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Analysis of Factors of Single-Use Plastic Avoidance Behavior for Environmental Sustainability in China

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Abstract: Governments have been introducing strategies to reduce plastic waste. The reduction in plastic waste can be possible through single-use plastic avoidance. However, this is only possible with the proper understanding of the behavioral factors of single-use plastic avoidance behavior (SPAB). This study explores the factors that influence the decision-making process regarding SPAB in China, a major environmental problem, climate change, and global warming. The authors used a questionnaire survey to collect data from 421 respondents and analyze it using structural equation modeling (SEM). The study examines the effects of attitude, subjective norms (SNs), perceived behavior control (PBC), and policy intervention (PI) on single-use plastic avoidance behavior (SPAB) mediated by plastic avoidance behavioral intentions (PABI) and plastic-related environmental concerns (PREC). The analysis reveals that attitude, PBC, and PI significantly affect PABI, which affects SPAB. Moreover, PREC influences both PABI and SPAB. Furthermore, PI significantly impacts SPAB through PABI and PREC. The study suggests that effective PIs are crucial to reducing single-use plastic waste by shaping attitude, PBC, PABI, and PREC among the public and promoting pro-environmental behavior to achieve the objective of environmental sustainability.

Keywords: plastic avoidance behavior; climate change and governance; policy intervention; subjective norms; behavioral control; behavioral intention; decision-making processes; structural equation modeling

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1. Introduction

Many nations and regions have exploited natural resources in tandem with the rapidly expanding global economy and industrialization, which has resulted in many issues, including global warming and climate change [1–3]. Plastic pollution is one of the major challenges for governments [4–6]. It is a severe environmental problem that endangers both the inhabitants of the planet and the planet itself. Single-use plastic harms ecosystems and wildlife because it takes centuries to disintegrate and can stay in the environment for decades [7]. Due to its durability and resilience to degradation, plastic—a helpful substance that promotes economic growth—has developed into a risk to the environment [5,8]. The improper disposal of plastic waste results in litter in various ecosystems and threatens environmental sustainability [9]. Notwithstanding plastics' comfort and safety benefits, their single-use nature and improper disposal outweigh these advantages. Because of the detrimental effects of plastic on the environment and human health, environmental stewardship issues are receiving more and more attention from the scientific community, governments, media, and the general public [6]. For society to function correctly, plastic must be used and disposed of properly [10,11]. People worldwide use and consume single-use plastic goods such as plastic bags, bottles, straws, and so on [12]. These items, however, cause significant environmental and societal issues, such as plastic pollution,

GHG emissions, resource depletion, waste management issues, and so on. It is critical to analyze and modify public attitudes about plastic usage and avoidance [13] to solve these issues. Nevertheless, one of the most important strategies to avoid plastic use and reduce its waste is to develop pro-environmental and plastic avoidance behavior in the public. However, this will not be possible without a proper understanding of the behavioral factors of peoples' plastic avoidance behavior.

Plastic avoidance behavior is a pro-environmental behavior that tries to limit plastic use and waste, which has significant environmental and human health consequences. The value–belief–norm (VBN) hypothesis [14], which maintains that behavior is influenced by societal norms, personal values, and environmental views, is another paradigm used to investigate pro-environmental behavior. Heidbreder et al. [15] added two variables—perceived efficacy and felt responsibility—to a VBN-based model to analyze young people's desire to reduce PM2.5 in China. They also discovered that personal norms moderated the impacts of values and beliefs on intention. The third paradigm used to investigate pro-environmental behavior is the norm activation model (NAM) [16], which holds that personal norms triggered by knowledge of consequences and ascription of responsibility influence behavior. Jacobsen et al. [17] used the NAM-based model to research how customers in economically developed nations, including China, avoid and recycle plastic packaging trash. They discovered that personal norms, which were favorably associated with avoidance and recycling behaviors, were positively correlated with knowledge of consequences and assigning blame. Moreover, they found that contextual variables, such as the accessibility and availability of recycling facilities, influenced the association between individual norms and recycling behavior. The so-called Attitude–Behavior Gap, which often occurs even among responsible consumers, is a substantial divergence between attitude and conduct concerning responsible consumption. Mühlthaler and Rademacher [18] attempted to enhance knowledge of the relevant Attitude–Behavior Gap, its impacting elements, and consumer social responsibility. This review forms the foundation for a single-source, cross-sectional study that intends to evaluate the Attitude–Behavior Gap influencing the use of plastic bags. The study demonstrates the gap's existence and the statistically significant influence of many influencing factors.

Several factors may affect plastic avoidance behavior depending on the theoretical framework and the particular behavior being studied. These factors include SNs [12,19,20], attitude [21–23], behavioral control [24–26], behavioral concern [27], and behavioral intention [12,22,28]. The theory of planned behavior (TPB) [26,29] explains the relationship between these variables and behavior. The TPB holds that behavioral intention (BI) determines behavior, whereas attitude, subjective norm, and perceived behavioral control determine BI. TPB is one of the most frequently used frameworks to explain pro-environmental behavior. Sun et al. [30] included three variables—convenience, environmental concern, and ethical belief—in an expanded TPB model to better assess customers' intention to use plastic bags in China. Sun et al. [30] discovered that whereas environmental concern and ethical conviction were inversely correlated with the intent to use plastic bags, attitude, subjective norm, perceived behavioral control, and convenience were all favorably correlated. Additionally, they discovered that attitude served as a mediator between environmental concern and ethical conviction and purpose.

Furthermore, government PIs have also impacted the pro-environmental behaviors of the public [7], PI is a significant factor in reducing single-use plastic [7,31,32], and policy effectiveness is an essential determinant of pro-environmental behavior [33,34]. Understanding the factors that impact consumers' plastic avoidance behavior can aid in developing practical initiatives and policies to promote this behavior. This literature overview covers some of the most current research investigating the factors influencing plastic avoidance behavior in China using various theoretical frameworks and approaches [12,35,36]. Although several initiatives have been suggested to promote the reduction of plastic waste, little is known about the behavioral aspects impacting the avoidance of single-use plastics. This study aims to analyze the behavioral elements influencing consumers' decisions to

avoid single-use plastics and pinpoint the facilitators and obstacles that affect their plastic avoidance behavior.

This study investigates the behavioral factors that impacted residents' single-use plastic avoidance behavior (SPAB) in selected cities of Jiangsu province in China. This study is based on the TPB, which states that attitude, subjective standards, and perceived behavioral control all influence behavioral intentions. This study explores how attitude affects SPAB through plastic-related environmental behavior intention (PABI) and environmental concern (PREC). Moreover, it also examines how SNs influence SPAB through PREC and PABI. Furthermore, it also explores the how perceived behavioral control impacts SPAB through the channel of PABI. Since the government's PIs could be influential in determining SPAB, this analysis also analyzes how PI influences PABI and PREC and, thereby, SPAB through the channels of PABI and PREC. For this purpose, the authors used a primary data-based research approach by collecting data through a questionnaire survey. The structural equation modeling method was used to estimate (s). The findings provide deeper insights into how behavioral factors determine SPAB in China. This study's results will help create strategies and initiatives to encourage sustainable plastic usage.

2. Literature Review and Hypotheses Development

2.1. Theory of Planned Behavior

These factors are part of various models explaining how attitudes predict behaviors. One such model is the theory of planned behavior [26,29], which proposes that three factors determine behavioral intention: attitude toward the behavior, subjective norm, and perceived behavioral control (Figure 1). The MODE model, which stands for motive and opportunity as spontaneous vs. intentional processing factors, is another paradigm. According to this paradigm, people are more likely to behave consistently with their attitudes when they have more motivation and the chance to think deeply about their attitudes and behaviors (deliberate processing). People are more likely to behave based on other indications, such as habits or emotions, when they have a low desire or chance to think thoroughly. The validity of two different measures of responsible environmental behavior (REB)—self-reported behavior (SB) and other-reported behavior (OB)—was investigated by Chao et al. [37]. In this study, Ajzen's theory of planned behavior (TPB), which uses SB and OB as dependent variables, was validated by comparing (a) the frequency of behavioral intention (BI), SB, and OB; and (b) the model fit.

The TPB contends that individuals are more likely to refrain from using single-use plastics if they have a favorable attitude towards the activity, feel that significant others support the conduct, and believe they have the means and capacity to act [30,38,39]. For instance, one study discovered that attitude and perceived behavioral control were the two TPB characteristics that affected students' usage of single-use plastic bags [40]. Attitude, subjective norm, perceived behavioral control, and convenience may influence the behavioral intention to use plastic bags [30]. Another study found that attitude, subjective norm, perceived behavioral control, environmental concern, and ethical conviction significantly predicted students' desire to reduce plastic usage [28]. According to Ru et al. [36], attitude, subjective norms, perceived behavioral control, and moral norms influence young people's intention to reduce PM2.5.

Based on the relationships between the behavioral factors to determine the final behavior represented by the TPB, this study proposes a model (Figure 2) to assess how behavioral factors influence SPAB in China. Given that plastic pollution is a severe environmental problem in China, it is necessary to evaluate how behavioral factors affect the use of SPABs. Single-use plastic bags are overused and improperly disposed of, significantly contributing to environmental deterioration and harming human and animal health. Behavioral variables such as attitudes, societal norms, and perceived behavioral control influence individuals' intentions and actions to reduce plastic trash. This study aims to understand better how attitudes, arbitrary standards, and perceived behavioral control affect people's intentions and actions regarding using single-use plastic bags. This study examines how

attitudes and SPAB are mediated by PABI and PREC and how SNs affect SPAB via the PABI and PREC pathways. The study also examines how SPAB is affected by perceived behavioral control through the PABI channel, and how PIs affect people's attitudes and behaviors toward SPAB. Policymakers and stakeholders can learn how PIs impact PABI, PREC, and SPAB to develop efficient methods for reducing plastic waste. Overall, this study offers insightful information into the intricate behavioral aspects that affect SPAB in China and can guide the creation of successful interventions to encourage sustainable plastics.

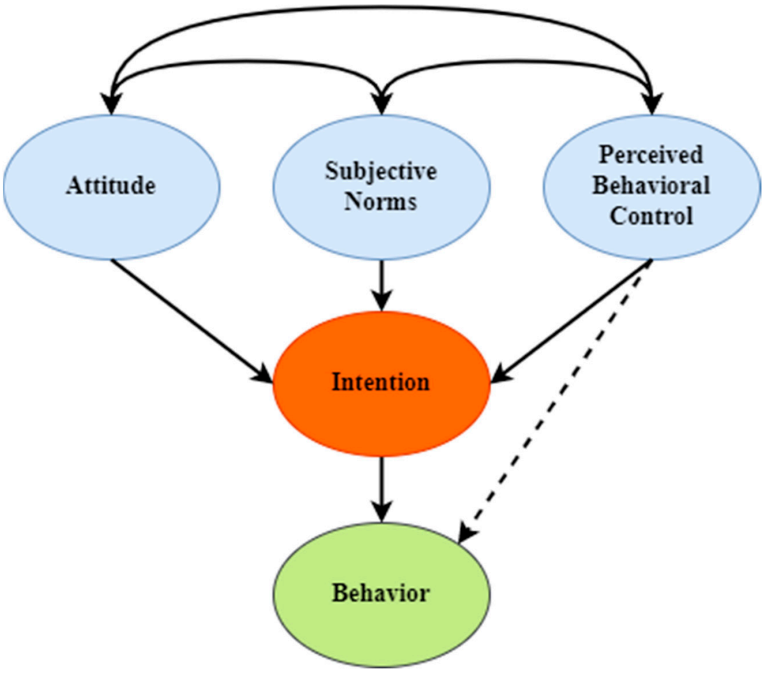

Figure 1. Theory of planned behavior.

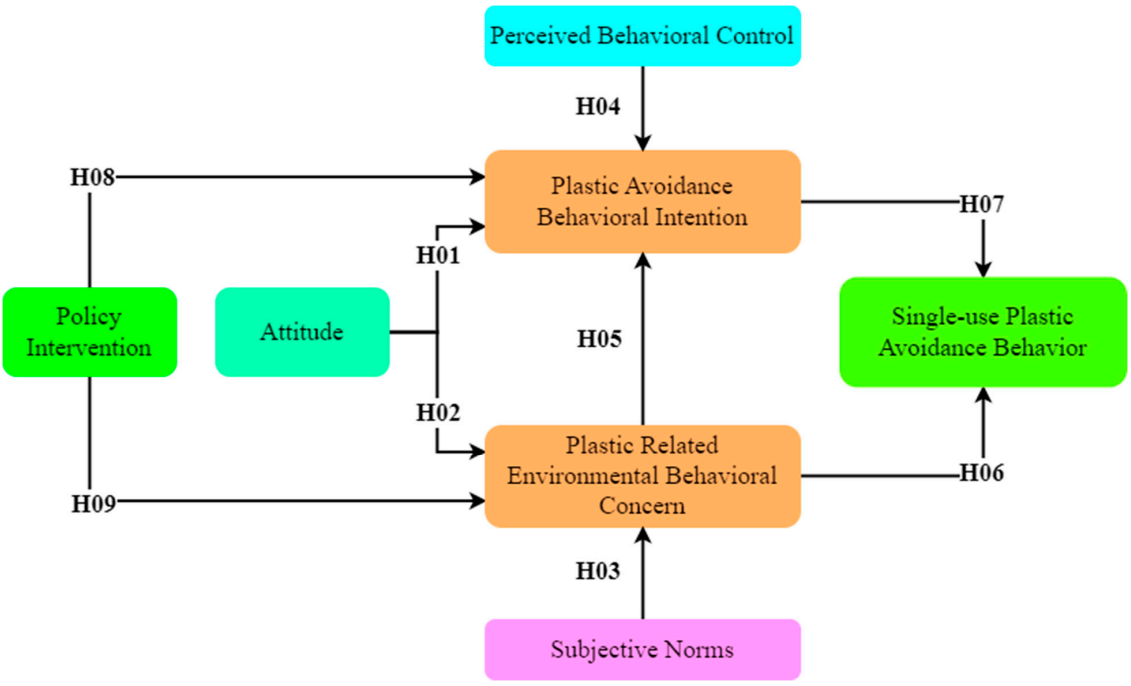

Figure 2. Proposed model.

2.2. Single-Use Plastic Avoidance Behavior (SPAB)

Single-use plastic avoidance behavior entails reducing or stopping the use of plastic goods intended to be used just once before being disposed of, such as plastic bottles, wrappers, bags, etc., by engaging in plastic avoidance behavior [41]. Several factors, including environmental awareness, individual beliefs, societal norms, financial incentives, and governmental rules, influence this behavior. Reducing plastic pollution, conserving resources, and promoting a circular economy are advantages of this practice. The problems with this practice include a need for more options, more significant expenses, greenwashing techniques, and antiquated technology [8]. Avoiding single-use plastics is essential for reducing plastic waste because it stops the production of plastic trash at the source and lessens the demand for limited resources. According to the United Nations, single-use plastics make up about 90% of all plastic and 8.3 billion metric tons of plastic pollution [8]. Consumers may reduce trash production and littering, conserve resources and energy, and promote a circular economy that encourages the continued use of materials and resources by refraining from using single-use plastics [8,42]. Hence, effective policy interventions are required to address these issues and inspire measures to reduce plastic pollution [42,43].

2.3. Attitude (AT)

Attitude is the set of beliefs, feelings, and behavior toward a situation [21]. Attitude significantly affects environmental behaviors, especially regarding plastic use [28,36,44]. Attitude plays an important role in environmental decision-making [45–47]. An attitude is an acquired tendency to assess things in a particular manner, including assessments of individuals, situations, items, or events. Attitude may affect behavior differently, depending on how strong, constant, and accessible it is. A stronger attitude is more likely to influence behavior. Strong attitudes are frequently based on personal experience, emotional engagement, or significant knowledge about the problem [48].

Moreover, the more congruent the attitude is with other ideas and values, the more likely it is to impact behavior. For example, suppose someone has a favorable attitude towards recycling and also values environmental protection. In that case, they are more likely to recycle than someone who has a positive attitude towards recycling but does not care about the environment [48,49]. Furthermore, the more accessible the attitude is in memory, the more likely it is to impact behavior. Accessibility relies on how frequently and recently the attitude has been engaged or expressed. For example, suppose someone has just viewed a video on animal cruelty and has a negative attitude regarding meat consumption. In that case, they are more likely to avoid eating meat than someone not exposed to such material recently [48,49]. By affecting how people view the advantages and disadvantages of using plastic, how they feel about minimizing plastic waste, and their trust in the quality and safety of alternative materials, attitudes can impact plastic-related environmental concerns. For instance, if someone has a favorable opinion of bio-plastics (from renewable sources), they could be more worried about how conventional plastics affect the environment and more inclined to convert to bio-plastics. People may be less concerned about plastic pollution and more reluctant to modify their behavior if they have a negative attitude about bio-plastics owing to concerns about their cost or shelf life [11,50].

Studies have shown that attitude influences the behavioral intentions of the users [22,44]. Moreover, the attitude positively and directly impacts the consumers' behavioral intention, and they follow the "bring your own shopping bags" behavior [51]. A recent study [39] showed that attitude positively and significantly affected behavioral intention regarding reduce, reuse, and recycle (3Rs) concepts in plastic usage. Attitude can also influence PREC [11]. The proposed hypotheses for the association between the attitude and single-use plastic avoidance behavioral intention are:

H_{01}. *There is a positive and significant relationship between attitude and plastic avoidance behavioral intention.*

H_{02}. *There is a positive and significant relationship between attitude and plastic-related behavioral concern.*

2.4. Subjective Norms (SNs)

Social norms are the unspoken codes of conduct that guide how individuals act in a group or community [39,44,52]. By demonstrating which behaviors are typical and acceptable and which are not, they can impact consumer decisions, stakeholder expectations, and the public's commitment to minimizing plastic consumption. For instance, one study discovered that consumer resistance to plastic was most strongly influenced by descriptive norms—what most people do [52]. According to further research, embracing the Sustainable Development Goals (SDGs), which contain objectives to reduce plastic waste and other environmental concerns, improved stakeholder support for businesses. However, the preferred SDGs of the stakeholders and the firms' priorities for implementing the SDGs could differ [53]. Hence, educating stakeholders about the SDGs may aid in closing the gap and fostering more environmentally friendly behaviors. A third study showed that societal norms might occasionally precede their preferences when consumers are uncertain or faced with trade-offs. This suggests that rather than concentrating just on the product, marketing tactics should address the ability of social norms to alter consumers' choices [54]. In addition, SNs can impact PREC [13]. SNs can influence PREC by influencing consumer attitudes, intentions, and behavior toward plastic usage and avoidance [19].

H_{03}. *There is a positive and significant relationship between subjective norms and plastic-related environmental concern.*

2.5. Perceived Behavior Control (PBC)

Perceived behavior control relates to people's perception of their capacity and resources to perform a specific activity, which might influence their purpose and desire to minimize plastic waste. According to the evidence, perceived behavior control can alter plastic use behavior in various ways. For instance, [20] discovered that perceived behavior control positively increased customers' intention to minimize plastic trash. Another Australian study found that perceived behavior control impacted the association between descriptive norms and plastic avoidance among consumers [15]. Moreover, psychological elements such as environmental awareness, personal standards, and moral duty were discovered to alter perceived behavior control [55], which could either improve or hinder consumers' sense of control over their plastic usage habit. PBC can influence PABI through influencing customer intentions and behavior towards plastic usage and avoidance [20,55].

H_{04}. *There is a positive and significant relationship between perceived behavioral control and plastic avoidance behavioral intention.*

2.6. Plastic-Related Environmental Concern (PREC)

The degree to which a person is aware of and concerned about the harmful effects of plastic pollution on the environment is referred to as plastic-related environmental concern. It can alter plastic usage behavior by influencing people's attitudes and intentions to decrease plastic waste. One study [20] discovered that customers' behavioral intentions to minimize plastic waste in Vietnam were positively connected with PREC. Another study discovered that customers' willingness to pay for biodegradable packaging in China was positively connected with their environmental concern over plastic [35]. A third study found that media exposure, personal experience, societal norms, and perceived responsibility impacted environmental plastic concerns. Several variables can influence consumers' concerns about plastic pollution and its implications.

H_{05}. *There is a positive and significant association between plastic-related environmental concern and plastic avoidance behavioral intention.*

H_{06}. *There is a positive and significant association between plastic-related environmental concern and single-use plastic avoidance behavior.*

2.7. Plastic Avoidance Behavioral Intention (PABI)

Plastic avoidance behavioral intention refers to the underlying psychological motive that motivates customers to use less single-use plastic products such as bags, bottles, straws, and other similar items. This pro-environmental activity aims to reduce the negative consequences of plastic pollution on the environment and human health [15,56,57]. Personal values, societal norms, self-efficacy, result expectations, media exposure, and communication are all aspects that might impact plastic avoidance behavioral intention [15,17,56]. Practitioners may build more effective methods and interventions to promote plastic avoidance behavior modification by learning how various audiences think and react to single-use plastics [56].

H_{07}. *There is a positive and significant association between plastic avoidance behavioral intention and single-use plastic avoidance behavior.*

2.8. Policy Intervention (PI)

Policy intervention refers to actions taken by governments or other authoritative entities to affect the behavior of individuals or groups to achieve a particular goal [43]. Taxes, subsidies, regulations, incentives, education, and restrictions are only a few examples of PIs [31,43]. Notably, it is not only the policy intervention but also the strict policy implementation that can be helpful in achieving the objectives of the policy [34]. It can influence plastic use behavior by affecting plastic products' manufacture, use, and disposal [31]. For example, legislative action can lower demand for single-use plastic goods by prohibiting or charging fees [7,31]. Success in reducing plastic pollution depends on clearly understanding and incorporating public input into government attempts to address the problem [58]. It can also stimulate the recycling and repurposing of plastic objects by offering infrastructure and waste management incentives. Moreover, legislative action may encourage eco-design and innovation in the plastics business by establishing standards and funding research and development [7,31].

H_{08}. *There is a positive association between policy intervention and plastic avoidance behavioral intention.*

H_{09}. *There is a positive association between policy intervention and plastic-related behavioral concern.*

3. Research Methodology

This study utilized a cross-sectional method and a self-administered survey approach for research. Owing to the reliable and responsive measurement characteristic [59], the interval 5-point Likert scale was used for the questionnaires. The target population in the current research was the Mainland Chinese from the four major cities in Jiangsu province—Nanjing, Wuxi, Changzhou, and Suzhou. Based on the 22 items in the survey, the sample size should range from 88 to 220. According to [60], the suggested item-to-response ratio is between 1:4–1:10. The sample size of more than and less than 2000 is considered significant. The sampling distribution-related characteristics are affected if the sample size is too small [61]. In this study, a sample size above 400 was considered sufficient to represent the population. Ting et al. [39] considered 400 an appropriate sample size.

Before conducting the survey, five experts in the relevant field designed and tested the draft questionnaire. The questionnaire questions were revised based on their feedback and suggestions. In [39], three experts inspected and verified the questionnaire. Following [39], the authors conducted a pilot test for 30 samples for the confirmation of validity of questionnaire items. A reasonable sample size for pilot testing ranges from 30–50 [62]. Therefore, 30 sets of questionnaires were distributed in Nanjing, Changzhou, Wuxi, and Suzhou on 20 July 2022 for the reliability and normality tests. The internal consistency of the questionnaire was tested by the measure of Cronbach's alpha [63]. Results of the pilot

testing revealed that Cronbach's alpha ranged from 0.784 to 0.916, which was acceptable. In this study, the normality test was carried out using the skewness and kurtosis tests, since they are frequently used to depict the normal distribution of independent and dependent variables in terms of shape and properties [64]. The pilot test showed that the skewness ranged from −1.082 to 0.523, and the kurtosis ranged between −1.371 and 1.179. These values indicate a normal distribution, within ±3 for skewness and ±10 for kurtosis [65].

3.1. Data Collection

The questionnaire was created and distributed online, ensuring anonymity and random distribution. To prevent participant subjectivity, we randomly assigned the items for each variable in the questionnaire. During pre-research, we gathered information from 86 respondents, and after analyzing that information, we redesigned the survey. Then, without offering incentives, we distributed an electronic questionnaire to all consumers. According to the literature, delivering presents may sway participants to predict the researcher's objectives [19,66]. Following [19], data from the respondents were gathered using a purposive sample approach, and 517 surveys were obtained. Due to repeated responses with the same I.P., incompletes, and response biases, unreliable surveys were eliminated. After the pilot testing, the data were collected using online platforms from 25 July 2022 to 10 September 2022. The questionnaire was drafted in two languages—Chinese and English. A total of 517 sets of responses were received. Moreover, 421 usable responses were finalized, which confirms that the valid response rate was 82 percent.

3.2. Data Analysis

3.2.1. Demographic Properties

The descriptive and demographic statistics of respondents summarized in Table 1 show that 248 male (58.91%) and 173 (41.9%) female respondents provided valid responses. Regarding age, about 398 (94.5%) respondents were older than 18 years, whereas 154 (36.58%) respondents were aged between 18–30 years, followed by 126 (29.93%) respondents aged between 31 to 40 years. This reveals that the response rate of the respondents aged 18 to 40 years provided valid responses. Considering the education levels of the respondents, the respondents with graduation, post-graduation, and higher education levels were 158 (37.53%), 109 (25.89%), and 62 (14.73%), respectively. Out of 421 respondents, 282 (66.98%) were unmarried or single, 128 (30.40%) were married, and 11 (2.61%) respondents preferred not to reveal their marital status. Moreover, 255 (60.57%) and 166 (39.43%) lived in urban and rural areas, respectively.

Table 1. Demographic profile of the respondents.

Demography		N	Frequency	Percentage
Gender	Male	421	248	58.91
	Female		173	41.09
Age	<18 Years	421	23	5.46
	18–30 Years		154	36.58
	31–40 Years		126	29.93
	41–50 Years		63	14.96
	51–60 Years		38	9.03
	>60 years		17	4.04
Education	Primary Education	421	6	1.43
	Elementary Education		17	4.04
	Secondary Education		22	5.23
	Higher Secondary Education		47	11.16
	Graduation		158	37.53
	Postgraduation		109	25.89
	Higher		62	14.73
Marital Status	Unmarried/Single	421	282	66.98
	Married		128	30.40
	Prefer not to answer		11	2.61
Residing Area	Urban	421	255	60.57
	Rural		166	39.43

3.2.2. Descriptive Statistics of the Constructs

The descriptive statistics summary in Table 2 reveals that the mean value of the items ranged from 2.99 to 3.89. PREC1 has the lowest mean value, whereas PABI3 has the maximum mean value. PBC2 and PABI1 have the lowest standard deviation of 0.052. SPAB4 has a maximum standard deviation of 0.067. The mean value of the dependent variable SPAB ranged from 3.05 to 3.32, with its normal deviation range from 0.057 to 0.067. The mean value of attitude (AT) ranged from 3.53 to 3.58 with standard deviation ranging from 0.059 to 0.065.

Furthermore, the mean value of SNs ranged from 3.15 to 3.18, whereas the mean of the items of PBC ranged from 3.46 to 3.54. PREC has the range of mean value from 2.99 to 3.08. PABI has the mean value range from 3.79 to 3.89, whereas the PI mean ranged from 3.67 to 3.73.

Table 2. Descriptive statistics of the constructs.

Latent Variables	Term	N	Mean	Std. Error	Skewness	Kurtosis
Attitude (AT)	AT1	421	3.53	0.062	−0.530	−0.906
	AT2		3.61	0.065	−0.737	−0.738
	AT3		3.58	0.059	−0.630	−0.631
Subjective Norms (SNs)	SN1	421	3.15	0.053	0.023	−1.054
	SN2		3.18	0.054	−0.067	−1.147
	SN3		3.21	0.053	−0.023	−1.169
Perceived Behavior Control (PBC)	PBC1	421	3.54	0.056	−0.539	−0.785
	PBC2		3.46	0.052	−0.505	−0.736
	PBC3		3.49	0.056	−0.405	−0.874
Plastic-Related Environmental Concern (PREC)	PREC1	421	2.99	0.059	0.058	−0.910
	PREC2		3.08	0.058	0.086	−0.916
	PREC3		3.05	0.062	0.108	−1.041
Plastic Avoidance Behavioral Intention (PABI)	PABI1	421	3.79	0.052	−0.898	0.256
	PABI2		3.84	0.054	−0.935	0.169
	PABI3		3.89	0.055	−0.911	−0.063
Policy Intervention (PI)	PI1	421	3.67	0.058	−0.657	−0.649
	PI2		3.73	0.056	−0.761	−0.360
	PI3		3.72	0.058	−0.659	−0.664
Single-use Plastic Avoidance Behavior (SPAB)	SPAB1	421	3.32	0.057	−0.159	−0.870
	SPAB2		3.20	0.057	−0.103	−0.750
	SPAB3		3.26	0.060	−0.132	−0.960
	SPAB4		3.05	0.067	0.017	−1.215

3.2.3. Normality Test

The study assessed the normality property of the data using skewness and kurtosis. The results in Table 2 show that the skewness ranged from −0.935 to 0.108. The kurtosis range of the items was between −1.215 and 0.256. The item PABI2 has the lowest skewness value, and PREC3 has the highest value, whereas the item PABI1 has the highest kurtosis value and SPAB4 has the highest value of −1.215. The condition for normality was met since all the items had skewness values within the benchmark of ±3 and kurtosis values within the benchmark of ±10.

3.2.4. Scale Measurement

Cronbach's alpha scores (Table 3) were higher than the threshold level of 0.7 [63]. SPAB had the lowest value of 0.74, whereas AT, PBC, and PI had a value of 0.85 at the highest end. Since the values of Cronbach's alpha were higher than 0.7 for all variables, this confirms the solid internal consistency of the constructs.

Table 3. Reliability and validity of latent variables.

Constructs and Their Related Items	F.L.s
Attitude (AT): (Cronbach's α: 0.85, C.R.: 0.86, AVE: 0.66)	-
AT1: Avoiding single-use plastic usage is good.	0.75
AT2: Avoiding single-use plastic usage is helpful for environmental protection.	0.85
AT3: Avoiding single-use plastic use is a responsible behavior.	0.84
Subjective Norms (SNs): (Cronbach's α: 0.81, C.R.: 0.81, AVE: 0.59)	-
SN1: Most people who are important to me think that I should avoid using single-use plastic in everyday life.	0.77
SN2: Most of my family members think that avoiding single-use plastic is a good thing to follow.	0.80
SN3: Most of my friends and acquaintances think that avoiding non-biodegradable plastic is a good thing to follow.	0.73
Perceived Behavior Control (PBC): (Cronbach's α: 0.85, C.R.: 0.86, AVE: 0.67)	-
PBC1: Avoidance of single-use plastic use is under my control.	0.85
PBC2: I am willing to avoid single-use plastic usage.	0.86
PBC3: I think I need to apply single-use plastic avoidance concept at home.	0.75
Plastic-Related Environmental Concern (PREC): (Cronbach's α: 0.75, C.R.: 0.76, AVE: 0.52)	-
PREC1: Environmental problems caused by plastics affect my everyday life and health.	0.64
PREC2: I am worried about the impact on my health of everyday objects made of plastics.	0.85
PREC3: I am concerned about the impact on the environment of everyday objects made of plastics.	0.66
Plastic Avoidance Behavioral Intentions (PABI): (Cronbach's α: 0.84, C.R.: 0.84, AVE: 0.64)	-
PABI1: I am willing to reduce the use of single-use plastic.	0.82
PABI2: I am planning to use alternatives to single-use plastic products.	0.84
PABI3: I am willing to participate in the campaign to reduce single-use plastic.	0.73
Policy Intervention (PI): (Cronbach's α: 0.85, C.R.: 0.85, AVE: 0.66)	-
PI1: The government should ban single-use plastic.	0.81
PI2: The government should impose a tax on single-use plastics.	0.86
PI3: The government should introduce a pricing policy on single-use plastics.	0.76
Single-use Plastic Avoidance Behavior (SPAB): (Cronbach's α: 0.74, CR.: 0.82, AVE: 0.53)	-
SPAB1: I always reuse old containers/bags.	0.66
SPAB2: I seldom buy disposable products (plastic cutlery, cups, plates, etc.).	0.84
SPAB3: I always buy groceries in bulk.	0.72
SPAB4: When I get groceries, I avoid buying products with multiple plastic packaging.	0.69

Cronbach's alpha (α) (>0.7), composite reliability (CR > 0.7), AVE: average variance extracted (>0.5), FLs: factor loadings (>0.5).

3.2.5. Reliability, Validity, and Dimension Assessment of the Constructs

The constructs' validity was determined by confirming the values of Cronbach's Alpha, composite reliability (CR), and average variance extracted (AVE), given in Table 3. The reliability and validity analysis results show that all constructs' measures fulfilled the required levels of Cronbach's Alpha, CR, and AVE estimates with the cuts of 0.7, 0.7, and 0.5, respectively. Convergent validity was tested using average variance extracted (AVE), CR, and factor loading. The composite dependability rating varied from 0.76 to 0.86 (Table 3), indicating that the structures met the suggested requirements outlined in [67]. The factor loadings (FLs) of the items ranged from 0.64 to 0.86, showing the values above the cut-off value of 0.5 [65]. The CFA model was used to assess the validity of constructs. Table 4 summarizes the goodness-of-fit index findings of the CFA model. The results demonstrate that all indices meet the recommended criteria suggested in [67,68].

Table 4. CFA model fit.

Index	Value Measured	Cut-Off Value	Benchmark Study	Decision
CFI	0.97	>0.90	[69]	Acceptable
GFI	0.94	>0.80	[68]	Acceptable
NFI	0.92	>0.90	[70]	Acceptable
TLI	0.96	>0.75	[71]	Acceptable
RMR	0.05	<0.08	[72]	Acceptable
RMSEA	0.03	<0.06	[73]	Acceptable
CMIN/DF	1.63	<5.0	[74]	Acceptable

3.2.6. Structural Equation Modeling

Market research and social science both employ statistical approaches such as structural equation modeling (SEM). The particular research issue, the available data, and the setting influence the choice of method. Each approach has advantages and disadvantages. SEM is a multivariate data analysis technique for examining intricate interactions between constructs and indicators [65,75]. Covariance-based SEM (CB-SEM) and partial least-squares SEM (PLS-SEM) are two techniques that may be used to estimate it. PLS-SEM is used to forecast and clarify causal linkages, whereas CB-SEM is mainly used to confirm hypotheses [75], whereas conjoint analysis, conversely, is a way to determine customer preferences for items or services based on their features. It may be accomplished using various strategies, including rating, ranking, and discrete choice experiments (DCEs) [76]. The latter are consistent with economic demand theory and are based on random utility theory [76]. Discrete-choice methods (DCMs) are a more prominent family of approaches, including DCEs and multinomial logit, nested logit, and mixed logit models. DCMs may be used to examine consumer preferences, willingness to pay, market shares, and policy implications [77], whereas the best–worst scaling (BWS) technique is employed to assess the importance of attributes or items by requesting respondents to identify the best and worst options from a group of alternatives. This method can be applied to obtain information on preferences, attitudes, or perceptions [78]. On the other hand, latent profile analysis (LPA) is a technique for figuring out unobserved sub-groups or profiles of people based on their reactions to several observable factors. Given the latent profile, LPA assumes that the observed variables are conditionally independent [79]. Kautish et al. [80] used the PLS-SEM method for the analysis of associations among product involvement, perceived marketplace influence and choice behavior. Since SEM may be used to evaluate particular assumptions regarding the correlations between variables, which is useful in theory-driven research, following [4] we used SEM to test the proposed hypotheses.

The hypotheses were tested after analyzing internal consistency, reliability, and validity. It is necessary to satisfy the threshold level of model fit for SEM when testing hypotheses. After the goodness-of-fit index of the SEM passes the criteria, the next step is to measure the hypotheses. To assess the model fit of SEM, we used C.M.I.N./Df, G.F.I., CFI, NFI, TLI, R.M.R., and R.M.S.E.A. Table 5 displays the values of the fit index. G.F.I., CFI, TLI, NFI, and CMIN/DF readings are all larger than the threshold level. R.M.R. and R.M.S.E.A. levels should be less than the cutoff level. As a result, the projected R.M.R. and R.M.S.E.A. values are less than the threshold level. As a result, the predicted values represent the goodness-of-fit index. The software SPSS and AMOS were used for the analyses.

Table 5. Model fit structural equation modeling.

Index	Value Measured	Cut-Off Value	Benchmark Study	Decision
CFI	0.96	>0.90	[69]	Acceptable
GFI	0.93	>0.80	[68]	Acceptable
NFI	0.91	>0.90	[70]	Acceptable
TLI	0.95	>0.75	[71]	Acceptable
RMR	0.07	<0.08	[72]	Acceptable
RMSEA	0.04	<0.06	[73]	Acceptable
CMIN/DF	1.76	<5.00	[74]	Acceptable

When the structural model meets the goodness-of-fit index requirements, the estimated (β) coefficient and p-value help evaluate the hypotheses. Figure 3 depicts the estimated structural model of the research. In summary, the preceding sections demonstrate that our reliability test meets the construct validity consistency requirements and that measuring discriminant validity is suitable (Table 6). Additionally, the structural model meets the goodness-of-fit requirement. Based on the investigation findings, it is safe to proceed with hypothesis testing using standardized path coefficients (β) and p-values. Path coefficients were used as a standard to measure the severity of the impact. The Harman single-factor test was used to investigate the common method bias. The research indicated that no one element accounted for more than 50% of the variation, showing that the study had no common factor bias.

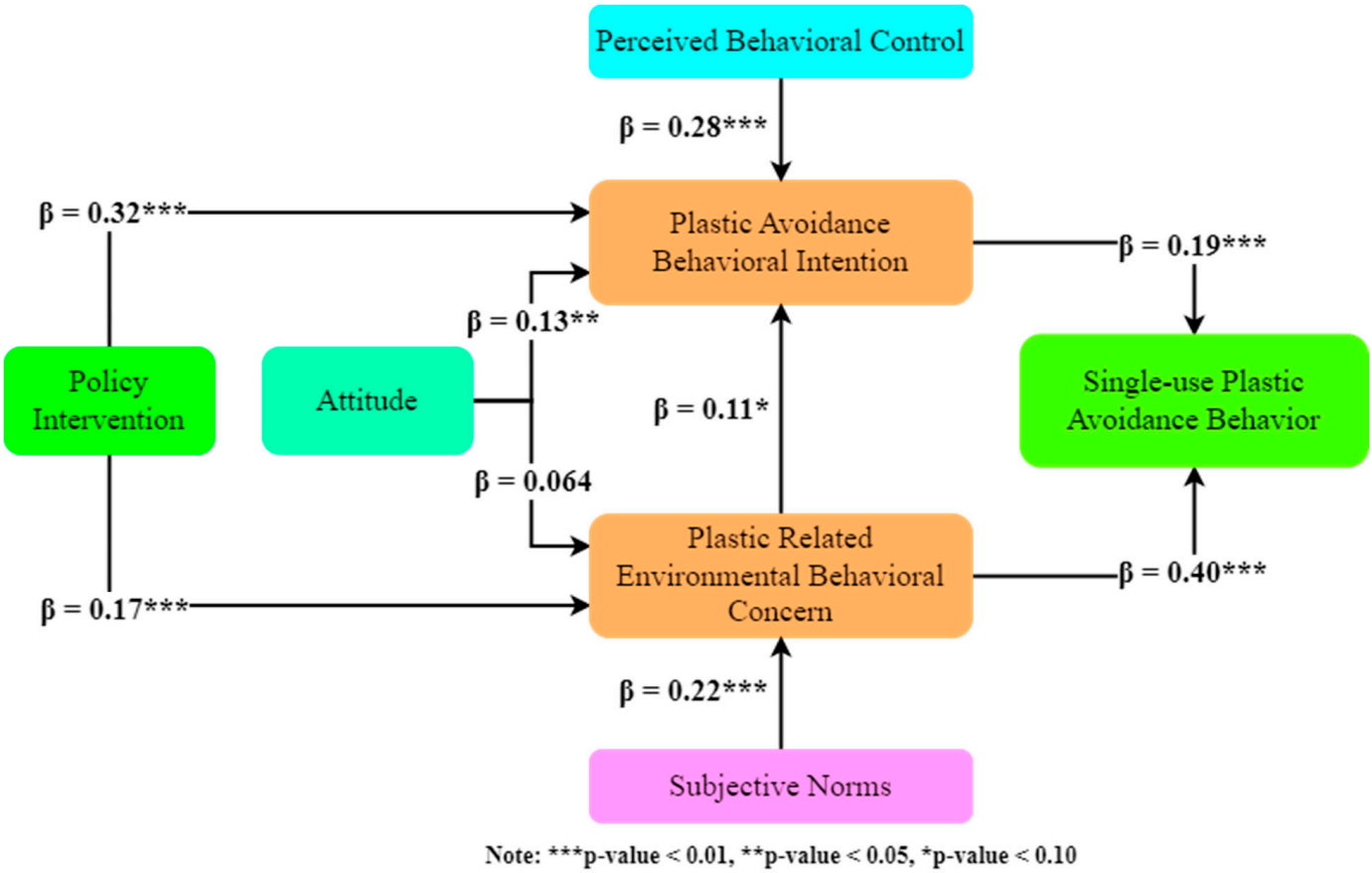

Figure 3. Estimated structural equation model.

Table 6. Discriminant validity.

Latent Variable	ATT	SN	PBC	PREC	PABI	PI	SPAM
ATT	0.81						
SN	0.28	0.77					
PBC	0.37	0.25	0.82				
PREC	0.17	0.29	0.24	0.72			
PABI	0.34	0.27	0.45	0.29	0.80		
PI	0.26	0.34	0.30	0.28	0.48	0.81	
SPAB	0.30	0.30	0.18	0.46	0.33	0.28	0.73

4. Hypothesis Testing

4.1. Attitude and Plastic Avoidance Behavioral Intention

The analysis results confirm the hypothesis that attitude positively and significantly influences households' plastic avoidance behavioral intention (H_{01}). The coefficient of attitude toward PABI is 0.13 with p-value < 0.05. Our results are in accordance with the results of [20], in which most respondents held a positive attitude toward reducing plastic waste, whereas Lin et al. [22] revealed that attitude had the lowest direct impact factor on pro-environmental behavioral intention. Moreover, attitude exerts a positive and significant effect on behavioral intention [51]. Ting et al. [39] also found attitude to be the most influencing factor that affects 3Rs behavioral intention. The government could put more effort into encouraging more pro-environmental behavior [81]. There is a positive correlation between residents' behavioral intention to reduce single-use plastic and their attitude towards reducing the use of such plastic products [82]. Widayat et al. [44] also confirmed that attitude determines the behavioral intentions of consumers. Educational and awareness programs could enhance awareness and exposure to stimulating plastic avoidance behavior. Thus, avoiding single-use plastics and the associated notion must expand nationwide and become ingrained in society. To raise awareness and establish a standard of environmentally friendly behavior among the public, it is important that knowledge about the advantages of avoiding single-use plastics be incorporated into the educational system's curriculum from an early age. According to Ali et al. [58], "clear perception of the adverse environmental effects of plastic pollution" and "use of social media to spread awareness" are the most effective CRs to limit the use of plastic pollutants because of their crucial interdependence.

4.2. Attitude and Plastic-Related Behavioral Concerns

However, the null hypothesis is that attitude positively and significantly affects a household's plastic-related behavioral concerns (H_{02}). The coefficient for "ATT → PREC" was the lowest of the variables, with the value of 0.064 and p-value of 0.209. Though the coefficient was insignificant, it was still an essential factor affecting pro-environmental behavior. Filho et al. [50] offer global research on detecting and resolving consumer attitudes and concerns about using bio-plastics to enhance people's and the environment's health. The survey results suggest that the participants had a favorable opinion of bio-plastics since they understood how the terms "bio-plastics" and "biodegradable" relate. Conventional petro-plastics kill wildlife, vegetation, and their ecosystems yearly by being burned, dumped in landfills, or washed into bodies of water. Traditional plastics also harm people's health by contaminating food and causing air pollution.

4.3. Subjective Norms and Plastic-Related Environmental Concern

The estimated results accept H_{03}: that SNs positively and significantly affect PREC with a coefficient value of 0.22 (p = value < 0.01). The findings are supported by previous studies showing that personal criteria can affect how individuals see the advantages and disadvantages of pro-environmental behaviors [19], such as recycling, consuming less energy, purchasing environmentally friendly goods, or avoiding single-use plastic consumption. Moreover, SNs can impact household plastic-related environmental concerns

by influencing how individuals view the advantages and costs of using plastic, decreasing plastic waste, or adopting alternative materials [83]. For example, suppose a family feels that most of their neighbors and friends are concerned about plastic pollution and support the avoidance of single-use plastics. In that case, they may be more inclined to follow suit and show more worry about plastic-related environmental concerns. Suppose a family believes that using plastic is convenient and acceptable in their social group. In that case, they may be less motivated to modify their habit and show less care for the environment [19,83].

4.4. Perceived Behavior Control and Plastic Avoidance Behavioral Intention

PBC significantly and positively influences the PABI with $\beta = 0.28$ and p-value < 0.01. This confirms the acceptance of H_{04}. According to the TPB, perceived behavior control (PBC) is one element that impacts customers' behavioral intentions [26,29] to minimize plastic waste. The results of our study are supported by a general rule: the greater the PBC, the greater the BI and the likelihood that the behavior would be performed. Moreover, PBC can also directly influence behavior by changing how hard individuals strive and how long they persevere [12,84]. According to specific research, PBC has a positive and substantial influence on customers' preferences to reduce plastic waste, which means that consumers who perceive they have more control over their plastic use are more inclined to avoid using plastic [28,50]. These results are in line with the results of [23] showing that perceived behavior affects behavioral intention. Furthermore, Ting et al. [39] also concluded that perceived behavioral concern influence recycling behavioral intention. Behavior Control (BC) impacts pro-environmental BI by influencing the perceived ease or difficulty of engaging in pro-environmental activities, such as garbage sorting and management, which depend on the availability of resources and opportunities. BC is analogous to PBC in the TPB, a cognitive theory that posits that an individual's desire to participate in a given activity might anticipate their choice to engage in that conduct. TPB has been used for various pro-environmental activities, including garbage sorting and management and environmental protection pledges [12,85].

4.5. Perceived Environmental Behavioral Concern and Plastic Avoidance Behavioral Intention

The hypothesis of PREC positively and significantly influencing PABI (H_{05}) is accepted as $\beta = 0.11$ with p-value < 0.10. This confirms that PREC has a significant impact on plastic avoidance behavioral concerns. The PREC on PABI implies that the more individuals are concerned about the environment, the more likely they are to avoid plastic use or produce plastic waste. This result is supported by Saari et al. [27] that environmental concern significantly affects behavioral intention. The PREC might influence behavioral choice due to social norms and societal pressure to reduce plastic waste [56]. Moreover, PREC influences how households evaluate the costs and benefits of reducing plastic waste for themselves and the environment [15,56]. In addition, PREC affects the PABI because individuals perceive their ability and confidence to reduce plastic waste and also depends on how they perceive overcoming barriers and challenges related to plastic avoidance. Media communications have played a pivotal role in creating awareness and propagating plastic waste's concerns, adverse impacts, and solutions to avoid or reduce plastic waste. Attitude is another driving force, due to which PREC drives the behavioral intention of the individual to reduce plastic waste. In this regard, PREC, based on individuals' beliefs, can affect how individuals formulate positive or negative assessments to minimize plastic waste [15,56].

4.6. Perceived Environmental Behavioral Concern and Single-Use Plastic Avoidance Behavior

The results of the SEM model show that PREC affects SPAB. The PREC $\rightarrow$ SPAB is $\beta = 0.40$ (p-value $= 0.00$), indicating that the H_{06} of PREC significantly and positively influencing SPAB is accepted. The results show that people are more likely to change their consumption habits and avoid single-use plastic consumption as they become more aware of the negative environmental impacts of plastic waste. This change in consumer

behavior can benefit the environment by lowering the quantity of plastic waste that enters landfills and the environment. Customers are more inclined to minimize their use of plastic and choose more environmentally friendly options when they are more aware of these negative impacts. This may entail using reusable items such as bags, water bottles, and straws made of metal or bamboo, which are gaining popularity as more people become environmentally concerned. The findings emphasize the significance of increasing public awareness about the adverse effects of plastic waste on the ecosystem and environmental health. The results of our study align with prior research that indicates how environmental concerns can impact a consumer's behavior and perspective regarding plastic usage [50].

4.7. Plastic Avoidance Behavioral Intension and Single-Use Plastic Avoidance Behavior

The SEM model's findings are consistent with hypothesis H_{07}: that PABI has a favorable impact on the avoidance of single-use plastics (SPAB). This indicates that customers are more likely to behave accordingly and refrain from using throwaway plastic items such as bags, bottles, and straws when they strongly desire to minimize their plastic usage. At the level of 0.01, this impact is moderately and significantly significant, as the $\beta = 0.19$ (p-value < 0.01). This result agrees with previous research regarding behavioral intentions and behavior, indicating that behavioral intention is an essential predictor of actual behavior, particularly when it is impacted by environmental concerns, social norms, and self-efficacy [52,56,82]. Ting et al. [39] also support the hypothesis that behavioral intention positively and significantly affects behavior. Hence, by emphasizing the advantages of avoiding plastic, the societal expectations and support for this behavior, as well as the individual capacity and confidence to conduct it, environmental communicators and educators should work to raise consumers' desire to decrease plastic waste.

4.8. Policy Intervention, Plastic Avoidance Behavioral Intention, and Single-Use Plastic Avoidance Behavior

Policy intervention is an essential factor that may influence the pro-environmental behavior of the public regarding plastic use. PI has been found to positively and significantly impact plastic avoidance behavioral intentions $\beta = 0.32$ and p-value $= 0.00$) (Table 7). This supports our hypothesis (H_{08}) that PI affects plastic avoidance behavioral intention. PIs impact the intentions of the residents to avoid plastic by offering incentives or disincentives to limit their plastic usage and waste. In this regard, governmental interventions such as taxes, deposit-refund systems, and single-use plastic bans might improve consumers' motivation to avoid plastic packaging [15]. Our findings are also supported by the results of Wang et al. [33] which show that perceived policy effectiveness positively affects the environmental behavior of the residents. The findings of Ali et al. [34] support the our findings that policy intervention is necessary to ensure environmental sustainability. Hayat et al. [4] also recommend PI by the government in terms of a ban on plastic behavioral intention. Since PI influences plastic avoidance behavioral intention, the latter significantly impacts single-use plastic avoidance behavior. It is concluded that PI strongly influences single-use plastic avoidance behavior through the plastic avoidance behavioral intention channel, whereas some studies also showed that the effectiveness of PI on behavioral intention might vary according to the behavior type and the context. For instance, Yang et al. [86] revealed no significant effect of PI on the energy-saving behavioral intention of college students. These findings provide strong reasons to believe that PI may interact with other elements, such as attitude, knowledge, and implementation intention. Still, it may not be sufficient to affect behavioral intention.

Table 7. Hypothesis testing.

Hypotheses	Path	β	S.E.	C.R.	*p*-Value	Decision
H_{01}	ATT → PABI	0.13	0.051	2.51	0.010	Accepted
H_{02}	ATT → PREC	0.064	0.051	1.25	0.209	Rejected
H_{03}	SN → PREC	0.22	0.064	3.38	0.000	Accepted
H_{04}	PBC → PABI	0.28	0.059	4.83	0.000	Accepted
H_{05}	PREC → PABI	0.11	0.060	1.89	0.050	Accepted
H_{06}	PREC → SPAB	0.40	0.060	5.82	0.000	Accepted
H_{07}	PABI → SPAB	0.19	0.053	3.54	0.000	Accepted
H_{08}	PI → PABI	0.32	0.055	5.78	0.000	Accepted
H_{09}	PI → PREC	0.17	0.055	3.14	0.000	Accepted

4.9. Policy Intervention, Plastic-Related Environmental Behavioral Concern, and Single-Use Plastic Avoidance Behavior

The results of the SEM model estimations in Table 7 also support the null hypothesis that PI strongly influences plastic-related environmental and behavioral concern. The $\beta = 0.17$ with p-value $= 0.00$ for PI → PREC, which confirms the acceptance of H_{09}. The PI influences SPAB through two channels. One channel through which PI impacts SPAB is PREC, i.e., PI è PREC è SPAB. The other channel is through PABI, which is PI è PABI è SPAB PI, can influence plastic-related environmental and behavioral issues by encouraging alternatives to plastic, creating incentives or disincentives for plastic use and disposal, and raising knowledge of the detrimental impacts of plastic pollution. For instance, governmental interventions, including taxes, deposit-refund programs, bans on single-use plastic, and awareness campaigns, can raise environmental awareness and inspire the public to reduce plastic use and waste [42]. PI in terms of plastic bag tax enormously decreases plastic bag consumption and creates a tremendous increase in the consumption of reusable or biodegradable bags [32]. According to a different study, regulatory changes, including restrictions on plastic additives, requirements for biodegradable polymers, and increased producer accountability, can lessen the adverse impacts of plastics on the environment and the climate throughout their lifetimes. Nevertheless, obstacles to policy involvement include a lack of enforcement, opposition from the general public, or unforeseen consequences [87].

5. Conclusions

This study aimed to examine the behavioral determinants of single-use plastic avoidance behavior in the selected study area of Jiangsu Province, China. The study examined how attitude, SNs, and perceived behavioral control influence plastic avoidance behavioral intention and plastic-related environmental and behavioral concerns that finally determine single-use plastic avoidance behavior. In addition, the study also considered how PI affects PABI and PREC. The data were collected using an online questionnaire survey in which 421 valid responses were used for SEM model estimations. The results show that attitude positively affects PABI, which strongly influences SPAB. However, the attitude positively influences PREC, but the influence is insignificant. However, PREC positively and strongly influences SPAB, whereas SNs also positively impact the former. In addition, the estimations also reveal that PI plays a pivotal role in determining SPAB through the channels of PABI and PREC. The impact of PI on PABI and PREC is positive and significant.

The findings of the study Imply that educational initiatives, neighborhood gatherings, community engagement, and public awareness efforts can help households better understand the value of avoiding plastic and its detrimental environmental effects. Incentivizing households to reduce their plastic usage can encourage them to take action. Examples of incentives include discounts for reusable containers or bags and rewards for participating in plastic recycling programs. The Chinese government can impose regulations, such as levying fees on plastic bags or banning single-use items, to promote plastic avoidance. This will encourage people to avoid using plastic and reduce the plastic waste households

generate. Collaborating with companies and community groups can help spread the word about plastic avoidance and inspire households to take action. This may involve partnering with local retailers to promote reusable bags or containers, or organizing clean-up activities with community organizations. Highlighting households that have successfully reduced their plastic usage can serve as examples for others. This can be achieved through social media campaigns or public forums that showcase the achievements of these households.

The study results imply that PI is essential to minimizing single-use plastic usage in China. Policymakers should develop and execute regulations that address attitudes, SNs, and perceived behavioral control, as these elements impact their intention and concern for plastic avoidance behavior. Policies include public awareness campaigns, social norm nudges, incentives or disincentives, and infrastructure development for plastic alternatives. In this regard, the government should frame innovative environmental education strategies to educate the public about environmental issues, their remedies, and the impact of individual behavior. Furthermore, using social media platforms would help promote pro-environmental behavior and adopt cultural values that support environmental conservation. In this way, policymakers can foster a more environmentally conscious attitude and behavior among residents, which would be productive in lowering the negative environmental consequences of single-use plastic.

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