert intention into purchase. This is consistent with motivation crowding research, under which the behavioral weight of external incentives is greatest precisely where intrinsic motivation is weakest, and crowding effects are most pronounced among individuals whose pro-environmental motivation and self-transcendent values are already strong [59–61]. Recent evidence that institutional and policy interventions shape low-carbon outcomes further underscores how the external governance context conditions individual behavior [62].

The salience of this substitution is further shaped by the current level of market maturity. Unlike well-established pro-environmental behaviors, the bamboo market remains nascent, with substantial variation in product quality and still-emerging certification systems [7]. In such settings, policy signals carry an additional informational function, signaling quality assurance and reducing perceived risk. Consumers with strong environmental values, however, can rely on their environmental commitment as an internal decision criterion and therefore depend less on these external signals to guide their choices. As the bamboo market matures and information asymmetries resolve, the informational role of policy, and with it this substitution pattern, may eventually weaken. These findings also help explain why our results differ from prior work in more established domains. PPE has been studied extensively in recycling, a behavior with clear scripts and low market uncertainty [21,39], and in other pro-environmental settings, it has been found to strengthen the translation of environmental awareness into behavior [38]. In the nascent and uncertain bamboo market, by contrast, policy effectiveness appears to operate as a compensatory mechanism for consumers with weaker value-based motivation.

A supplementary analysis suggests that this substitution logic extends beyond motivation to a second, economic resource. Because bamboo products typically command a price premium [54], we examined whether residents' income conditions the policy effect.

PPE was a meaningful driver of consumption among lower-income, more price-sensitive respondents, but was largely inconsequential among higher-income respondents, for whom the premium is less binding. Just as strong environmental values provide an internal basis for choice that renders external policy signals redundant, sufficient economic capacity appears to do the same. When PPE was disaggregated by instrument, the income difference was concentrated in the incentive instrument (reward-point deductions) that offset spending and was absent for the information instrument (carbon labeling), which showed the strongest overall association with consumption yet did not vary with income. Income did not moderate perceived behavioral control, indicating that the conditioning role of economic capacity is specific to the policy-signal channel and not a general feature of how higher-income consumers behave. We interpret this moderation cautiously, given its marginal significance and the small higher-income subsample; together, however, these results indicate that policy effectiveness matters most for consumers who lack either the motivational or the economic resources to adopt bamboo on their own.

5.2. Contributions and Limitations

Our study highlights the role of perceived policy effectiveness at the purchasing stage of the green consumption cycle. This responds to the broader call to address sustainability upstream, through material substitution at the source. While research on PPE historically centered on post-consumption behaviors, our findings demonstrate that these effects extend to market-based acquisition. These findings complement recent work on nature-based solutions [25] and highlight PPE as a vital driver in the early stages of the green product life cycle. Furthermore, we advance the specific domain of bamboo product research by integrating PPE into the extended TPB framework. We explore both direct and interactive roles of PPE in bamboo product consumption. In this way, we complement existing bamboo research that has mainly adopted a top-down perspective [63,64] or focused on individual psychological drivers such as environmental awareness and green values [10,11]. We find a synergistic effect with environmental knowledge and a compensatory effect with environmental values. These findings provide a more nuanced understanding of how the policy effectiveness that residents perceive influences their actual behavior.

Beyond theoretical insights, this study improves the empirical reliability of green consumption research through two methodological strengths. By utilizing actual consumption metrics (purchase frequency and volume), we provide a direct assessment of behavior that mitigates the “attitude-behavior gap” issue in intention-based studies. Additionally, the reliance on a large-scale, stratified sample of urban residents ensures that our findings reflect tangible market participation. This approach enhances the credibility and practical validity of the results within the context of China’s BASP initiative and the broader pursuit of carbon neutrality.

Despite these insights, several limitations remain. First, while our five-stage stratified sampling improves representativeness, the cross-sectional design limits our ability to establish definitive causality. Future research could employ longitudinal panels to observe how consumption patterns evolve as bamboo-related standards and market infrastructures mature. Second, this study focused on urban residents in Zhejiang Province. Given the regional disparities in China’s bamboo industry development, the generalizability of these findings to non-producing regions or rural contexts remains an open question for future comparative studies. Third, our measures did not capture consumers’ information processing, so we could not determine through which channel environmental knowledge strengthens the effect of policy signals, whether by reducing information asymmetry or by increasing trust in instruments such as carbon labels; mediation models that include measured information asymmetry and label trust, or experiments that manipulate label

exposure, could isolate these channels. Relatedly, our environmental values items capture general environmental orientations, and product-specific value measurement is a useful direction for future work. Finally, although we captured actual purchase data, self-reported measures are still susceptible to recall bias and social desirability bias, a challenge that future experiments or objective transaction data could help address.

6. Conclusions

This study investigated whether and how perceived policy effectiveness (PPE) is associated with bamboo product consumption among urban residents ($n = 1121$) in Zhejiang Province, China. We estimated a set of OLS models to test the direct association between PPE and bamboo consumption (RQ1) and interaction effects between PPE and psychological predictors (EK, EV, AT, SN, PBC) based on the extended TPB framework (RQ2). Overall, our results showed that PPE is positively associated with individual bamboo consumption behavior. This association was conditional: Environmental knowledge showed a marginally significant positive interaction with PPE, whereas environmental values showed a negative interaction. A supplementary analysis further indicated that residents' income moderated this association: PPE was positively associated with consumption among lower-income consumers but not among higher-income consumers, for whom the price premium is less binding.

These findings carry practical implications for the design of local policies. As perceived policy effectiveness operates at the purchasing stage and appears to act as a market signal, the credibility and visibility of policy implementation plausibly shape demand for bamboo products; sustained and clearly communicated enforcement may matter as much as the instruments themselves. The instruments are, in turn, best targeted by segment. Incentive measures that offset spending, such as purchase subsidies or reward-point schemes, appear most useful for lower-income and weakly value-motivated consumers, for whom the price premium is a binding constraint, and are likely to add little for higher-income or strongly motivated consumers. Information measures such as carbon labeling showed the strongest average association with consumption and did not vary with income, which suggests a broad-based role; because their behavioral value appears to depend on consumers being able to interpret them, pairing labeling with environmental education may strengthen their effect. Constraint measures such as plastic charges were only weakly associated with consumption in this nascent market and warrant cautious, supporting use.

Demand-side antecedents can also be cultivated. Subjective norms were a robust correlate of consumption, so community campaigns, visible social modelling, and family and peer channels may help normalize bamboo adoption. Environmental values shift more slowly and are better addressed through long-term education that emphasizes health and intergenerational responsibility, consistent with the content of our value measure. A caution follows from research on motivation crowding: because external incentives add least where intrinsic motivation is already strong [59,60], broad and untargeted incentive schemes risk weakening the autonomous motivation of the most committed consumers, which is a further reason to direct incentives toward price-sensitive and weakly motivated segments.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of school of Economics and Management, Zhejiang Sci-Tech University (protocol code 21NDJC065YB and 28 May 2025 of approval).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting the findings of this study are available from the authors upon reasonable request.

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Appendix A

As an exploratory check on the composite PPE $\times$ environmental knowledge (EK) and PPE $\times$ environmental values (EV) interactions reported in Table 5, we disaggregated PPE into its three policy-instrument types (information-based, incentive-based, and constraint-based) and re-estimated each interaction. The results are consistent with the composite findings: the value-based substitution is general across instruments (all three EV interactions are negative, and significant for the information- and incentive-based instruments), whereas the knowledge-based synergy is diffuse (all three EK interactions are positive but none reach significance), consistent with environmental knowledge operating as a general capacity to interpret policy signals of any type.

Table A1. Instrument-level disaggregation of the PPE $\times$ EK and PPE $\times$ EV interactions.

PPE Instrument	$\times$ Environmental Knowledge (β)	$\times$ Environmental Values (β)
Information-based PPE	0.024 (n.s.)	−0.041 **
Incentive-based PPE	0.019 (n.s.)	−0.037 ***
Constraint-based PPE	0.016 (n.s.)	−0.031 *

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; n.s. = not significant ($p > 0.10$). $N = 1121$. Each coefficient is the interaction term from a separate model in which the focal standardized PPE instrument is interacted with the moderator (EK or EV); all models control for the remaining psychological variables (EK, EV, AT, SN, PBC) as main effects and for demographic characteristics, with heteroskedasticity-robust standard errors. Exact interaction estimates: information-based $\times$ EV, $\beta = -0.041$ ($p = 0.013$); incentive-based $\times$ EV, $\beta = -0.037$ ($p = 0.005$); constraint-based $\times$ EV, $\beta = -0.031$ ($p = 0.077$).

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