PSYCHOLOGICAL AND BEHAVIORAL DECISION MAKING OF GREEN CONSUMPTION

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PSYCHOLOGICAL AND BEHAVIORAL DECISION MAKING OF GREEN CONSUMPTION

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Factors Affecting Green Agricultural Production Financing Behavior in Heilongjiang Family Farms: A Structural Equation Modeling Approach

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Adhering to large-scale agricultural operations is one of the basic ways to develop green agriculture, and it is also an inevitable choice for the development of modern agriculture in the country. Among them, as a major agricultural production province in China, the development of family farms in Heilongjiang Province has a significant impact on green agriculture. Based on the theory of planned behavior (TPB), this study takes the 222-demonstration bases of family farms evaluated in Heilongjiang Province in 2019 as samples and constructs a structural equation model (SEM) to discuss the influence of participation in the family farms in green agricultural production financing behavior in-depth based on directional design, distribution, recycling, and sorting out questionnaires. The research found that the financing willingness of the farmers is determined by the attitude, subjective norms, and perceived behavior system of the family farm manager, and the financing willingness of the farmers and perceived behavioral control are determined by the financing behavior of the farmers. Among them, attitudes, subjective norms, and perceived behavioral control have a significant positive impact on financing intention and have a further effect on financing behavior. Financing willingness and perceived behavioral control have a direct effect on financial behavior and have a significant positive effect on it. This article aims to improve and enhance the financing environment for family farms to participate in green agriculture, to increase the enthusiasm of the new agricultural operators to participate in green agriculture.

Keywords: family farm, green agricultural production, financing behavior, theory of planned behavior, SEM

INTRODUCTION

China is a big agricultural country, and agriculture has always been in an important position in the economic development of China. Especially since the reform and opening-up, the agriculture of China has developed rapidly and experienced a series of major changes from collectivization to marketization, and small-scale peasant economy to a large-scale operation. However, due

to many years of household contract responsibility system in China, coupled with insufficient social security, unclear land property rights, and other factors, the phenomenon of agricultural industry decentralization is serious (Ling et al., 2015). At the same time, it also brings a variety of environmental consequences that cannot be ignored (Chen et al., 2017; Shen et al., 2018; Liu Y. F. et al., 2020). Therefore, promoting agricultural modernization is of great significance to the sustainable development of agriculture of China, among which, insisting on large-scale agricultural management is one of the basic ways (Wan et al., 2018; Zhang et al., 2018).

The family farm as a new mode of large-scale operation, can effectively guarantee food security, increase the income of the farmers and narrow the gap between urban and rural, is the accelerator of agricultural economic development of China, and is also the development direction of future agricultural modernization. It not only promotes the process of agricultural commercialization, makes more scale and intensive agricultural production and operation but also contributes to improving the overall level of the agriculture (Mao et al., 2014; Vliet et al., 2015; Zhou et al., 2015; Graeub et al., 2016; Lowder et al., 2016; Veronika and Johannes, 2021). Green agriculture is based on "green environment," "green technology," and "green products," which is transformed into a new agricultural development mode based on traditional agriculture. From the connotation of green agriculture, scholars mainly explain green agriculture from two perspectives. The first is that green agriculture pays full attention to the relationship between man and nature and pays more attention to the harmonious development of man and nature (Ghadiyali and Kayasth, 2012). The second is that green agriculture should follow the environmental law, make rational use of agricultural resources, and rely on green technology to realize the green transformation of agricultural economic activities (Behera, 2012). No matter from the perspective of factors of production such as land, capital, and labor, or from the point of view of product attributes and development concept, family farms are more tend to kind of green agricultural enterprises. Compared with traditional farmers, the economic strategy of the family farm is oriented to consumers, the market, and the future. It emphasizes more enterprise and scale management, pays more attention to the brand marketing concept and agricultural product certification, and, therefore, attaches more importance to the development of family farm green development (Gao et al., 2017a).

However, the family farms are still in their infancy, and there are many problems in the development process (Guo, 2013; Du and Xiao, 2014). On the one hand, in the early stage of development, the operators need to savings, scale, specialization of management to lay a solid foundation, solve the unexpected needs of land circulation and scale expansion. On the other hand, rural financial institutions, as indispensable capital suppliers of new agricultural operation entities, have not been able to adapt to the new operation mode of family farms in terms of credit products and financial services, and the serious information asymmetry has caused the mismatch between credit demand and supply (Xu, 2014; Gao et al., 2017b). Therefore, the financing problem is the main dilemma faced by family farms in the process of green development, which hinders the growth of family farms to a large extent and seriously restricts the pace of agricultural modernization (Howley et al., 2014). Financial support can promote the further development of family farms by affecting farmers' psychological structure (attitude, subjective norms, perceived behavioral control) to determinine their financing behavior (King and Levine, 1993; Morck and Nakamura, 1999; Cafer and Rikoon, 2018; Stefan et al., 2018). Knis et al. (2016) divided farmers into poor type, maintenance type, and affluent type in the study, and found that among the three types of farmers, the affluent type had the strongest financing willingness, followed by the maintenance type, while the poor farmers had a very negative attitude toward borrowing from financial institutions, and their financing willingness was very weak. They said that even if they could borrow by the mortgage, they are also reluctant to mortgage with financial institutions, because they often default due to lack of integrity, and the collateral cannot be recovered, so for them, the loss of high-value collateral is greater. In addition, this study proposes that education level, income level, vocational training, and other factors can also affect the attitude of the farmers and willingness to determine their financing behavior. Hansson et al. (2012) believed that attitude is the most important psychological activity in decision-making, and farmers make cognitive choices based on attitude and subjective norms. Kuhfuss et al. (2016) also reached a similar conclusion and emphasized the influence of social norms, that is, individual behavior is easily affected by other individual behaviors. Therefore, it is very important to analyze the psychological factors that affect the financing behavior of family farms for the green development of agriculture.

Heilongjiang Province, as a major agricultural production province in China, has become the most important commodity grain production base in China, and its agricultural operation has gradually become large-scale. However, due to the relatively backward level of financial development, the financing problem of family farms in the Heilongjiang Province is more prominent. Therefore, it is of great significance to study the influencing factors of family farms participating in green agricultural production financing behavior of Heilongjiang Province to promote the sustainable development of agriculture in China.

The existing research has achieved a wealth of research results, which has laid a solid foundation for this study to research family farm financing behavior but there are still some shortcomings: First, the existing literature on agriculture mainly focuses on traditional agriculture with economic benefits, and the degree of attention to environmental protection is insufficient. Second, the research on the financing behavior of the farmers only stays at the national level, lacking the research on the financing behavior of the farmers in provinces, especially in some representative provinces. Third, the research subjects mainly focus on ordinary small-scale farmers, ignoring the important impact of the financing behavior of family farms, a new agricultural management subject, on the development of green agriculture. In addition, the existing literature in the study of financing behavior of the farmers is based on subjective consciousness to select variables and lack of necessary theoretical basis. Therefore, the contributions of this study are as follows:

first, there are many family farms in China, among which the Heilongjiang Province is a big agricultural province, and its family farm demonstration field has a typical representative role. This study takes 222 demonstration bases of family farms in Heilongjiang Province as the research object for the first time to analyze their financing behavior. Second, based on the research perspective of the demonstration base of the family farm, this study constructs the research framework of the family farm and green agricultural production. Third, based on the theory of planned behavior (TPB), this study uses TPB to test the potential psychological structure and studies the financing behavior of family farms participating in green agricultural production, and to analyze the potential factors influencing the diversification of financing behavior of family farms. At the same time, the structural equation model (SEM) is used to explore the influencing factors of participation of the family farms in green agricultural production financing behavior and put forward the countermeasures and suggestions to optimize the financing environment of the demonstration base of family farms participating in green agricultural production.

THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESIS

Theoretical Framework

Ajzen and Fishbein (1980) pointed out that rational behavior theory is a theoretical model to understand and predict human behavior. According to this theory, human is rational, and individual behavior is mainly determined by individual behavioral intention, that is, the intensity of willingness of the individual to carry out a certain behavior. Therefore, to some extent, individual behavior can be predicted by individual behavior intention, which in turn depends on individual attitudes and subjective norms. Among them, the attitude of the individual to behavior refers to the perception of the individual and evaluation of the possible results of a certain behavior; the subjective norm refers to the perception of the individual of the opinions of the important people or groups on their behavior, and the motivation to keep consistent with the opinions of these people or groups. The conceptual model of rational behavior theory is shown in **Figure 1**.

The theory of rational behavior holds that behavior is only controlled by will. However, many behaviors are not only controlled by will but also influenced by other factors. Taking family farm financing as an example, whether the farmer carries out financing is largely affected by the degree of financing willingness, but it is also restricted by subjective and objective factors such as self-owned capital, financing interest rate, education level, and financing channels. Therefore, the theory of rational behavior is not suitable to predict the behavior which is controlled by unwillingness. Therefore, the TPB is based on the theory of rational behavior, adding the element of control beliefs and perceived behavioral control (Ajzen, 1985), and using it as a substitute variable of actual constraints to predict the possibility of behavior. In addition, TPB further points out that if a behavioral intention of the person is stronger, he is more likely to make a certain behavior, that is to say, the behavioral intention is the direct precursor of a specific behavior (Ajzen and Fishbein, 2005). The specific conceptual model diagram is shown in **Figure 2**.

In view of this, this study analyzes the influencing factors of the demonstration base of family farms participating in green agricultural production financing behavior from four aspects of behavior attitude, subjective norms, perceived behavioral control, and behavior intention.

Research Hypothesis

According to the TPB, the attitude of the individual refers to the perception and evaluation of the possible results of certain behavior. TPB can not only effectively predict behavior but also provide an effective framework for behavior change (Chase, 2014). Beedell and Rehman (2000) pointed out that attitude plays a decisive role in the decision-making of the farmers. Therefore, in the process of financing decision-making, the attitude of the farmers has a significant impact on their final financing willingness. Different financing motives reflect the different views of family farmers on financing behavior. We can deduce their attitude toward financing behavior from different financing motives of family farmers. Combined with the research of Ploypailin (2021), this study evaluates the attitude of the family farm to participate in the financing behavior of green agricultural production from three aspects, namely, the expectation of family farm operators on the economic benefits of the farm operation, the expectation of green agricultural development, and the psychological expectation of the incentive policies of the government. Based on this, the hypothesis is put forward:

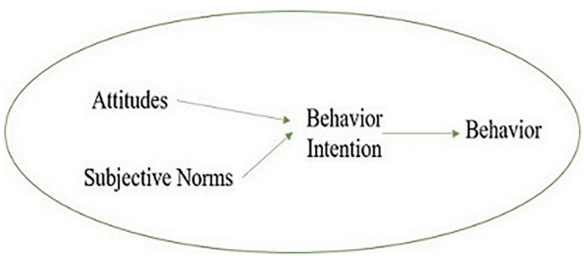

FIGURE 1 | Conceptual model of rational behavior theory.

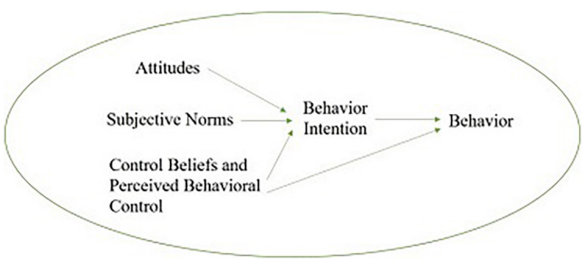

FIGURE 2 | Conceptual model of planned behavior theory.

H1: Attitude of the farmers have a significant positive impact on their willingness to participate in green agriculture financing.

Subjective norms mainly reflect the social pressure on individuals when they take certain actions. Xu et al. (2014) pointed out that if other people expect them to make a decision, the individual will also think that the action is feasible. Chen (2016) and Nadia et al. (2018) reached similar conclusions. In terms of subjective norms, the decision-making of the farmers is mainly affected by the opinions of family members, relatives and friends, and regional entrepreneurial climate (Yanto et al., 2016; Al Balushi et al., 2018). Therefore, this study measures the subjective norms of family farms participating in green agricultural production financing behavior from three aspects, namely, whether family members support it, whether relatives and friends support it, and the financing atmosphere in the region. Based on this, the hypothesis is put forward:

H2: Subjective norms of the farmers have a significant positive impact on their willingness to participate in green agriculture financing.

Perceptual behavioral control can not only affect the behavior intention of the individual indirectly but also directly (Ajzen, 1991, 2005). Taylor and Todd (1995) believed that there is a positive relationship between perceived behavior control and behavior intention. Farrell et al. (2016) reached a similar conclusion and pointed out that perceived behavior control is one of the important factors affecting decision-making. Therefore, a comprehensive analysis of the losses and benefits obtained by financing behavior of the farmers is not only conducive to the correct judgment of financing behavior of the farmers choice but also conducive to the in-depth discussion of the researchers on the motivation mechanism of financing behavior. According to the cost-benefit theory, the cost of participation of the farmers in green agriculture financing consists of direct cost and indirect cost. The direct cost mainly includes three aspects, namely, capital cost, time cost, and credit cost; the indirect cost mainly includes the risk cost caused by financing (Freeman et al., 2014; Bergstrom and Randall, 2016). In this study, the influencing factors of perceived behavioral control on the participation of the farmers in green agriculture financing can be explained from the following four aspects, namely, the interest level of loans, the efficiency of financing, whether there is collateral, and repayment risk. In addition, the TPB theory further points out that behavior intention refers to the subjective probability of a decision-maker to make a certain behavior. The higher the probability, the greater the possibility of an individual to implement the behavior. In other words, the willingness of the farmers to finance is an important incentive for farmers to generate financing behavior. The stronger their willingness, the more likely their financing behavior is to occur (Al Balushi et al., 2018; Ploypailin, 2021). Based on this, the hypothesis is put forward:

H3: Perceived behavioral control of the farmers has a significant positive impact on their willingness to participate in green agriculture financing.

H4: Perceived behavioral control of the farmers has a significant positive impact on their participation in green agriculture financing.

H5: The financing willingness of the farmers has a significant positive impact on their participation in green agriculture financing behavior.

MATERIALS AND METHODS

Design and Sample

Brown and Cantor (2000) proposed that a structured questionnaire can collect a relatively large amount of data in a short time, so this study uses a questionnaire survey to obtain research data. In 2019, in order to give full play to the demonstration and guidance role of farmers' family farms, Heilongjiang province adopted the procedures of county-level application for preliminary review, municipal review and verification, and expert review and identification. After being reviewed and approved by the office meeting of the director of the Provincial Agricultural Commission, 222 provincial farmers' family farm demonstration farms engaged in green agricultural production were selected in the province. In this study, 222 family farms were taken as research samples, and with the help of the Heilongjiang Provincial Department of agriculture, questionnaires were sent to them. The questionnaire (Appendix 1) consists of two parts. According to the research of Li et al. (2020), the previous part of the survey includes seven aspects, namely, gender, age, education level, operation time of the farm, annual income of the farm, annual expenditure of the farm, and whether it has been financed before; the second part, adapted from Borges et al. (2014) and Nadia et al. (2018), analyzes the influencing factors of participation of the family farms in green agriculture financing behavior from five aspects, namely, behavior attitude, subjective norms, perceived behavioral control, financing willingness, and financing behavior. Likert's five scales were used in the questionnaire, with scores of 1, 2, 3, 4, and 5 representing complete disagreement, disagreement, general agreement, basic agreement, and complete agreement (Harpe, 2015). The final formal questionnaire includes five potential variables and 18 measurement items (**Table 2**). In addition, the effective rate of the questionnaire is 100%, the samples meet the requirements of the SEM model, the research data is relatively reliable, and has a certain policy conversion value (Chen et al., 2012; Molwus et al., 2017).

Data Description and Analysis

Among the 222 demonstration farms investigated in this study (**Table 1**), 62.6% of the total sample gender of the farmers are men and 37.4% are women. It can be seen that most families are still headed by men, and there are traces of a small-scale peasant economy in rural agricultural production. The proportion of farmers over 60 years old was the highest, accounting for 34.6%, and the proportion of farmers aged 46–60 years old was the second, accounting for 24.6%, accounting for more than 50%. The proportion of children aged 31–45 and under 30 years old

TABLE 1 | Basic information of farmers interviewed.

Index	Category	Frequency	Percentage	Effective percentage	Cumulative percentage
Gender	Male	139	62.6	62.6	62.6
	Female	83	37.4	37.4	100.0
Age of farmers	<30	43	19.4	19.4	19.4
	31–45	47	21.3	21.3	40.8
	46–60	55	24.6	24.6	65.4
	>60	77	34.6	34.6	100.0
Education level of farmers	Junior high school and below	61	27.5	27.5	27.5
	High school	84	37.9	37.9	65.4
	Junior college	28	12.4	12.4	77.8
	Undergraduate	22	10.0	10.0	87.8
	Master degree or above	27	12.2	12.2	100.0
	5–10 year	55	24.8	24.8	86.9
	>10 year	29	13.1	13.1	100.0
	210–300 thousand	14	6.3	6.3	33.3
	310–400 thousand	56	25.2	25.2	58.5
	41–50 thousand	75	33.8	33.8	92.3
	>500 thousand	17	7.7	7.7	100.0
Annual farm expenditure	<50 thousand	33	14.9	14.9	14.9
	60–100 thousand	41	18.5	18.5	33.4
	110–150 thousand	77	34.7	34.7	68.1
	160–200 thousand	46	20.7	20.7	88.8
	>200 thousand	25	11.2	11.2	100.0
Has the farm ever been financed	Yes	77	34.6	34.6	34.6
	No	145	65.4	65.4	100.0

are 21.3 and 19.4%, respectively. It can be seen that the older you are, the more experienced you are in family farm production and the better the farm management. In the survey, 37.9% of the family farmers have a high school education, 27.5% have a junior high school education, and 12.4% have a junior college education. Nearly 80% of the farmers have a degree of bachelor or below. It can be seen that the family farmers generally have low education. In the survey of demonstration farms, the proportion of farms with 3–5 years of operation is the highest, accounting for 32.4%, followed by 1–3 years and 5–10 years, accounting for 29.7 and 24.8%, respectively, and the proportion of farms with more than 10 years is the lowest, accounting for 13.1%. It can be seen from the data that the operation of the family farm is a bottleneck period in about 5 years. At this time, the farm needs more financial support to expand production. If there is a continuous lack of funds, the production situation of the farm will decline year by year. According to the statistics of farm income, the middle-aged income of the demonstration farm is the most in the range of RMB 410–500 thousand, accounting for 33.8%. The income below RMB 20 thousand and 31–40 thousand rank second and third, accounting for 27.0 and 25.2%, respectively. The income above RMB 50 thousand and 21–30 thousand is the least, accounting for 7.7 and 6.3%. Among the 222 demonstration farms, more than 70% of them have an annual income of more than RMB 20 thousand. It can be seen that the income of family farms engaged in green agricultural production is still considerable. According to the survey of farm annual income, we find that 34.7% of the farms with the annual expenditure of RMB 11–15 thousand accounted for the highest proportion, while 20.7% of the farms with an annual expenditure of RMB 16–20 thousand and 11.2% of the farms with the annual expenditure of more than RMB 20 thousand accounted for the highest proportion. Nearly 70% of the annual expenditure of the farm is more than RMB 10 thousand, which indicates that the demonstration farm has a large demand for funds in the process of green agricultural production, which is also in line with the original intention of this study. Finally, in the survey on whether the farms have been financed, 65.4% of the farms have not been financed, and only 34.6% of the farms have been financed. It can be seen that there are still more farmers who have not made any financing due to various factors. On the other hand, we can also see that there is still a huge space for the development of family farms in Heilongjiang Province, and the shortage of funds is the primary problem we need to solve.

RESULTS

Reliability Analysis of the Scale

Reliability refers to the reliability of measurement results, and its significance refers to the consistency and stability of measurement values. The main methods to measure the reliability are test-retest reliability, half reliability, and internal consistency reliability. Internal consistency reliability is a commonly used method to evaluate the reliability of the scale. Cronbach's α is used to indicate the degree of reliability. Generally speaking, when the α coefficient is greater than 0.7, the reliability of the questionnaire is better (Liu J. et al., 2020).

In this study, SPSS26.0 software is used to test the reliability of the questionnaire data. As shown in **Table 2**, the overall Cronbach's α coefficient of 222 valid questionnaires is 0.846. The overall Cronbach's α coefficients of behavioral attitude, subjective norm, perceived behavior, financing willingness, and financing behavior were 0.803, 0.821, 0.863, 0.739, and 0.725, respectively. Therefore, the reliability of this questionnaire is good and the reliability is high.

Validity Analysis of the Scale

Validity analysis refers to the degree of a certain attribute that can be measured by a questionnaire or scale. The more the result of the questionnaire is consistent with the real situation of a certain attribute, the higher the validity of the questionnaire; on the contrary, the lower the validity of the questionnaire.

Exploratory Factor Analysis

To ensure that the data of the questionnaire can accurately measure the behavior attitude, subjective norms, and perceived behavioral control of family farm operators, this study uses SPSS26.0 to further analyze the validity of the questionnaire and uses the exploratory factor analysis method of structural validity to test the validity. The purpose of exploratory factor analysis is to reduce many observed variables to a few factors. Before exploratory factor analysis, it is necessary to test whether the survey data are suitable for factor analysis. Among them, the commonly used test indexes are kaiser-meyer-olkin (KMO) value and Bartlett's test of sphericity. The closer the KMO value is to 1, the stronger the correlation between variables. It can be seen from **Table 3** that the KMO value of the data is 0.809 (>0.8), $p = 0$ (<0.05), indicating that the observation indexes are suitable for factor analysis. Therefore, this study makes exploratory factor analysis on all topics. First, principal component analysis is used to extract common factors, and the factors with eigenvalues greater than 1 are extracted during analysis. The maximum variance method is used to rotate the factors to verify the classification of indicators and define the factors. The analysis results and gravel diagram are shown in **Table 4** and **Figure 3**. The results show that after the principal component analysis, five factors with eigenvalues greater than 1 are extracted according to the principle of eigenvalues greater than 1, which is consistent with the dimension design of the scale. The cumulative variance contribution rate is 72.39%, which can cover most of the information on the scale. It also shows that the factor extraction result is ideal.

It can be common factors of attitude, subjective norm, perceived behavioral control, financing willingness, and financing behavior have good explanatory power.

Confirmatory Factor Analysis

The purpose of Confirmatory Factor Analysis (CFA) is to test whether the observed indicators can effectively measure their corresponding factors through survey data, that is, to test the fitting ability of the preset factor model (Anderson and Gerbing, 1988). Therefore, CFA is used to test the construct validity, convergent validity, and discriminant validity of the scale. The results are shown in **Figure 4** and **Tables 5**–**7**. As shown in **Figure 4** and **Table 8**, χ^2/degree of freedom (DF) = 1.23, root mean square error of approximation (RMSEA) = 0.032, goodness-of-fit index (GFI) = 0.946, adjusted goodness-of-fit index (AGFI) = 0.92, comparative fit index (CFI) = 0.985, incremental fit index (IFI) = 0.986, tucker-lewis index (TLI) = 0.981, it shows that the CFA model has a good fit, and all indicators are within the standard range.

As shown in **Table 9**, the standardized factor load coefficient values of each observation index of convergent validity on its corresponding latent variables are greater than 0.5, the combined reliability CR values of each variable are greater than 0.7, and the average variance extraction (AVE) values of each variable are greater than 0.5, which meet the standard requirements of convergent validity. Therefore, the scale has good convergent validity.

It can be seen from **Table 5** that the AVE square root of each latent variable in the discriminant validity test is greater than the correlation coefficient with other latent variables, which indicates that there is good discrimination between the observation indexes measuring different latent variables, and the discriminant validity of the scale in this study has also been effectively guaranteed.

To sum up, it shows that the sample quality of this survey is good, the data is more effective and the answer of the respondents is reliable.

Test of the Structural Model

In this study, AMOS22.0 is used to estimate and test the (SEM) established in this study by using the maximum likelihood method, to ensure that the fitting index of each SEM meets the

TABLE 2 | Reliability test results.

Dimension	Subject	Global Cronbach's α	Global Cronbach's alpha
Attitude	Q1	0.803	0.846
	Q2		
	Q3		
Subjective norm	Q4	0.821	
	Q5		
	Q6		
Perceived behavior control	Q7	0.863	
	Q8		
	Q9		
	Q10		
Financing willingness	Q11	0.739	
	Q12		
	Q13		
Financing behavior	Q14	0.725	
	Q15		

TABLE 3 | KMO and Bartlett test results.

KMO		0.809
Bartlett sphericity test	Approximate χ^2	1317.460
	Degree of freedom	105
	Significance	0.000

TABLE 4 | Results of principal component analysis.

Component	Initial eigenvalue			Extract the load sum of squares			Sum of squares of rotational loads		
	Total	Variance percentage	Accumulate %	Total	Variance percentage	Accumulate %	Total	Variance percentage	Accumulate %
1	4.9	32.669	32.669	4.9	32.669	32.669	2.871	19.139	19.139
2	1.952	13.01	45.679	1.952	13.01	45.679	2.199	14.657	33.796
3	1.679	11.195	56.874	1.679	11.195	56.874	2.189	14.595	48.391
4	1.245	8.298	65.172	1.245	8.298	65.172	2.037	13.577	61.968
5	1.082	7.216	72.388	1.082	7.216	72.388	1.563	10.42	72.388

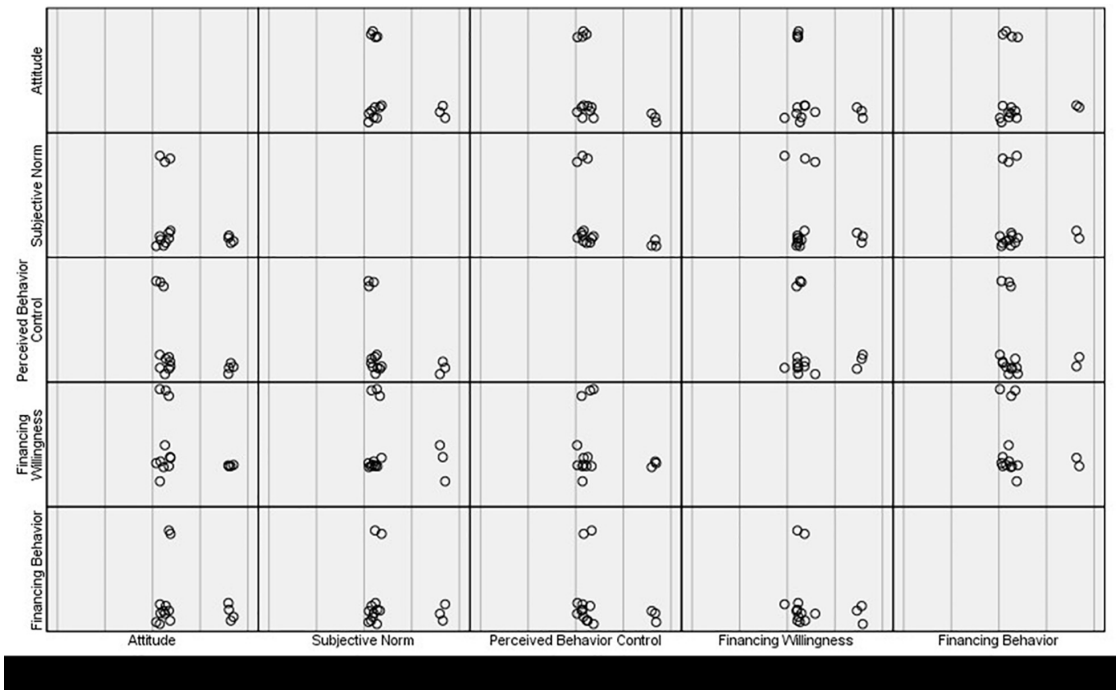

FIGURE 3 | Matrix diagram.

fitting evaluation standard. The model implementation results are shown in **Figure 5**.

According to **Table 6**, the absolute fitting index CMIN/DF = 1.298 (<3), the relative fitting index GFI = 0.942 (>0.9), AGFI = 0.915 (>0.9), RMSEA = 0.037 (<0.05), and all the indexes fit well; in the value-added fitting index, NFI = 0.921, RFI = 0.900, IFI = 0.981, CFI = 0.980 are all greater than the critical value of 0.9, which fully meets the fitting standard; in the simple fitting index, NFI = 0.921, RFI = 0.900, IFI = 0.981, CFI = 0.980 are all greater than the critical value of 0.9, PGFI = 0.644 (>0.5), PNFI = 0.720 (>0.5), all meet the standard.

Path Analysis

This study uses path analysis to further verify the above hypothesis (**Table 7**). As can be seen from the results, the standardized path coefficient is 0.228 ($p < 0.001$), which is significant at the significant level of 1%, indicating that the attitude of family farmers has a significant positive impact on their financing willingness. The path coefficient of subjective norms affecting financing willingness is 0.206 ($p < 0.001$), which is significant at a 1% significance level, showing that the subjective norms of family farmers have a significant positive

TABLE 5 | Results of discriminant validity analysis.

	Perceived behavior control	Subjective norm	Attitude	Financing willingness	Financing behavior
Perceived behavior control	0.763				
Subjective norm	0.150	0.779			
Attitude	0.120	0.215***	0.783		
Financing willingness	0.151***	0.195***	0.138***	0.700	
Financing behavior	0.171***	0.250***	0.217***	0.159***	0.760

*** *denote statistical significance at the 1% significance levels.*

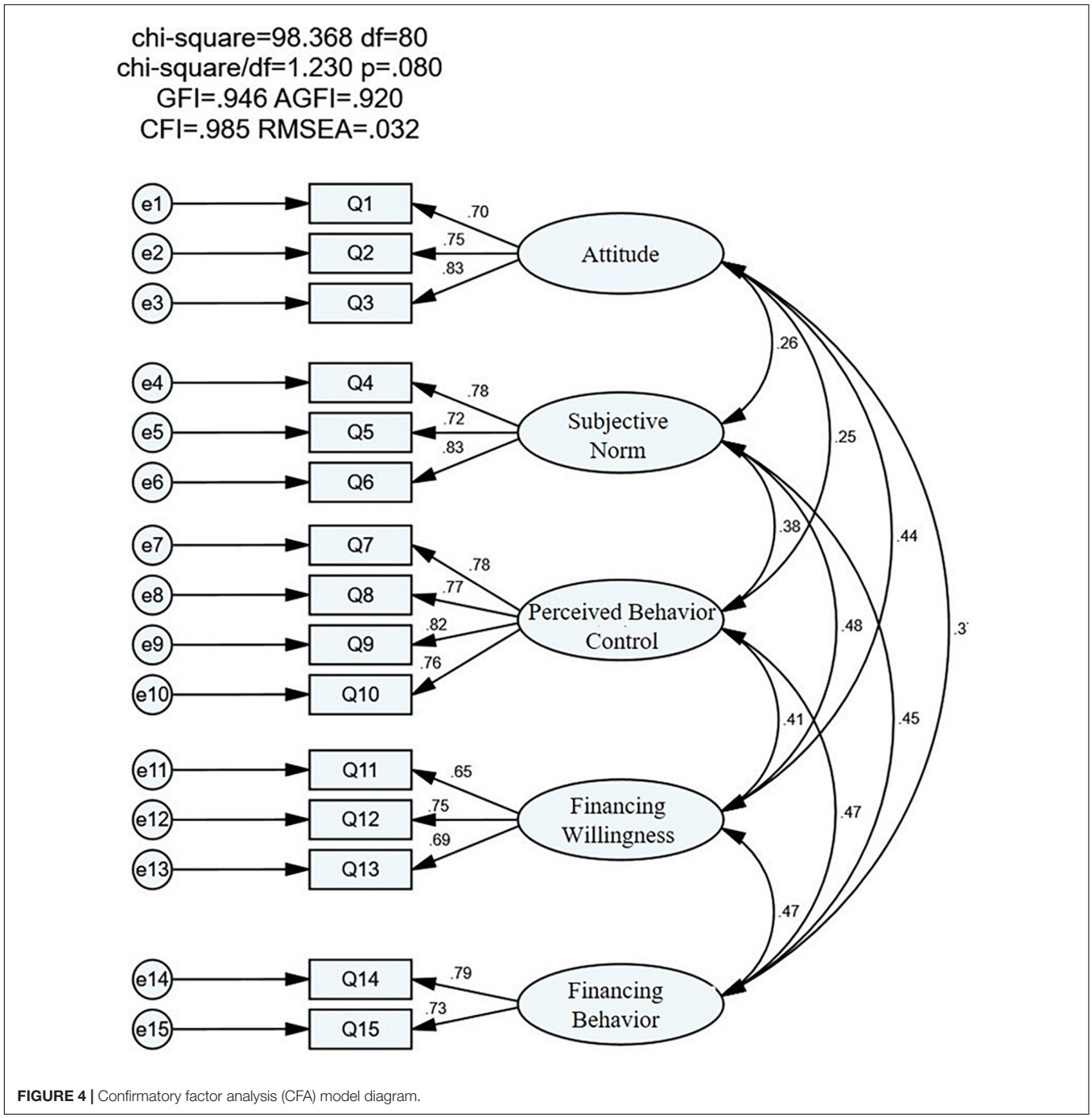

FIGURE 4 | Confirmatory factor analysis (CFA) model diagram.

TABLE 6 | Fitting results of structural equation model.

Classification	Absolute fitting index				Value added fitting index				Parsimony fit index	
Index	CMIN/DF	GFI	AGFI	RMSEA	NFI	RFI	IFI	CFI	PCFI	PNFI
Fitting value	1.298	0.942	0.915	0.037	0.921	0.899	0.981	0.980	0.766	0.720

impact on their financing willingness. The path coefficient of perceived behavior influencing financing willingness is 0.140, $p = 0.022$ (<0.05), which indicates that the perceived behavior of family farmers has a significant positive impact on their financing willingness. The path coefficient of financing willingness influencing financing behavior is 0.522 ($p < 0.001$),

TABLE 7 | Path analysis.

Path			Standardization coefficient	C.R.	*p*
Financing willingness	←	Attitude	0.228	3.648	***
Financing willingness	←	Subjective norm	0.206	3.762	***
Financing willingness	←	Perceived behavior control	0.140	2.287	0.022
Financing willingness	←	Financing willingness	0.522	3.860	***
Financing behavior	←	Perceived behavior control	0.313	3.558	***

*** *denote statistical significance at the 1% significance levels.*

indicating that the financing willingness of family farmers has a significant positive impact on their financing behavior. The path coefficient of perceived behavior influencing financing behavior is 0.313, and $p < 0.001$, which shows that the perceived behavior of family farmers has a significant positive impact on their financing behavior.

Mediating Effect Test

In addition, considering that there may be mediating effect in the influencing factors of participation of the family farmers in green agricultural production financing behavior, this study uses AMOS22.0 software to conduct a further study by bootstrap test. Among them, the random sample set is 2,000, and the confidence interval (CI) is 95%. According to **Table 10**, the CI of behavior attitude → financing willingness → financing behavior is [0.033, 0.250], and the mediating effect coefficient is 0.119. The CI of subjective norm → financing willingness → financing behavior is [0.027, 0.247], and the mediating effect coefficient was 0.107. The CI of perceived behavioral control → financing willingness → financing behavior is [0.001, 0.221], and the mediating effect coefficient was 0.073. The CIs of the three paths are both positive numbers, excluding 0. Therefore, the mediating effect of financing willingness on the participation of the household farmers in green agricultural production financing behavior is significant.

DISCUSSION

The attitude of family farm operators has a significant positive impact on their willingness to participate in green agricultural production financing, thus affecting the financing behavior of the farmers (Läpple and Kelley, 2013; Veronika et al., 2020) used the discrete choice experiment to investigate the willingness of German farmers to accept sustainability standards, and found that the behavior and attitude of the farmers have a significant impact on the final decision-making. In the TPB, the process of attitude formation is the process of attitude acquisition. The relationship between attitude and behavior is extremely close, and there is a high degree of consistency between individual attitude and behavior. Therefore, if the family farmers think that financing can obtain more income, financing is more conducive to the development of green agriculture, and government policies are more conducive to their financing, then the willingness of the farmers to finance is stronger, which is easier to produce financing behavior.

The subjective norms of family farm operators also have a significant positive impact on their willingness to participate in green agricultural production financing, thus affecting the financing behavior of the farmers. The observation of Hansson et al. (2012) also supports this result, that is, the psychological structure of the people can affect the decision-making of the farmers. Human beings are social animals with social attributes. Living in a society, people cannot escape from social life and the influence of the surrounding environment on their behavior, that is, there will be a certain "neighbor effect" (Chabé-Ferret et al., 2018; Le Coent et al., 2018). The family members, relatives, and friends of farmers, and the cultural atmosphere of their living environment are all important variables that affect the financing willingness of the farmers. In other words, subjective norms of the farmers change their financing willingness through the process of internalization and identification, thus affecting their financing behavior. Therefore, the more support a farmer gets from his family and friends, the stronger the financing atmosphere in his area, the stronger the willingness of the farmer to finance, and the easier it is to generate financing behavior (Nadia et al., 2018).

TABLE 8 | Results of confirmatory factor analysis.

Index	X2/df	RMSEA	GFI	AGFI	CFI	IFI	TLI
	1.23	0.032	0.946	0.92	0.985	0.986	0.981

TABLE 9 | Standardized regression coefficients and standard errors for latent variable pathways.

Path			Estimate	AVE	CR
Q1	←	Attitude	0.701	0.5819	0.806
Q2	←	Attitude	0.752		
Q3	←	Attitude	0.83		
Q4	←	Subjective norm	0.781	0.6071	0.8221
Q5	←	Subjective norm	0.724		
Q6	←	Subjective norm	0.829		
Q7	←	Perceived behavior control	0.777	0.6136	0.8639
Q8	←	Perceived behavior control	0.773		
Q9	←	Perceived behavior control	0.82		
Q10	←	Perceived behavior control	0.762		
Q11	←	Financing willingness	0.653	0.4897	0.7416
Q12	←	Financing willingness	0.749		
Q13	←	Financing willingness	0.694		
Q14	←	Financing behavior	0.788	0.5769	0.7314
Q15	←	Financing behavior	0.73		

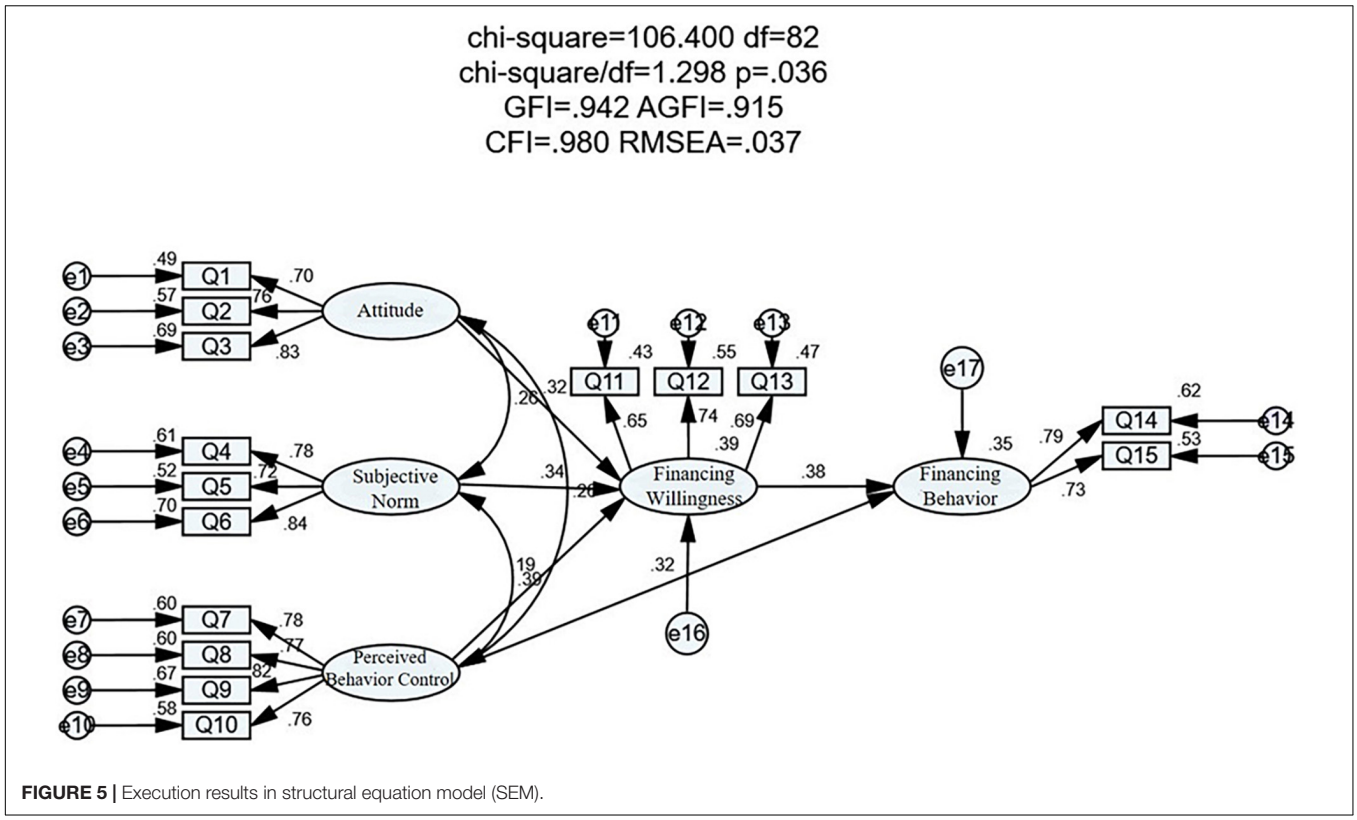

FIGURE 5 | Execution results in structural equation model (SEM).

TABLE 10 | Mediating effect test results.

Path	Standardized path coefficient	Bootstrap		*p*
		Lower	Upper	
Attitude → Financing willingness → Financing behavior	0.119	0.033	0.250	0.003
Subjective norm → Financing willingness → Financing behavior	0.107	0.027	0.247	0.005
Perceived behavior control → Financing willingness → Financing behavior	0.073	0.001	0.221	0.005

Perceived behavioral control of the farmers has a significant impact on financing willingness and financing behavior. On the one hand, perceived behavioral control factors indirectly affect financing behavior by influencing financing willingness. On the other hand, perceived behavioral control can directly affect financing behavior. In this study, perceived behavioral control refers to the subjective judgment of family farm operators on whether they can carry out financing behavior. It reflects the perception of the farmers of individual internal factors and environmental external factors of the specific goal of financing behavior. The stronger the perceived behavioral control of the farmers, the stronger the financing willingness, and the easier it is to carry out financing behavior. Therefore, we can further find that the lower the interest level of the loan, the higher the financing efficiency, the more sufficient the collateral, and the smaller the repayment risk, the stronger perceived behavioral control. On the one hand, it directly affects their financing behavior, on the other hand, it indirectly affects their financing behavior by affecting their financing willingness. The interaction of the two is more likely to lead to financing behavior (Liu et al., 2018).

CONCLUSION AND IMPLICATION

In this study, 222 provincial household farm demonstration farms selected by Heilongjiang Province in 2019 are selected as research samples, and questionnaires are designed, distributed, and collected. Based on the SEM, the influencing factors of household farm demonstration farms participating in green agricultural production financing behavior in Heilongjiang Province are investigated. The results show that the attitude and subjective norms of family farm operators have a significant positive impact on their willingness to participate in green agricultural production financing, and further indirectly affect the financing behavior of the farmers. Perceived behavioral control of the farmers has a significant impact on financing willingness and financing behavior. On the one hand, perceived behavioral control factors indirectly affect financing behavior by

influencing financing willingness; on the other hand, perceived behavioral control can directly affect financing behavior.

Based on the above conclusions, we propose the following suggestions:

In terms of national policies, we should establish and improve the agricultural policy financial system, improve the farmland financial system, and promote the financial needs of farmers. In addition, the government should increase the support for informal financial channels, give preferential policies, speed up the development of various forms of rural financial organizations, and guide and regulate informal financing, so that the formal financing channels and informal financing channels can coexist and accommodate each other, and improve the new rural financial system.

For financial institutions, it is necessary to optimize the credit business process, simplify the loan operation procedures, and improve the efficiency of loan processing of the farmers. On the one hand, it is to simplify the process of handling business, strengthen the standardized operation of a business, and reduce the time cost of financing. On the other hand, in the process of customer business investigation, we should deepen the analysis of potential needs of the customers according to their asset status, business situation, and industry characteristics, fully consider the expected development needs of customers, improve the investigation contents of credit matters, report multiple matters at the same time, and conduct a combined investigation on credit business matters, which can effectively reduce the repeated investigation and report of multiple credit businesses for a single customer, and improve the efficiency of business operation. At the same time, agricultural land financial institutions should carry out policy financial business with the support of the state, and provide long-term and low-interest loans to farmers through the innovation of financial products and financial instruments, to realize the strategic goal of agricultural modernization. Especially for Heilongjiang Province, focusing on the national and provincial "three rural" policy guidance, combined with the characteristics of agricultural development in Heilongjiang Province, we should innovate the personal credit products of three rural areas, and gradually establish the personal credit product system of three rural areas suitable for family farms. We have innovated loan varieties suitable for Heilongjiang family farm and other new agricultural business entities designed a set of risk controllable and easy to operate process specifications for serving new agricultural business entities, and made full use of order agriculture, "company + farmers," "credit company + farmers," "leading enterprise + base," and other forms to innovate family farm loan business mode.

Family farm operators promote the quality of farmers by building training centers for the farmers or combining agricultural colleges and family farms. Enhance the subjective initiative of operators to learn financial knowledge, so that operators can actively understand the financial information about benefiting farmers launched by banks and cooperatives in various regions, and pay attention to credit policies conducive to their financing from various aspects and channels. At the same time, it is necessary to cultivate the sense of integrity of the operators. After obtaining the loan, the operators must strictly use the special funds for a special purpose, to achieve a "win-win" result for both sides.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

HW: conceptualization and formal analysis. SZ: writing the original draft. JG: conceptualization. YF: validation. All authors contributed to the article and approved the submitted version.

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Influence Mechanism of Energy Efficiency Label on Consumers' Purchasing Behavior of Energy-Saving Household Appliances

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Mandatory energy efficiency label is an effective way to change consumers' consumption habits and guide them to buy energy-saving appliances. However, few studies concerned about the impact of energy efficiency label on consumers' purchasing behavior. Based on the theory of planned behavior (TPB), social cognitive theory and signaling theory, this paper constructs a theoretical model of the effect of the energy label on consumers' purchasing behavior of energy-saving household appliances. The survey data of 396 household appliance consumers in Mianyang City, China, are collected by the interception method, and the theoretical model is tested by structural equation modeling (SEM). Empirical results of this study indicate that consumers' cognition and perceived value of energy efficiency label significantly affect label trust. Perceived value has a significant impact on consumers' purchasing behavior of energy-saving appliances, while label cognition and label trust indirectly influence consumers' purchasing behavior through the intermediary variable of purchase intention. External environmental factors such as publicity and education as well as subjective norms affect consumers' actual purchasing behavior through the intermediary effect of purchase intention. This study provides important insights into the policy intervention measures to promote consumers' purchasing behavior of energy-saving appliances.

Keywords: energy efficiency label, energy-saving household appliances, purchasing behavior, influence mechanism, intermediary effect

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INTRODUCTION

Energy consumption of household appliances is an important component of household energy consumption in China. About 70% of household carbon dioxide emissions result from household appliances, of which refrigerators, air conditioners and televisions account for 50% (Guo et al., 2018). By guiding consumers to buy energy-saving appliances, household energy consumption can be effectively reduced, which is an effective method to achieve the target of energy conservation and emission reduction (Song et al., 2019a; Wang Z. et al., 2019; Zhang et al., 2020). Therefore,

governments all over the world, including China, have realized the importance of promoting energy-saving appliances and guiding consumers to use them, and have issued various supportive policies, among which the most effective is the informative energy efficiency label program. In 1975, the United States first proposed the energy efficiency labeling system in The Energy Policy and Conservation Act. Canada began to implement the mandatory energy efficiency labeling (Energy Guide) in 1978. China's household appliance industry formally implemented the mandatory energy efficiency labeling system in 2005, and issued a new version of The Energy Efficiency Label Management Measures in 2016. By July 2020, the catalog of products with energy efficiency label has been updated to the 15th batch. The implementation of this system has accelerated the elimination of low efficiency household appliances. The application of energy efficiency label is becoming more and more popular in the home appliance market all over the world (Weil and McMahon, 2003). Most of the research results in this field show that energy efficiency label can have a positive impact on consumers' home appliance purchasing behavior and play a certain role in reducing energy consumption (Shen and Saijo, 2009; Sammer and Wüstenhagen, 2010; Ward et al., 2011). Therefore, energy efficiency label is a common tool to reduce energy consumption of household appliances in many countries around the world (Mahlia and Saidur, 2010; Anna et al., 2018), which provides additional information about product characteristics for consumers and especially plays a crucial role in shaping consumers' choice of energy-saving electrical products (Zainudin et al., 2014).

Energy efficiency label provide consumers with environmental and energy information related to home appliance products and services, aiming to help consumers compare and choose more energy-efficient products (Brazil and Caulfield, 2017). At the same time, household appliance enterprises can also increase the credibility of information through the third-party certification of energy efficiency label (Vanclay et al., 2011). Studies have shown that consumers in developed countries such as Germany and Italy prefer to buy energy-efficient appliances with higher energy efficiency grades (Topolansky Barbe et al., 2013; Tan et al., 2016). Sammer and Wüstenhagen's research has found that consumers prefer to choose energy-saving products with higher energy efficiency when purchasing home appliances (Sammer and Wüstenhagen, 2010). The Energy Star labeling program in the United States has been successful since its implementation. Scholars have studied consumers' intention to buy refrigerators under the Energy Star policy, and found that consumers are willing to pay 249.8–349.3 US dollars for refrigerators with energy star label (Murray and Mills, 2011). A study based on a large online retailer in Switzerland has found that the energy efficiency label can increase the sales of energy-saving appliances, and that the impact of different designs of label on consumers' purchase decisions is similar (Marcel and Renate, 2018). Chinese consumers are willing to buy energy-saving household appliances with higher energy efficiency, but they have different choices toward conditioners and washing machines, that is, they tend to buy energy-saving refrigerators rather than energy-saving air-conditioners (Shen and Saijo, 2009).

Whether consumers concerned about energy efficiency label is a key factor affecting their purchasing behavior of energy-saving appliances. When consumers trust the energy efficiency label of products and they have had the intention to purchase energy-saving appliances, they often pay more attention to energy efficiency labels (Issock et al., 2018). Similarly, some research results show that the decisive factor of the effectiveness of the Energy Star labeling program is whether consumers pay attention to energy efficiency labels. If consumers are willing to know about them, they are likely to respond to the information on the labels and change their purchasing behavior (Murray and Mills, 2011). The results of an online survey in Brunei also show that the energy efficiency labeling system for air conditioning systems can encourage manufacturers to improve their system energy efficiency, and the energy efficiency labeling system which is developed based on consumers' concern has a significant impact on reducing the overall energy consumption of the country (Abas and Mahlia, 2018). When consumers are willing to pay attention to energy efficiency label and can respond to the information on them, they prefer to buy energy-saving appliances with higher energy efficiency grade and level. However, a large-scale survey of more than 20,000 German households by Mills and Schleich (2010) shows that when consumers lack an understanding of energy efficiency label, there may be large deviations in the estimation of the utilization rate of energy-saving appliances and their potential determinants. Consumers' response to energy efficiency label is also affected by the label type. Generally speaking, consumers pay more attention to and trust in the mandatory labeling scheme, and they are more likely to change their purchasing behavior in response to the information on energy efficiency label. In this case, energy efficiency label can help consumers make the best choice for household appliances with different energy efficiency grades (Bernard et al., 2015).

A very small number of scholars have come up with research that contradicts previous studies. Zainudin's study found that energy efficiency label is negatively correlated with green purchasing behavior, and energy efficiency label has no effect on encouraging consumers to deliver good information in purchasing decisions (Zainudin et al., 2014). Similar to this research result, research evidence from South Africa shows that most consumers do not give priority to energy efficiency label when purchasing products, but take other factors into consideration (Dreyer et al., 2016).

Most studies have shown that energy efficiency label can guide consumers to buy energy-saving appliances. However, the formation of consumers' decision-making behavior is a complex process. Issues such as how energy efficiency label change consumers' purchasing behavior, what are the deep-seated psychological reasons of consumers' purchasing behavior of energy-saving appliances and what is the internal influence mechanism are worthy of further study. There are a lot of researches on the influencing factors of green consumption behavior and energy-saving behavior in academia. However, there are few achievements of researches based on energy efficiency label' influence on Chinese consumers' intention and behavior of energy-saving consumption. Therefore, based on the theory of planned behavior (TPB), social cognitive theory

and signaling theory, this paper uses the structural equation model to explore the internal influence mechanism of consumers' purchasing behavior of energy-saving household appliances.

The rest of the paper is organized as follows. Section "Theoretical Framework, Variables, and Hypothesis" introduces the theoretical framework, variables and research hypothesis used in this paper. Section "Methodology" and "Results" demonstrates the methodology and the empirical results respectively. Section "Discussion" presents the discussion. Finally, the conclusions, policy implications, limitations and perspectives are drawn in Section "Conclusions, Policy Implications, Limitations, and Perspectives."

THEORETICAL FRAMEWORK, VARIABLES, AND HYPOTHESIS

Theoretical Basis

Theory of Planned Behavior

Theory of Planned Behavior is mainly used to predict and explain the occurrence of human behaviors in specific environments (Ajzen, 1991). This theory is now one of the most widely used social psychological models to understand and predict human behavior patterns. It is based on the assumption that human beings act in the way of rational man. The core element of this theory is whether a person intends to perform a given behavior (Conner and Armitage, 1998).

TPB includes five core elements, such as behavior attitude, subjective norm, perceived behavior control, behavior intention and actual behavior. Behavioral attitude refers to a person's positive or negative attitude toward the implementation of a certain action. The formation of attitude can be explained from two levels: the important beliefs of the individual's behavior results and the evaluation of the results (Fishbein and Ajzen, 1975). Subjective norm refers to the social pressure of individuals when they take a particular behavior. This kind of pressure mainly comes from important salient individuals or groups, such as parents, spouses, friends, colleagues, etc. Subjective norm is the sum of normative belief and motivation to comply. Perceptual behavior control is the degree to which an individual perceives that it is easy or difficult to perform a particular behavior. It can influence the actual behavior indirectly by controlling behavior intention, and can also be used to predict the occurrence of actual behavior (Xu et al., 2013). Behavioral intention is the willingness of individual's subjective probability when they take a particular behavior (Fishbein and Ajzen, 1975). Behavior intention is the necessary process of any behavior performance, and it is the decision before the behavior appears. Actual behavior is the actual behavior taken by individuals.

TPB believes that an individual's behavioral intention has a significant impact on his actual behavior which has been proved by abundant scholars' research (Soorani and Ahmadvand, 2019; Zhang et al., 2019). In the past, some scholars used the measurement results of behavior intention to replace the measurement of actual behavior. However, this fuzzy substitution is controversial (Zhao et al., 2018, 2019). Therefore, one of the inspirations of TPB to this paper is that energy efficiency label should measure consumers' purchase intention and purchase behavior separately.

At the same time, TPB emphasizes that individual's behavior attitude significantly affects the occurrence of behavioral intention (Zhang et al., 2017), but the concept of behavioral attitude is too vague and difficult to measure effectively, so variables that are not easily confused and more easily measured can be selected for substitution (Paul et al., 2016; Scalco et al., 2018). For these reasons, this paper selects two variables: consumers' cognition degree and trust degree on energy efficiency label to measure consumers' behavior attitude.

In addition, TPB also shows that normative beliefs in the external social environment play a significant role in individual behavior intention (Ajzen, 1991). Although individual internal psychological factors are the important research objects of consumers' purchase behavior of energy-saving appliances, we cannot ignore the influence of social environment variables on purchase intention and behavior. Therefore, this paper selects the subjective norm dimension in TPB framework to represent the external social environment variables in the purchasing situation.

To sum up, this paper makes the following improvements based on the basic framework of TBP theory. First, we measure consumers' purchase intention and purchase behavior separately, and consider that purchase intention significantly affects purchase behavior. Secondly, consumers' attitude toward energy efficiency label has impact on their intention when they buy energy-saving appliances. This paper uses two variables of consumer's cognition and trust to define consumer's behavior and attitude. Third, the external social environment variables (subjective norms) will have a significant impact on consumers' purchase intention of energy-saving appliances.

Social Cognitive Theory

Previous studies of cognitive psychologists often ignore the effect of social environment variables on behavior. Albert Bandura, an American psychologist, proposed Social Cognitive Theory (SCT), which takes social factors into account (Bandura, 1977). The main contribution of SCT is the framework of ternary interaction theory, which includes three factors: individual, environment and behavior. It emphasizes the role of environment-individual-behavior interaction. Environmental factors include the whole social environment, such as political, economic, cultural and other environmental factors. Personal factors include individual cognition, motivation, attitude, and ability. The theory holds that, in the actual process of individual behavior, the environment and individual have the greatest influence on the behavior, and both act on the behavior together. And the environment and individual also affect each other, that is, the environment will affect the individual, and different individuals have more or less influence on the environment (Bandura, 1986, 1999, 2002, 2006).

According to the perspective of SCT, the joint influence of external environmental factors and individual internal factors should be considered in the study of consumers' purchasing behavior of energy-saving appliances (Trotta, 2018). In particular, consumers have an accumulation about environmental protection and energy knowledge. The interaction

of external social environment and individual cognition determine whether the individual's actual purchase behavior occurs. When the individual's environmental awareness is high, the external environmental factors will guide consumers to buy energy-saving household appliances with higher energy efficiency level. When the individual's sense of responsibility and environmental awareness are low, external environmental factors will not have a significant impact on consumers' actual purchase behavior (Bandura, 2002, 2006). This view is consistent with TBP theory (Valliere, 2017; Samah, 2018). TBP also emphasizes that individual behavior attitude (internal cause), behavior intention (internal cause), and subjective norm (external cause) work together on individual actual behavior. Therefore, referring to SCT, this paper selects the subjective normative dimension in TPB framework as the external social environment variables in the purchasing situation when studying the impact mechanism of energy efficiency label on consumers' purchasing behavior of energy-saving appliances.

At the same time, publicity and education of environmental protection is also selected as one of the social environmental variables in this paper, because it is of great significance to solve environmental problems permanently (Ata, 2018; Zhang et al., 2021). Strengthening publicity and education of environmental protection can effectively improve residents' awareness of environmental protection and energy conservation, and reduce household energy consumption (Yang et al., 2016; Emiru and Waktola, 2018; Yang, 2018). Many scholars have analyzed the impact of publicity and education on environmental behavior from the perspective of government intervention strategy. Some scholars clearly pointed out that the publicity of green consumption can not only convey the correct connotation of green consumption, but also improve consumers' willingness to green consumption and the knowledge level of environmental protection (Bolderdijk et al., 2013). Based on cognitive learning theory, it is found that individual cognition of green consumption and environmental knowledge have a significant impact on promoting consumers' purchase behavior of green products (Mohamed, 2007).

Finally, according to the viewpoint that environmental factors and individual factors jointly act on behavior in social cognitive theory, this paper constructs the theoretical model framework from the individual internal factors and social external factors that affect the purchase behavior of energy-saving appliances by energy efficiency label.

Signaling Theory

Under the situation of information asymmetry, Spence's signal transmission theory holds that signal can transmit unobservable attributes to different individuals, so as to alleviate the phenomenon of information asymmetry (Spence, 2002). Signal transmission theory includes three core elements: signal, signal sender, and signal receiver. It solves the problems of the uncertainty of consumption market and labor market and information asymmetry between them as well as how to transfer unobservable attributes, such as trustworthiness, among individuals.

Since trustworthiness (e.g., product quality and certification) cannot be directly observed, we have to identify it by relevant external signals (Connelly et al., 2011; Cheung et al., 2014). Consumers who come into contact with a product for the first time often try to look for various signals related to product quality to infer the real quality of the product and its comparison with other products (Xu et al., 2013). Similar to the various information tips or signals attached to products, environmental labels are a tool used by consumers to evaluate the quality and environmental impact of products (Atkinson and Rosenthal, 2014; Issock et al., 2018). Atkinson and Rosenthal (2014) used ST to study the energy-saving behavior of 213 college students in the United States. In their study, environmental label is an important marketing signal and positively affects consumers' trust in the green declaration of products. Issock et al. (2018) investigated the main drivers of consumers' concerns about energy efficiency labels in South Africa using ST and behavior attitude theory, and the results show that when buying energy efficient appliances, consumers would pay attention to energy efficiency labels if they have confidence in energy-saving certified products. Although environmental labels are important product information, many consumers tend to ignore these signals when purchasing products (Tan et al., 2016), which may be due to lack of prominent environmental label information and understanding of environmental label (Thøgersen, 2000), or lack of trust in signals of green products (Liobikien et al., 2017).

This study supports ST. Energy efficiency labels can provide consumers with important information such as product attributes, energy efficiency grade and reliability, thus effectively reducing the asymmetry of product information and enhancing consumers' product cognition or trust. Therefore, when choosing energy-saving home appliances, consumers tend to attach importance to energy efficiency label signals, perceive information such as the quality and price of energy-saving home appliances, which will influence their purchase intention and purchasing behavior.

Variables Selection

The theoretical model of this paper is not completely expanded by adding variables under the framework of TPB theory. Its core idea is to build a theoretical model framework system based on the social cognitive theory, starting with the individual internal factors and social external factors that affect the purchase behavior of energy-saving appliances by energy efficiency labels. Then based on TPB, social cognitive theory and signal transmission theory, the theoretical model variables are selected through exploratory factor analysis. Through the exploratory factor analysis of 179 valid trial survey data, it is found that the perceptual behavior control variables in the TPB framework are not in good agreement with the data we collected, so they are considered and abandoned in our theoretical framework. The selection of variables is as follows. Firstly, according to TPB and signal transmission theory, the individual internal factors based on energy efficiency labels choose three factors: cognition, trust and perceived value based on energy efficiency labels. Secondly, according to TPB and social cognitive theory, publicity and education and subjective norms are selected to

measure individual external environmental factors. In addition, it also focuses on the impact of consumers' purchase intention on purchase behavior.

Individual Internal Factors

(1) Cognitive level. Cognition can be understood as the process of recognizing, selecting, organizing and explaining the stimuli acting on individuals. Generally, consumers only pay attention to stimuli closely related to their existing needs, beliefs and attitudes. So cognitive level is defined as consumers' acceptance and interpretation of information stimuli related to external energy efficiency labels. Consumers selectively accept and interpret the stimuli related to energy efficiency labels according to individual characteristics. Therefore, there are differences in consumers' cognition of energy efficiency labels. The degree of cognition mainly includes the following three aspects: consumers' understanding of energy efficiency labels, consumers' attention to energy efficiency labels and their perception of energy labels.

(2) Trust degree. Trust degree refers to consumers' expectations on the energy efficiency and environmental information of products displayed on the energy efficiency labels (Chen et al., 2015). It mainly includes three aspects: consumers' trust degree in the cognitive institutions of energy efficiency labels, consumers' trust in the certification process of energy efficiency labels and consumers' trust in the information marked on the energy efficiency labels.

(3) Perceived value. Perceived value mainly includes perceived quality and perceived price of energy-saving household appliances. Perceived quality refers to consumers' overall evaluation of the excellence or superiority of products, which is affected by consumers' impression in advance. Perceived price is considered to be the key determinant of purchasing environmental protection products. Consumers with strong awareness of energy conservation and environmental protection are usually willing to pay more for energy conservation and environmental protection products (Testa et al., 2015). Perceived value mainly includes three aspects: consumers' perception of the quality of energy-saving household appliances, consumers' perception of the price of energy-saving household appliances and consumers' comprehensive perception of the value of energy-saving household appliances.

External Environmental Factors

(1) Publicity and education. Based on the research results of relevant scholars, publicity and education are used to represent one of the external environmental factors of society. Whether the government or household appliance enterprises publicize energy efficiency labels or energy-saving household appliances, it will have a certain impact on consumers' energy-saving behavior. Publicity and education mainly consider the following three aspects. First, consumers take the initiative to publicize the willingness of energy-saving appliances. Second, consumers' willingness to actively participate in publicity activities. Third, consumers' acceptance level of publicity and education on energy-saving household appliances.

(2) Subjective norms. The framework of TPB considers the factors of subjective norms, takes into account the influence of others on consumers' purchase behavior, and believes that subjective norms affect individuals' actual behavior by affecting their behavior intention. Subjective norms mainly consider the following three aspects: first, people who are important to consumers want them to buy. Second, the cognition of important people to consumers' purchase behavior. Third, their purchase behavior of people who are important to consumers.

(3) Purchase intention
Purchase intention refers to the possibility that consumers give priority to environmental protection products rather than traditional products when considering purchase. Consumers' attention to energy efficiency labels reflects consumers' willingness and behavior in purchasing behavior to a certain extent. It mainly consider the following three aspects: first, consumers' willingness to buy energy-saving appliances, second, consumers' willingness to recommend others to buy energy-saving appliances, and third, consumers' willingness to pay more for energy-saving appliances with higher energy efficiency.

(4) Purchase behavior
Purchase behavior is defined as the actual purchase behavior finally taken by consumers. It mainly considers the following three aspects: the premium of energy-saving household appliances compared with ordinary household appliances, the actual consumption of energy-saving household appliances and the purchase frequency of energy-saving household appliances.

Research Hypothesis

The Relationship Individual Internal Factors and Purchase Intention as Well as Purchasing Behavior

(1) The relationship between Individual internal factors of Energy Efficiency Labels and purchase intention as well as purchasing behavior
Most of the research show that energy efficiency labels will generate purchasing intention for energy-saving appliances then lead to actual purchasing behavior (Wang Z. et al., 2019). Other studies on environmental labels such as carbon labels and ecological labels also show that environmental labels have a positive impact on consumers' purchase intention and purchasing behavior (Issock et al., 2018). According to the previous theoretical basis and variable selection analysis of this study, the individual internal factors affecting the purchase behavior of energy efficiency labels mainly include three dimensions: consumers' label cognition, label trust and perceived value based on energy efficiency labels.

①Label cognition (LC)

Energy efficiency labels provide consumers with more information about the energy efficiency of products. If consumers have higher awareness and more concerns about the energy

efficiency labels, they will be more motivated to buy energy-saving household appliances (Shen and Saijo, 2009). A study from the United States shows that as of 2008, more than 75% of the total population have a certain awareness of "Energy Star," and there is a rising trend. This increase in awareness will lead consumers to switch from non-Energy Star appliances to energy-saving appliances with the logo (Murray and Mills, 2011). It is obvious that consumers' label cognition of home appliance products has a significant influence on consumers' Purchase Intention (PI) and Purchasing Behavior (PB). Therefore, the following hypotheses are proposed:

H1a: Consumers' perception of energy efficiency labels has a significant positive impact on their purchase intention of energy-saving appliances.

H1b: Consumers' perception of energy efficiency labels has a significant positive impact on their purchasing behavior of energy-saving appliances.

②Label Trust (LC)

Consumers usually distrust environmental labels as they often suspect that "energy-saving features" makes deceptive assertions (Atkinson and Rosenthal, 2014). Studies have proved that the distrust of energy efficiency labels play a negative regulatory role in the purchase intention, which also shows that trust in energy efficiency labels can affect consumers' purchase intention (Daugbjerg et al., 2014; Nuttavuthisit and Thøgersen, 2017). Some studies have proved that third-party certification is the most important driving force for buying green and energy-saving products. That is, consumers' purchasing behavior is significantly affected by label trust (Ishak and Zabil, 2012; Topolansky Barbe et al., 2013). Therefore, the following hypotheses are proposed:

H2a: Consumers' trust in energy efficiency labels has a significant positive impact on their purchase intention of energy-saving appliances.

H2b: Consumers' trust in energy efficiency labels has a significant positive impact on their purchasing behavior of energy-saving appliances.

③Perceived value (PV)

In this paper, perceived product quality and perceived product price are integrated into perceived value for measurement. According to the Signaling Theory, product price and product quality are important marketing signals, which can improve the perceived ability products. Besides, it also has impact on consumers' purchase intention (Cheung et al., 2014). Previous studies have shown that consumers' evaluation of product value largely depends on their perception of quality and price. Then the perceived value affects their purchase intention and purchasing behavior (Ariffin et al., 2016; Haryanto and Budiman, 2016; Liobikien et al., 2017; Marakanon and Panjakajornsak, 2017; Song et al., 2019b). Therefore, the following hypotheses are proposed:

H3a: Consumers' perceived value based on energy efficiency labels has a significant positive impact on their purchase intention of energy-saving appliances.

H3b: Consumers' perceived value based on energy efficiency labels has a significant positive impact on their purchasing behavior of energy-saving appliances.

(2) Relationship between individual internal factors

In addition to exploring the individual internal factors that affect the purchasing behavior, the relationship between individual internal factors should also be analyzed. When consumers understand the meaning of environmental labels, they will choose to trust the information annotated on the label (Issock et al., 2018). Therefore, label cognition plays a significant positive role in label trust. At the same time, consumers' perceived value based on energy efficiency labels also significantly affects consumers' trust in relevant information labels. A research survey on energy-saving electronic products in Thailand shows that green satisfaction and perceived quality positively affect green trust, and green perceived quality also partially mediates the positive relationship between environmental friendliness and green trust (Chen et al., 2016). Based on the above analysis, we propose the following hypotheses:

H4: consumers' perception of energy efficiency labels has a positive and significant impact on their label trust in energy efficiency labels.

H5: consumers' perceived value based on energy efficiency labels has a significant positive impact on their label trust in energy efficiency labels.

The Relationship Between External Environmental Factors and Purchase Intention

According to SCT, the factors influencing consumers' behavior can be roughly divided into external environmental factors and internal psychological ones. The factors relevant to energy efficiency labels mainly achieve the purpose of influencing consumers' purchasing behavior through the internal psychological factors of consumers. As one of the social environmental factors, external environment publicity and education can effectively improve human's cognitive of environmental issues and promote the formation of residents' awareness of energy conservation and environmental protection, thus influencing their purchasing behavior (Steg, 2008).

Many scholars have analyzed the impact of publicity and education on environmental behavior from the perspective of government intervention strategy. Some scholars clearly pointed out that the publicity of green consumption cannot only convey the correct connotation of green consumption, but also improve consumers' willingness to green consumption and the knowledge level of environmental protection (Bolderdijk et al., 2013). Based on cognitive learning theory, it is found that individual cognition of green consumption and environmental knowledge play a significant role in promoting consumers' purchase behavior of green products (Mohamed, 2007).

Meanwhile, TPB emphasizes that external social environmental factors such as subjective norm have a significant positive impact on consumers' purchase intention (Wang Z. et al., 2019). Empirical results from India show

that friends are a crucial factor which impact on consumers' purchase decisions, that is, subjective normative factors in the TPB framework significantly affect consumers' intention to buy energy-saving products (Testa et al., 2015). Therefore, in addition to considering the impact of energy efficiency labels on consumers' purchasing behavior of energy-saving appliances, this paper also studies the influence of two external environmental factors, namely, Publicity and Education (PE) and Subjective Norm (SN). Here, we propose the following hypotheses:

H6: Publicity and education of energy-saving appliances have a significant positive impact on consumers' purchase intention.

H7: Subjective norms have a significant positive impact on consumers' purchase intention of energy-saving appliances.

The Intermediary Role of Purchase Intention

TPB emphasizes the positive influence of individual's behavioral intention on his actual behavior. Studies have shown that the increase in consumers' willingness to buy green products will positively promote the formation of green purchasing behavior (Trivedi et al., 2018). This means that green purchase intention is the most critical factor in green purchase behavior (Chen and Tung, 2014; Liobikien et al., 2017; Yadav and Pathak, 2017). At the same time, ecological labels, environmental value, and consumers' knowledge of green products all significantly affect consumers' purchase intention, thus further influencing consumers' green purchasing behavior (Yadav and Pathak, 2017; Zhang et al., 2019). Combined with the framework of TPB, it can be found that purchase intention acts as an intermediary variable between behavior attitudes such as label cognition as well as label trust and purchasing behavior (Zhao and Zhong, 2015; Zhao et al., 2016).

In addition, perceived value not only affects consumers' purchase intention, but also directly affects their purchasing behavior to a certain extent, while purchase intention affects their purchasing behavior. Therefore, purchase intention plays an intermediary role between perceived value and purchasing behavior (Sweeney and Soutar, 2001; Petrick, 2002; Clement et al., 2013). The following hypotheses are proposed in this paper:

H8: Consumers' purchase intention of energy-saving appliances has a significant positive influence on their purchasing behavior.

H9a: Purchase intention plays an intermediary role in the influence of label cognition on purchasing behavior.

H9b: Purchase intention plays an intermediary role in the influence of label trust on purchasing behavior.

H9c: Purchase intention plays an intermediary role in the influence of perceived value on purchasing behavior.

Figure 1 is the theoretical framework model studied in this paper, which describes the hypothetical relationship between variables.

METHODOLOGY

Selection of the Research Method

At present, the situational experiment and questionnaire survey are the two main methods to investigate consumers' purchasing behavior. Situational experiment is a method to create, control or change certain conditions or situations with a purpose to cause the psychological activities and behavior of the experimenters. Although this method can test the causal relationship between variables by actively creating or controlling experimental conditions, there are obvious defects (Lewis and Sjoestrom, 2010). Firstly, the simulated test scenario is not real, and it is difficult to design such a virtual artificial environment, and its novelty and external validity are not high; Secondly, the setting cost of scenarios is high and the period is long. Generally, small samples are taken as research objects without random sampling, and thus the research conclusions are not universal; Thirdly, the method mainly simulates the current and future situation, and is not applicable to the past experiences.

Therefore, in the light of the applicable conditions and limitations of the situational experiment, this paper adopts the method of questionnaire survey. As a common method in market survey, the core of this method is questionnaire design and questionnaire survey. This method can achieve large random sampling in a short period of time, obtain a large number of extensive data and information and ensure the scientific nature of the research results.

Questionnaire Structure

The questionnaire is composed of two parts. The first part is demographic characteristics information, including five identification questions such as gender, age, education level, job category, and family annual income level. The second part consists of seven variable questions, involving 21 research questions, among which six variables, namely, perceived value, label cognition, label trust, subjective norm, publicity, and education as well as purchase intention are measured by Likert five-point scale. The purchasing behavior is mainly measured by three research questions, which aim to reflect the actual purchasing behavior of energy-saving appliances. The purchase frequency and purchase intention of energy-saving household appliances are also measured by Likert five-point scale, and the price proportion range of energy-saving appliances higher than ordinary appliances is measured by percentage range. All the questions in the questionnaire are modified by the mature scale or the results of existing studies. In order to ensure the validity of the scale, 30 participants are selected from the population to conduct a preliminary test. In the preliminary test, ambiguous and repetitive questions are deleted. Then the reliability of the scale is evaluated, and it showed acceptable levels of internal consistency according to their Cronbach's alphas.

Sample Selection

In order to study the influence of different factors on consumers' purchasing behavior of energy-saving appliances, it is necessary for consumers to determine their perception of these internal and

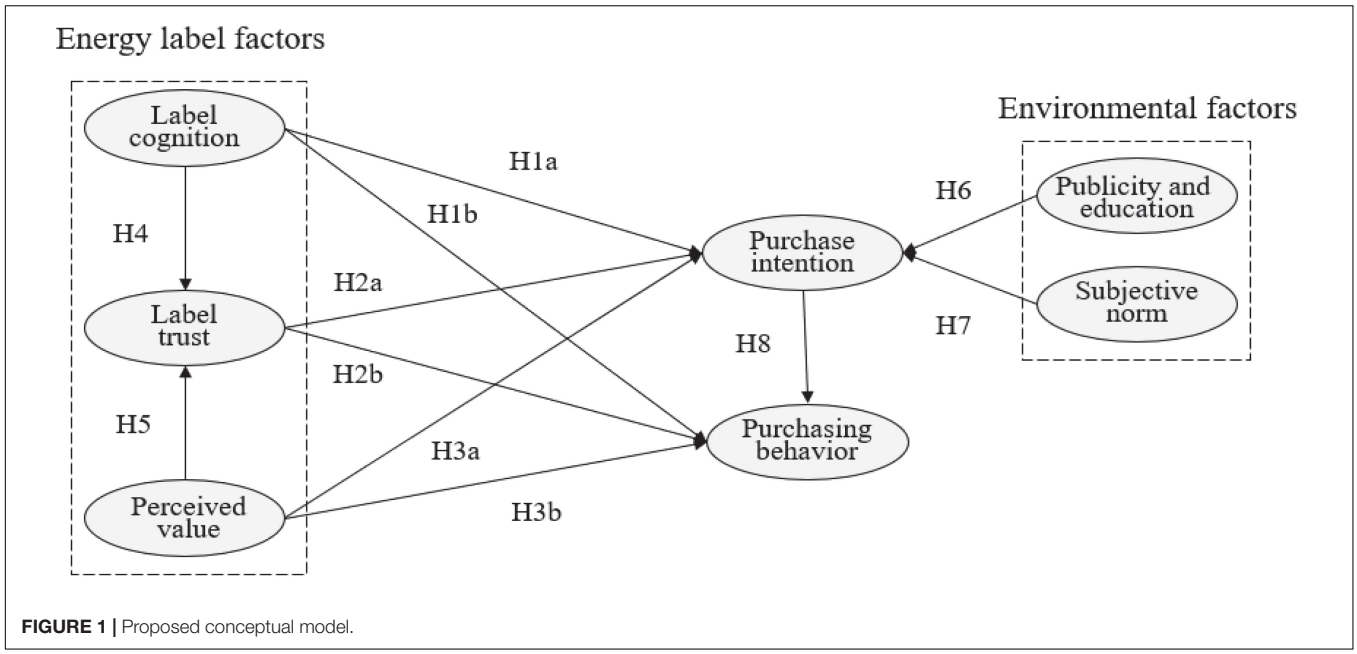

FIGURE 1 | Proposed conceptual model.

external factors according to their own purchase experience. In order to ensure the representativeness of the sample, considering that the student group and the group under 20 years old do not have the demand for energy-saving appliances and the probability of active purchase is not high, the two groups are excluded in the sample selection. The paper questionnaires are distributed to major shopping malls in the main urban area of Mianyang City, China. In this paper, data are collected by intercepting interview method and consumers who voluntarily participate in the questionnaire survey are selected by professional trained staff in the shopping area of household appliances. The questionnaire survey personnel observed the consumers who entered the home appliance purchase area, and selected the consumers who have consulted the merchant's product information or have purchased home appliances as the survey object. Ask consumers if they are willing to participate in the questionnaire without causing resentment. If so, guide them to the workbench where the survey team is located to fill in the questionnaire. If not, investigators also need to thank. The consumers who participated in the questionnaire survey are all voluntary and the research group do not provide any form of reward. A total of 425 questionnaires were distributed, and 396 valid questionnaires and 29 invalid questionnaires were recovered with the questionnaire validity of 92%. During the pre-processing of the survey data, there were 29 questionnaires with many missing data and completely consistent questionnaire data, and they were excluded from the recovered questionnaire.

TABLE 1 | Demographic profile of respondents.

Variables		N	Percentage
Gender	Male	206	52%
	Female	190	48%
Age group	21–30	72	18%
	31–40	149	38%
	41–50	153	39%
	Above50	22	6%
Education level	Primary school	73	18%
	High school	108	27%
	Junior college	44	11%
	Undergraduate	114	29%
	Postgraduate	57	14%
Household annual	0–80 K	111	28%
Income (RMB)	80–150 K	140	35%
	150–400 K	134	34%
	400–800 K	8	2%
	Above 800 K	3	1%

RESULTS

Test on Common Method Variance

The problem of Common Method Variance (CMV) is likely to arise by using the questionnaire data (Chang et al., 2010). The Harman single factor method is usually used to test CMV, that is, factor analysis is performed on all items in the questionnaire, and the first principal component proportion without rotation is solved, which reflects the quantity of CMV (Gorrell et al., 2011). When not rotated, the factor load of the first principal component is 39%, lower than 40% of the standard value, indicating that CMV results are within the acceptable range, and thus the test on CMV is passed.

Descriptive Statistics of the Study Sample

Table 1 describes the descriptive statistics of respondents. From the perspective of gender dimension, the frequency of male

TABLE 2 | Variable mean, standard deviation, and correlation coefficient.

	Label cognition	Label trust	Perceived value	Publicity and education	Subjective norm	Purchase intention	Purchasing behavior
Mean	3.91	3.78	3.56	3.74	3.60	4.05	2.83
S.D	0.86	0.82	0.84	0.79	0.83	0.82	1.05
Label cognition	1						
Label trust	0.52**	1					
Perceived value	0.36**	0.47**	1				
Publicity and education	0.49**	0.48**	0.35**	1			
Subjective norm	0.36**	0.46**	0.43**	0.50**	1		
Purchase intention	0.43**	0.53**	0.52**	0.51**	0.54**	1	
Purchasing behavior	0.13**	0.29**	0.35**	0.19**	0.28**	0.38**	1

*"**" means $P < 0.01$.*

sample (52%) is slightly higher than that of female sample (48%), and the distribution of gender characteristics is generally balanced. From the perspective of age group, the samples are mainly young and middle-aged. The cumulative frequency of samples aged between 21–50 years old reaches 94.44%. The education level of the sample is mainly distributed in senior high school or technical secondary school (27%), junior college (11%), and undergraduate (29%), which conforms to the current educational structure of China. From the perspective of household annual income, the three sample groups of below 80,000 yuan (28%), 80,000–150,000 yuan (35%), and 150,000–400,000 yuan (34%) shows a balanced distribution, with the cumulative proportion reaching 97%. This study collected 396 valid questionnaires. The sample size is far more than 10 times the number of parameters to be estimated by the model (Hoogland and Boomsma, 1998), and he sample size generally obeys the normal distribution, so it is reasonable. In the sample data, the absolute value of skewness of all indicators is less than 2, and the absolute value of skewness of most indicators is close to 0; the absolute value of kurtosis of all indicators is less than 3. This means that the sample data follows the normal distribution, the distribution of different characteristics of the sample can represent the different characteristics of current consumption of energy-saving household appliances, so the sample data is representative.

Before testing each hypothetical model, the correlation analysis of each variable should be carried out firstly. The mean, standard deviation and correlation coefficients of the seven variables involved in this study are shown in **Table 2**. The results showed that all correlation coefficients were significantly positively correlated.

Model Testing

KMO test and Bartlett's spherical test are required for the variables in the scale with the help of SPSS software analysis tools. The results show that the KMO test value is 0.85, which is greater than the critical value of 0.50; the concomitant probability of Bartlett's spherical test is 0.00, less than 0.05. This means that the items of the scale are suitable for factor analysis. Therefore, through the exploratory factor analysis (EFA) results, the total contribution rate of the sum of rotation squares of the seven factors reaches 77%, and the factor loading values after orthogonal rotation are between 0.5 and 0.95, which meets the parameter test conditions.

TABLE 3 | Reliability test results of the scale.

Dimension	Average variance extracted (AVE)	Composite reliability (CR)	Cronbanch's alpha
Label cognition	0.65	0.85	0.85
Label trust	0.78	0.91	0.92
Perceived value	0.56	0.79	0.79
Publicity and education	0.51	0.76	0.77
Subjective norm	0.68	0.86	0.86
Purchase intention	0.74	0.88	0.90
Purchasing behavior	0.67	0.86	0.84

Then, the reliability and validity of the scale need to be tested, and the results are shown in **Table 3**. Reliability analysis is required to verify the consistency or reliability of the test results so as to verify the authenticity of the sample data. The composite reliability (CR) and Cronbanch's α coefficient are both greater than 0.70, indicating that the scale has good reliability (Wang B. et al., 2019). The validity is the explicit variable to measure the validity and accuracy of latent variables, and the convergent validity is usually used to judge whether the model is valid or not. It can be seen from **Table 3** that the average variance extracted (AVE) of each variable is greater than 0.50, which means that the structural equation model in this paper has passed the convergence validity test (Fornell and Larcker, 1981).

Finally, the model fitting should be tested overall, and the results are shown in **Table 4**. The absolute fitting

TABLE 4 | Model fitting result table.

Fitting indicator	χ^2/df	GFI	AGFI	CFI	TLI	RMSEA
Test result	1.99	0.93	0.90	0.97	0.96	0.05
Judging criteria	<2	>0.90	>0.90	>0.90	>0.90	<0.08
Model fitting judgment	Yes	Yes	Yes	Yes	Yes	Yes

indicators meet the fitting criteria, among which, $\chi 2$/df (1.99) is less than the critical value 2, AGFI is greater than 0.9, and RMSEA (0.05) is less than 0.08. Two value—added fitting indicators, CFI and TLI, are also up to the standard. This means that the measurement model and its parameter estimation are valid and the fitting effect of the measurement model is good.

Hypothesis Test Results

The structural equation model is used to test the influence mechanism of factors related to energy efficiency labels on consumers' purchasing behavior of energy-saving appliances. The test results are shown in **Table 5** and **Figure 2**. In addition to label cognition, label trust, perceived value, publicity and education as well as subjective norm all have positive effects on consumers' purchase intention of energy-saving appliances, that is, hypothesis H1a is untenable, hypothesis H2a, H3a, H6, H7 are all tenable.

Label cognition and label trust do not directly affect consumers' purchasing behavior, while perceived value and purchase intention significantly affect purchasing behavior, and the influence of purchase intention on purchasing behavior is significantly greater than that of perceived value. In other words, hypothesis H1b and H2b are not tenable, while hypothesis H3b and H8 are. Both label cognition and perceived value have positive effects on consumers' trust for energy efficiency labels, proving that H4 and H5 are tenable. From the intermediary effect results of structural equation, the hypothesis that purchase intention, as the intermediary variable of label trust and perceived value affects consumers' purchasing behavior has passed the test, that is, H9b and H9c have been verified, while purchase intention as the intermediary variable of label cognition influencing purchasing behavior has not been verified, meaning that H9a does not hold.

To further verify the significance of the intermediary effect, this paper uses Process3.2 to test the intermediary effect of purchase intention between label cognition, label trust as well as perceived value and purchasing behavior. The test results are shown in **Table 6**. The indirect effect in the table represents the intermediary effect, and if the indirect effect is significant, there is the intermediary effect. From the parameter estimates, the intermediary effect of label trust and perceived value are 0.16 and 0.29, respectively. The deviation correction Bootstrap confidence intervals under 95% confidence level are [0.02, 0.30] and [0.14, 0.43], respectively, excluding the 0 value. This indicates that purchase intention has a significant intermediary effect between label trust, perceived value and purchasing behavior, that is, H9b and H9c are valid. The estimated intermediary effect of label cognition is 0.05, and the deviation correction Bootstrap confidence interval under 95% confidence level is [−0.17, 0.08], including the 0 value, that is, the intermediary effect is not significant, and H9a is not tenable. In a word, the consistency between the results of intermediary effect and that of structural equation is further tested by process.

According to the hypothesis test results of the structural equation model, the influence mechanism model of energy efficiency labels on consumers' purchasing behavior of energy-saving appliances is shown in **Figure 2**. It is easy to find that among the relevant factors of energy efficiency labels; the cognition degree and perceived value of energy efficiency labels jointly affect the trust degree. The trust degree and perceived value affect consumers' actual purchasing behavior through the intermediary effect of purchase intention, while the perceived value can directly influence purchasing behavior. Therefore, the related factors of energy efficiency labels are not simple coordinate relations. External environmental factors such as publicity and education as well as subjective norms also influence consumers' actual purchasing behavior through the intermediary role of purchase intention.

DISCUSSION

This study discusses the impact of energy efficiency labels on consumers' purchase intention and purchase behavior of energy-saving household appliances from two aspects: individual internal factors and external environmental factors. The individual internal factors include behavior attitude of TPB framework and perceived value of signal theory. And behavioral attitude variables are subdivided into two dimensions: label cognition and label trust. The external environmental factors include publicity and education and subjective norms.

Previous studies have confirmed that carbon label cognition has a significant positive impact on label trust (Zhao et al., 2017). Our results further verify this result, that is, the standardized regression coefficient of the path from label cognition to label trust is 0.63, which is significant at the level of 0.001. Label recognition is one of the preconditions for the establishment of label trust. The higher consumers' awareness of energy efficiency labels, the more they trust energy-saving household appliances with higher energy efficiency levels (Wang B. et al., 2019). The standardized estimated coefficient of the path from perceived value to label trust is 0.54 and passes the test of significance level of 0.001. That is, the higher the perceived value level of energy efficiency labels, the higher the label trust level. Some studies pointed out that green perceived value has a positive impact on green trust when studying the purchase behavior of energy-saving electronic products (Chen et al., 2016), which is the same as our research results. This means that the perceived

TABLE 5 | Hypothesis test results.

Hypothesis	Regression path	Standardized path coefficients	*P*-value	Results
H1a	LC→PI	0.02	ns	Rejected
H1b	LC→PB	−0.06	ns	Rejected
H2a	LT→PI	0.14	*	Supported
H2b	LT→PB	0.02	ns	Rejected
H3a	PV→PI	0.30	***	Supported
H3b	PV→PB	0.22	**	Supported
H4	LC→LT	0.63	***	Supported
H5	PV→LT	0.54	***	Supported
H6	PE→PI	0.27	**	Supported
H7	SN→PI	0.26	***	Supported
H8	PI→PB	0.38	***	Supported
H9a	LC→PI→PB	–	–	Rejected
H9b	LT→PI→PB	–	–	Supported
H9c	PV→PI→PB	–	–	Supported

"" means P < 0.05, "**" means P < 0.01, "***" means P < 0.001, "ns" means P > 0.05.*

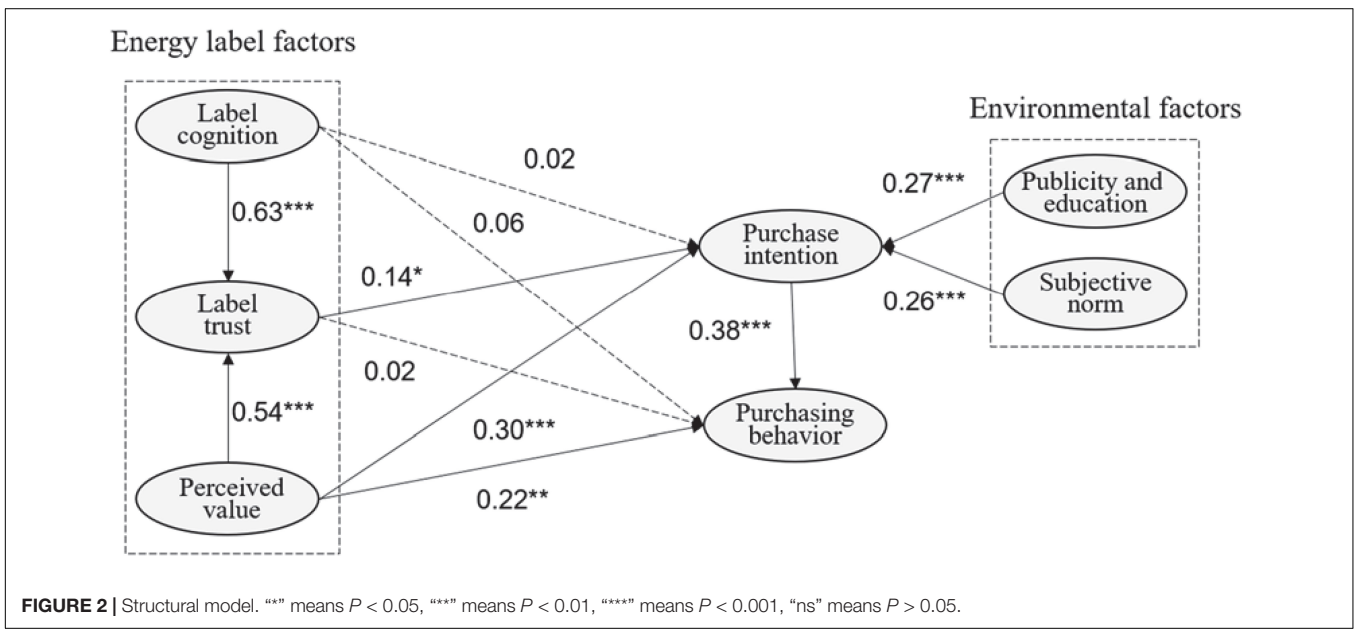

FIGURE 2 | Structural model. "*" means $P < 0.05$, "**" means $P < 0.01$, "***" means $P < 0.001$, "ns" means $P > 0.05$.

TABLE 6 | Intermediary effect test results.

Regression path	Indirect effect	Standard error	t	*p*	Bootstrap's 95% CI	
					LLCI	ULCI
LC→PI→PB	0.05	0.06	0.72	0.47	−0.17	0.08
LT→PI→PB	0.16	0.07	2.26	0.03	0.02	0.30
PV→PI→PB	0.29	0.07	3.96	0.00	0.14	0.43

product price and the perceived product quality are the key influence signals to promote consumers' trust in green products (Issock et al., 2018).

The empirical results show that label cognition has no significant effect on purchase intention and purchase behavior, but indirectly affects purchase intention and further affects purchase behavior through the intermediary variable of label trust (Wang B. et al., 2019). The standardized regression coefficient of the path from label trust to purchase intention is 0.14, which is significant

at the level of 0.05. This means that the higher the trust level of energy efficiency labels, the stronger the consumers' willingness to buy energy-saving household appliances with higher energy efficiency levels. This conclusion is consistent with the research results of most scholars (Wang B. et al., 2019), which further verifies the correctness of the ternary interaction model of social cognitive theory. There is no significant relationship between label trust and purchase behavior, but the intermediary effect test shows that the trust degree causes consumers' attention to energy efficiency labels through the intermediary variable of purchase intention, resulting in purchase behavior (Paul et al., 2016). The standardized regression coefficients of the path from perceived value to purchase intention and perceived value to purchase behavior were 0.30 and 0.22, respectively, and both passed the significance level test of 0.001. This means that perceived value has a significant positive impact on purchase intention and purchase behavior. It shows that the higher the perceived value of energy-saving household appliances based on energy efficiency labels, the stronger the consumers' willingness and behavior to buy energy-saving household appliances (Issock et al., 2018). Consumers perceive that the greater the environmental value of energy-saving appliances through energy efficiency labels, the more they feel that their value matches the price. At this time, the more obvious the positive bias of willingness and behavior to buy energy efficiency labeled products will be (Ariffin et al., 2016; Liobikien et al., 2017).

The standardized regression coefficients of the path from publicity and education to purchase intention and subjective norm to purchase intention were 0.27 and 0.26, respectively, and both passed the significance level of 0.001. Subjective norms indirectly affect purchase behavior through purchase intention (Wang Z. et al., 2019), which is also consistent with the TPB theoretical framework system (Ajzen, 1991). The publicity and education on energy efficiency labels has a significant positive impact on purchase intention, which means that publicity and education can effectively promote the formation of consumers' environmental awareness, so as to generate positive purchase intention (Steg, 2008).

The standard regression coefficient of the path from purchase intention to purchase behavior is 0.34, which is significant at the level of 0.001. The results show that the purchase intention significantly affects the actual purchase behavior, that is, the stronger the purchase intention of consumers for energy-saving appliances, the greater the possibility of purchase behavior. This conclusion is not only consistent with the core view of TBP, but also consistent with other research conclusions, that is, green purchase intention is the most key leading factor of green purchase behavior (Chen and Tung, 2014; Liobikien et al., 2017; Yadav and Pathak, 2017; Trivedi et al., 2018; Zhang et al., 2019).

CONCLUSION, POLICY IMPLICATIONS, LIMITATIONS, AND PERSPECTIVES

Conclusion

This study constructs a theoretical model of the impact mechanism of energy efficiency labels on consumers' purchase behavior by using social cognition theory, planned behavior theory and signal transmission theory. And the empirical test conclusions are as follows.

Firstly, both the label cognition and perceived value significantly affect label trust, which shows that label trust plays an important role in promoting purchase intention and purchase behavior. Therefore, it is very important to improve the understanding, attention and cognition of energy efficiency labels, and to provide consumers with important information such as product attributes, energy efficiency grades and reliability through the real energy efficiency labels information of products. When consumers buy energy-saving appliances, they often pay attention to energy efficiency labels signals, perceive the information such as the quality and price of energy-saving appliances products, thus enhancing consumers' trust in energy-saving and energy-saving products, and improving consumers' purchasing willingness and purchase behavior.

Secondly, among the factors related to energy efficiency labels, only perceived value has a direct positive impact on consumers' purchasing behavior of energy-saving household appliances. Neither label cognition nor label trust has a direct effect on consumers' purchasing behavior of energy-saving appliances, but influences consumers' purchasing behavior through the intermediary variable—purchase intention. Through the intermediary effect test of purchase intention, it is found that purchase intention, as a complete intermediary variable, transmits the influence of energy efficiency label trust on purchasing behavior, while purchase intention, as a partial intermediary variable, transmits the influence of consumers' perceived value for energy efficiency labels on the purchasing behavior of energy-saving appliances. This conclusion indicates the importance of consumers' purchase intention on their actual purchasing behavior, and further reveals the connection mechanism of the factors related to energy efficiency labels on consumers' purchasing behavior.

Thirdly, external environmental factors, such as publicity, education and subjective norm, have a significant impact on consumers' intention to purchase energy-saving appliances, and affect actual purchasing behavior through the intermediary role of purchase intention. This conclusion mainly considers the influence of external environmental factors. The response mechanism of energy efficiency labels to consumers' purchasing behavior of energy-saving appliances is not an internal closed mechanism, but a dynamic mechanism affected by external environmental variables. The publicity and education of energy-saving appliances and subjective norms have a significant impact on consumers' purchase intention, which provides a new idea for promoting the formation of consumers' purchasing behavior of energy-saving appliances.

Policy Implications

According to the above research conclusions, it puts forward the following three policy implications.

(1) Improve consumers' cognitive ability of energy efficiency labels. Although the energy efficiency labeling system has been popularized in China for more than 10 years, some consumers still do not understand energy efficiency label at all. The results show that consumers' cognitive ability of labels significantly affects their trust in energy efficiency labels, thus affecting their purchase intention. So it is very important to improve consumers' cognitive ability of energy efficiency labels. Therefore, the government and household appliance enterprises should do a good job in the popularization of energy efficiency label and root the concept of energy efficiency label in the hearts of consumers. At the same time, enterprises should enhance the credibility of energy efficiency label from the perspectives of energy efficiency labeling information, energy efficiency labeling certification institutions and transparency of energy efficiency labeling certification process, so as to leave a good impression on consumers.

(2) Enhance the perceived value of energy-saving household appliances through innovation. Consumers' perceived value of energy efficiency labels significantly affects their willingness to buy energy-saving household appliances, and it is the only variable that can have a direct effect on purchase behavior. Therefore, we must recognize the importance of improving enterprise brand. First, household appliance enterprises should speed up technological innovation and product innovation, improve the quality of energy-saving products or promote product upgrading, and optimize and adjust the product structure. At the same time, they should rely on technological innovation to improve the control ability of the production process, improve the product qualification rate and the efficiency of comprehensive utilization of resources, and gradually improve the technical guarantee system. Secondly, focusing on consumer demand and its changes, they comprehensively should adopt various forms such as management innovation, organizational innovation, and value innovation to improve the image value of household appliances, improve loyalty and purchase confidence of consumers, so as to improve customer perceived value.

(3) Enhance consumers' subjective norms through the publicity and education of energy efficiency labels. The governments and enterprises can make full use of traditional and emerging media to effectively transmit energy efficiency labeling information to the public, so as to improve consumers' awareness of energy efficiency label. And home appliance enterprises should take user experience as the guidance, actively improve product service quality, form a good reputation effect, improve the subjective norms of consumers.

Limitations and Perspectives

This study constructs and tests the formation mechanism of energy efficiency labels on consumers' purchase behavior through empirical analysis, which has certain academic value and practical significance. But there are also some limitations.

Firstly, there is still room for improvement in the selection of research objects. The research object of this study is limited to the urban area of Mianyang, and the differences of economic development, social environment and other factors in different regions are not fully considered. There may be the problem of insufficient sample representation, especially the lack of samples from rural areas. Therefore, more extensive sampling can be adopted in more areas for follow-up research to expand the scope of application of the research.

Secondly, due to the constraints of research time, cost and other factors, this study uses time cut-off data to study the impact mechanism. Compared with long-term tracking research, the persuasion is relatively weak, which is difficult to reflect the dynamic process of the impact mechanism of energy efficiency labels on consumers' purchase behavior. Therefore, the follow-up research can improve the persuasiveness of the empirical test results of the model through long-term tracking observation.

Thirdly, although the formation mechanism of energy efficiency labels on consumers' purchase behavior is revealed from individual internal factors and external environmental factors, the demographic characteristics and consumers' personal psychological characteristics affecting consumers' purchase behavior are not considered. Therefore, the follow-up study can explore the influence mechanism of different factors on consumers' purchase behavior.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

GS-D and LC-P: conceptualization, writing—review and editing. GS-D, LH, and ZN: methodology, investigation, and writing—original draft preparation. LH and ZN: formal analysis. All authors have read and agreed to the published version of the manuscript.

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Study on Willingness to Pay and Impact Mechanism of Gutter Oil Treatment: Taking Urban Residents in Sichuan Province as an Example

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"Gutter oil" is a term for the practice of recycling used waste oil from restaurant fryers, sinks, and even slaughterhouses and sewers, and has been a major food safety and sanitation issue in China for many years. However, with proper treatment, these issues can be mitigated, turning large amounts of waste product into valuable resources and conserving energy resources. Based on this questionnaire survey conducted in the cities of Chengdu and Mianyang in Sichuan, China, this paper uses the value evaluation method to measure urban residents' willingness to pay for the treatment of gutter oil, and explores the factors and path influencing residents' willingness to pay based on the extended theory of planned behavior. The results of this study affirms the validity and universality of the Theory of Planned Behavior. Behavioral attitude, perceived behavioral control, and subjective norms have a direct positive impact on their willingness to pay. Risk perception and past experience indirectly affect residents' willingness to pay for gutter oil through the intermediary variable of behavioral attitude, which means that the public's risk awareness can be improved by vigorously publicizing the harmful effects of gutter oil, thereby also increasing acceptance toward gutter oil treatment. As an intermediary variable, subjective norms have a significant indirect effect on the impact path of past experience on willingness to pay, which reflects the significant influence of subjective norms such as reference group and environment. The results show that urban residents have a higher willingness to pay for the treatment of gutter oil. The mean willingness to pay is 7.75 RMB per month per capita.

Keywords: gutter oil, willingness to pay, impact mechanism, past experience, risk perception

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INTRODUCTION

With the significant improvement of living standards throughout China, the thriving of China's restaurant industry, and expansive growth of dining establishments throughout urban areas, Chinese families are paying more attention to their quality of life, and consuming more as well. As a result of all these factors, kitchen waste oil is increasing, as is concern for its treatment and quality. As a major consumer of edible oil, China produces and consumes more than 20 million tons of gutter oil every year, and the impact of this has created major food safety problems in China. These waste edible oils contain high volumes of toxins and carcinogens, and this can cause great harm to the human body (Bai, 2010; Wang and Lu, 2012). Although returning gutter oil to

the dinner table presents a number of ethical and sanitation issues, its utilization value is very high. Given these factors, the most optimal possible solution may be to properly recycle gutter oil and extract the greatest possible value therefrom (Zhang et al., 2012). This not only helps prevent the sanitation issues associated with waste cooking oil, it also helps alleviate the shortage of energy resources.

Managing gutter oil incorporates issues of both waste management and food safety (Karmee, 2017). Its sustainable utilization provides a significant step toward the formation of a healthy society. About 1.8 billion liters (476 million gallons) of biofuels can be produced from gutter oil produced in China every year. Learning to sustainably utilize gutter oil is therefore very important. The production and sale of illegal cooking oil is the main obstacle to utilizing this gutter oil to produce sustainable and clean biodiesel. The government should adopt policies to encourage the legitimate and effective recycling of gutter oil, establish standards for edible oil, and implement strict inspection measures (Cho et al., 2015). It is also necessary to strengthen the government's regulatory responsibility, improve the management and supervision system for gutter oil, and to improve the technical inspection standards of edible oil (Ramos et al., 2013; Yano et al., 2015; Wallace et al., 2017). Governments at all levels across China have expressed great concern for the recycling and treatment of illegal cooking oil. They have therefore formulated a number of policies and measures to regulate the disposal, collection, and transportation of kitchen waste, management systems thereof, and are actively carrying out special rectification activities for illegal cooking oil to combat actions in violation of these statues. By designating pilot cities for exploratory policies, they will continue to experiment with recycling, no-harm treatment methods, process routes and management modes for kitchen waste. However, it is difficult for the government to supervise waste edible oil due to highly decentralized and dispersed nature of the sources (i.e., potentially every household and restaurant in China). For example, although the Chinese government actively promotes the conversion of gutter oil into biodiesel through government regulation, subsidies, and tax incentives, issues of sourcing and the illegal sale of gutter oil have yet to be resolved (Zhang et al., 2012), which means that China's recycling industry chain of gutter oil has not been fully formed, resulting in a desperate lack of capacity in zero-harm treatment and recycling of gutter oil. At present, problems such as irregular discharge, recycling, production, and sale of illegal cooking oil have yet to be checked. Covert transactions of illegal cooking oil still exist, and illegal cooking oil is still discovered on Chinese dinner tables from time to time.

One key factor in the gutter oil supply chain, households' or residents' willingness to pay for the treatment of gutter oil, can determine the recycling rate of gutter oil in China through conduction mechanisms. Financial support for gutter oil treatment is a crucial factor (Escobar et al., 2015), and financial subsidies from the government offer is an especially important measure to solve issues related to gutter oil (Zhang et al., 2014; Eguchi et al., 2015; Maria et al., 2016). Based on game theory, this paper studies the influence of tax preferences, raw material subsidies, sales subsidies, and investment subsidies for waste cooking oil (WCO) on biodiesel supply. The results shows that the price subsidy for raw materials and sales subsidy for finished products can improve the profits of biofuel enterprises and recyclers. However, existing research often ignores the role and participation of households, which is the main source of gutter oil creation. Compared with mandatory and normalized recycling performed by restaurants and other food service enterprises, the sources of domestic waste cooking oil are even more scattered, and their means of production and collection are cruder. Therefore, the recycling and management of domestic waste cooking oil is more difficult than conventional waste oil recycling. According to the principle of "the polluter pays," it is of great practical significance to study residents' willingness to pay for gutter oil recycling and the influencing factors thereof, since families are the primary source of gutter oil. According to a survey from Petaling, Malaysia, families have a relatively high willingness to accept (WTA) and willingness to collect and recycle waste cooking oil (WCO). The average WTA amount of households was found to be 0.72 MYR per kilogram, and the major influencing factors on this value were income level, age, education level, bidding practices, and gender of the participant, and cash incentives were found to effectively improve the participation rate of families in the collection of gutter oil (Yacob et al., 2015). Awareness and attitude are important factors that affect families' participation in gutter oil recovery. Although many families recognize the importance of gutter oil recovery, only a few actually participate in it (Kabir et al., 2014). A survey from South Korea showed that waste cooking oil (WCO) has become the main raw material of the biodiesel industry in South Korea. Under the precondition of providing incentives, the household recovery of WCO can be improved, but this will not significantly increase the raw material production of biodiesel (Cho et al., 2015).

Urban residents are the main providers of treated gutter oil, and the academic research on this subject focuses on means of behavior analysis. As academic disciplines broaden and integrate and society continues to complexify, the classic Theory of Planned Behavior proves unable to fully interpret or accurately judge the behavioral intention of individuals. As an example of more complex theory, Fishbein theory believes that consumers' degree of environmental cognition affects their willingness to pay and the amount they are willing to pay to a certain extent (Rodríguez-Ortega et al., 2016). Theories of cognitive psychology and cognitive behavior systematically analyze individual cognition from different angles and agree that individual cognition of given issues plays a particularly important role on an individual's behavioral intention and indirectly affects their behavioral decision-making. A number of researchers (Carlsson, 2000; Hossain, 2003; Vassanadumrongdee and Matsuoka, 2005; Spash, 2006), respectively, analyzed individuals' willingness to pay for services such as increased air quality, genetically modified food, and treatment air pollution. The results of these studies show that age, gender, education, occupation, income, and residence will affect consumers' willingness to pay. However, no scholars have yet studied the willingness of urban residents to pay for the treatment of gutter oil.

Therefore, this study uses the value evaluation method to calculate the willingness to pay for the treatment and recycling of gutter oil among residents in China's pilot cities experimenting in resource utilization and zero-harm treatment of kitchen waste. Based on the extended theory of planned behavior, this paper studies the factors influencing residents' willingness to pay and discusses the key influencing factors of the residents' willingness to pay by using the structural equation model. The goal of this is to provide some decision-making references for governments to formulate targeted incentive policies.

The remainder of this paper is arranged as follows. The second section mainly introduces the theoretical basis of the model, and puts forward corresponding hypotheses on the basis of theoretical and literature analysis. The third section mainly discusses the employed methods. The fourth section verifies the relevant hypotheses, and uses the Bootstrap method to further test the mediating effect of the model before obtaining the final empirical analysis results. The fifth section discusses the research results, and the sixth section briefly discusses the limitations of the research and future research directions.

EXTENDED THEORETICAL FRAMEWORK OF PLANNED BEHAVIOR AND HYPOTHESIS DEVELOPMENT

Extended Theoretical Framework of Planned Behavior

The theory of planned behavior is developed on the basis of the theory of rational behavior (Ajzen, 1985). The theory of rational behavior holds that individual behavior is controlled by one's own will and driven by one's own subjective will (Fishbein and Ajzen, 1975). However, subsequent research found not many external factors in addition to one's own personal will have an impact on individual behavior. Therefore, the control factors of perceptual behavior are introduced on the basis of the theory of rational behavior. Perceived behavioral control refers to how many obstacles an individual will suffer from the implementation of the behavior before implementing said behavior. Therefore, the difficulty of completing the transaction, including controllability and self-efficacy. The theory of planned behavior emphasizes that three factors, namely behavioral attitude, subjective norms and perceived behavioral control, all of which affect people's behavioral intentions, and thus their behavioral decision-making.

The theory of planned behavior has been widely used in both the fields of consumption behavior and environment (Wang et al., 2016; Wong et al., 2020). However, some scholars still believe that individual behavior is not only determined by factors such as behavioral attitude, subjective norms and perceived behavior, but also by factors such as moral norms, personal responsibility, and convenience (Nigbur et al., 2011; Wang et al., 2011; Yin et al., 2014). Ajzen also indicates that this theory is open and extensible. Scholars can also therefore introduce other theories into the theory of planned behavior according to their research needs. Therefore, based on the theoretical framework of planned behavior, this paper introduces two important influencing factors, namely, past experience (Henk et al., 1998; Forward, 2009) and risk perception (Taylor, 1974; Covello et al., 2001) to form an extended framework of Theory of Planned Behavior.

Hypothesis Development

Willingness to Pay

The concept of willingness to pay (WTP) was first put forward by Hicks' neoclassical economic theory, and is defined as the sum of consumer surplus and actual payment. When Ciriacy-Wantrup (1947) measured the positive externalities of soil erosion control, the conditional value method was first used to calculate the price that people are willing to pay for soil pollution control. Different scholars have given different analyses of these factors and definition of key terms. Kim et al. (2009) says that the WTP refers to the price that consumers voluntarily pay out for products when they participate in market transactions. Mankiw (2011) adds the definition of WTP as being the consumers' highest psychological price. WTP is widely used in assessing public services, mainly to measure payments that the consumer is willing to pay for public services or products. This includes willingness to pay for the protection of public land (Rosenberger and Richard, 1997; Rolf et al., 1999), willingness to pay for air quality improvement (Liu et al., 2017; Wang et al., 2018), willingness to pay for treatment of water pollution (Zhao et al., 2018), and willingness to pay for soil pollution prevention (Lu et al., 2018). However, in the field of waste management, most literature focuses on public awareness of the collection and recycling of solid waste, such as urban electronic waste (Keramitsoglou and Tsagarakis, 2013; Kumar, 2019), and has rarely been concerned about the willingness to pay for gutter oil treatment.

Past Experience

Some scholars have confirmed that past experience has an impact on behavioral habits. Henk et al. (1998) conducted a study on "repetitive behavior" and confirmed that existing behavior is largely influenced by past behavior. Through research, Gardner (2009) confirmed that when a decision-making environment tends to be stable, past experience has a positive impact on behavioral intention. By studying a person's primary behaviors, it is found that past experience will affect behavioral attitude and subjective norms, thus affecting individual behavioral intention (Forward, 2009). Therefore, this paper introduces the variable of past experience to study the influence of past experience on the willingness to pay for gutter oil treatment, and puts forward the following hypotheses:

H1a: The past experience of urban residents has a direct and significant positive effect on their risk perception.

H1b: The past experience of urban residents has a direct and significant positive effect on their behavior and attitude.

H1c: The past experience of urban residents has a direct and significant positive effect on their subjective norms.

H1d: The past experience of urban residents has a direct and significant positive effect on their willingness to pay.

Risk Perception

In the field of enterprise decision-making, studies of consumers' modes of response to risk perception have confirmed that risk perception can significantly affect an individual's behavioral attitude and behavioral intention, and thus can play a decisive role on individual behavior (Taylor, 1974). In the study of the public's risk perception and response to viral distribution, it was found that the degree of risk perception will affect the individual's enthusiasm to make a response (Covello et al., 2001). Simsekoglu (2019) established an extended theory of planned behavior including risk perception, and verified that risk perception could affect consumer purchasing behavior regarding electric vehicles. According to the experience of previous scholars, when introducing risk perception into the theory of planned behavior, the following hypotheses can be proposed:

H2a: The risk perception of urban residents has a direct and significant positive effect on their behavior and attitude.
H2b: The risk perception of urban residents has a direct and significant positive effect on their subjective norms.
H2c: The risk perception of urban residents has a direct and significant positive effect on their perceived control behavior.
H2d: The risk perception of urban residents has a direct and significant positive effect on their willingness to pay.
H2e: Risk perception plays an intermediary role on urban residents' past experience on their willingness to pay.

Behavioral Attitude

Behavioral attitude is a determinant of the person's willingness to pay (Taufique et al., 2017). Behavioral attitude is interpreted as the degree of concern and recognition of the respondents as concerns their behavior results. Positive attitudes may increase their willingness to pay, while negative and disapproving attitudes may lead to adverse intentions and behaviors (Greaves et al., 2013). If consumers are increasingly concerned about environmental sustainability, this naturally suggests they will behave in a more pro-environmental way (Wong et al., 2020), which may result in a higher willingness to pay for environmental services. This is so say that there is a significant positive link between behavioral attitude and behavioral intention (Chan et al., 2016). The more positive of an attitude that consumers have toward organic food, the more likely they will be to buy low-carbon products with carbon label certification; that is, the stronger their willingness to buy will be (Trivedi et al., 2018). However, some scholars believe that the proportion of behavioral attitude to corresponding willingness to pay is generally low. Because willingness to pay implies that payment behavior has not yet taken place, the respondents may substitute actual feelings or willingness with the response tendency to meet social expectations, and their willingness to pay will be overestimated in surveys (Roozen and Pelsmacker, 1998). Davies et al. (2002) found that 84 percent of consumers who do not participate in recycling still claim to have recycled some of their household waste. Therefore, the following assumptions are proposed:

H3a: The behavioral attitudes of urban residents have a direct and significant positive effect on their willingness to pay.
H3b: Behavioral attitudes play an intermediary role on the impact of risk perception on residents' willingness to pay.
H3c: Behavioral attitudes play an intermediary role on the influence of past experience on Residents' willingness to pay.

Subjective Norms

According to the theory of planned behavior, subjective normative factors have a positive impact on the individual's behavioral intentions, thus affecting the occurrence of their actual behavior (Ajzen, 1991). Based on the theory of planned behavior, Yadav and Pathak evaluated the influencing factors of Indian consumers' purchases of green products, and found that social norms can significantly affect consumers' intent to purchase green products (2017). However, the occurrence of individual behavior is not an independent process of individual choice, and is instead often affected by social factors such as external environment and reference groups (Blaise et al., 2018). For example, social pressure is a key factor affecting the intent to recycle (Singh et al., 2018). Therefore, risk perception, past experience, and other external environmental factors will affect the willingness to pay through subjective norms. Therefore, the following hypotheses are put forward

H4a: Subjective norms of urban residents have a direct and significant positive effect on their willingness to pay.
H4b: Subjective norms play a mediating role on the impact of risk perception on willingness to cope.
H4c: Subjective norms mediate the effect of past experience on residents' willingness to pay.

Perceived Behavioral Control

The theory of planned behavior emphasizes that individual perceived behavioral control has a significant impact on individual behavior. If the individual has a higher degree of controllability and self-efficacy in a risk-prone field, they are likely to implement said behavior; if the individual has a lower sense of controllability and self-efficacy in a risk-prone field, they will avoid the related behavior (Ajzen, 1991). Individuals are constrained by internal and external conditions, and this may affect their confidence in the implementation of certain behaviors. This factor is called perceptual behavioral control. This can measure the perception of individuals to certain behaviors that may be either easy or difficult to perform, as measured through a series of controlled variables that can be traditionally perceived (Tonglet et al., 2004). Research in the field of recycling behavior shows that respondents who are confident in "how, when, and where" to recycle tend to show a stronger willingness to recycle than those who believe they have existing or imminent restrictions and limited controls on their recycling behavior (Kumar, 2019). The following hypotheses are thereby proposed:

H5a: The perceived behavioral control of urban residents' has a direct and significant positive effect on their willingness to pay for the treatment of gutter oil.

H5b: Perceived behavioral control plays a mediating role on the impact of risk perception on residents' willingness to pay for treatment of gutter oil.

According to the above research hypotheses, the research hypothesis model of urban residents' willingness to pay for treatment of gutter oil is established, as shown in **Figure 1**.

METHODOLOGY

Research Design

This paper adopts the contingent valuation method (CVM) to evaluate residents' willingness to pay for the treatment of gutter oil. Based on the questionnaire survey, the respondents were guided to answer whether they were willing to pay a certain amount for the treatment of gutter oil. If they were willing, they were asked the specific amount they were willing to pay. Through this mode of inquiry, the average willingness to pay could be obtained from the sample subjects.

The questionnaire was designed according to the validation practices of the extended influence behavior questionnaire produced by Yukl et al. (2008). In this paper, 167 questionnaires were distributed across Chengdu and Mianyang for preliminary investigation. A total of six factors were extracted in the exploratory factor analysis, and the interpretation rate of the cumulative variance was 73.11%, indicating that the questionnaire was well-designed. In the confirmatory factor analysis, some items with high correlation values were deleted, and the ultimate model of "urban residents' willingness to pay for gutter oil treatment" contained six latent variables (with five independent variables and one dependent variable) and 18 explicit variables, and the overall fitness of the model was found to be good. The final questionnaire included 21 research questions, three situational experimental questions and, four socio-economic background questions. The research questions were all based on a five-point Likert scale. The selection of the sample source for this study was mainly performed for three reasons. First of all, the cities of Chengdu and Mianyang in Sichuan are both pilot locations for resource utilization and zero-harm treatment of kitchen waste in China. Secondly, Sichuan cuisine is one of China's primary culinary traditions, and many of its dishes utilize high volumes of oil. Last but not least, Sichuan is the largest center of pig breeding among any province in China, slaughtering 65.791 million pigs annually, and its waste oil from meat processing is therefore also very sizable. Therefore, Chengdu and Mianyang in Sichuan provide fertile opportunities and an ideal representative sample source.

This questionnaire survey adopts a remote structured questionnaire method. We selected four of the 28 county-level administrative regions in Chengdu and Mianyang cities as the questionnaire distribution points by simple random sampling. A total of 468 questionnaires were distributed across Chengdu and Mianyang. 431 valid questionnaires were retrieved, making for a recovery rate of 92.1%. In order to make the sample more representative, a stratified sampling method was adopted for Chengdu and Mianyang. On the basis of considering the uniform distribution of survey sites across geographical location, 10 survey sites were selected in both core urban regions and suburbs according to the principle of random sampling. The sample size of each geographical urban area is basically proportional to the local population. Before issuing the formal survey, the researchers were trained on the contents of the questionnaire,

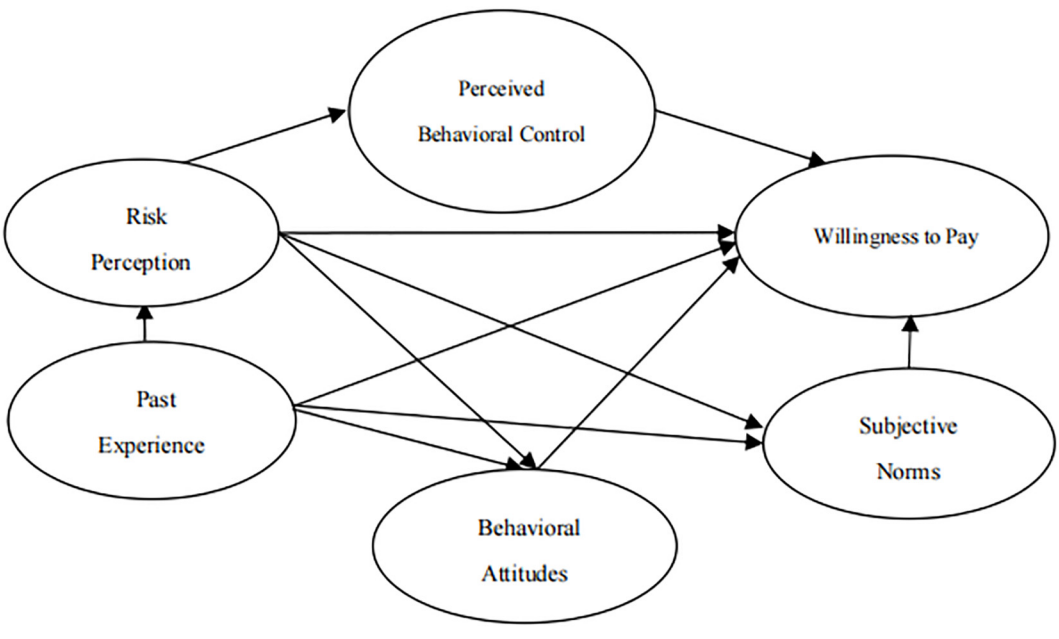

FIGURE 1 | Research hypothesis model.

survey skills, and survey arrangements, and 60 questionnaires were pre-surveyed.

The descriptive statistical results are shown in **Table 1**. It can be seen that women accounted for the majority of the respondents (61.5%), basically ranging in age between 30 and 50 years old, the majority being 41–50 years old. Bachelor's degree holders formed the largest proportion by education level, followed by those with some college, senior high school, junior high school or below, and master's degree holders or higher respectively. The average monthly household income of the respondents was less than 20,000 yuan.

Statistics of Willingness to Pay

This paper used a bidding card system to explore residents' willingness to pay. Firstly, it asks whether the residents were willing to pay for the treatment of gutter oil. If not, the bidding value was given as zero. The respondents who choose "willing" were asked to choose from the given bid values, and the final statistical results of this are shown in **Table 2**. From the 431 questionnaires, 341 respondents were willing to pay for the treatment of gutter oil, accounting for 79.1% of the total, and 90 respondents were not willing to pay for the treatment of gutter oil, accounting for 20.9%. From the perspective of statistical proportion, most respondents stated a relatively low willingness to pay, accounting for 80.1% of the total respondents, and their willingness to pay for treatment of gutter oil was mainly between 0 and 10 yuan.

TABLE 1 | Descriptive statistics of participants.

Demographic characteristic		Sample distribution (%)	Frequency
Gender	Male	38.5%	166
	Female	61.5%	265
Age	<30	24.8%	107
	31–40	25.3%	109
	41–50	39.4%	170
	51–60	6.7%	29
	>60	3.8%	16
Educational background	Junior high school or below	10.2%	44
	Senior high school	21.8%	94
	Some college	23.0%	99
	Bachelor's degree	36.0%	155
	Master's degree or higher	9.0%	39
Monthly household income (RMB)	<9,999	45.5%	196
	10,000–19,999	30.9%	133
	20,000–29,999	11.1%	48
	30,000–49,999	7.2%	31
	>50,000	5.3%	23

TABLE 2 | Results of willingness to pay.

Price range	Frequency	Percentage
0	90	20.9%
2	69	16%
4	18	4.2%
6	27	6.3%
8	25	5.8%
10	116	26.9%
12	10	2.3%
14	2	0.5%
16	2	0.5%
18	4	1%
20	68	15.6%

Secondly, the respondents' average willingness to pay was calculated as follows:

$$E(WTP)_{+} = \frac{\sum_{i}^{20} A_i N_i}{\mathbf{N}} \quad (1)$$

Where *Ai* is the specific bid value and *Pi* is the probability of selecting the bid value. According to the statistical results, the average value of *E* (WTP) was 9.8 yuan. Note that the existence of samples willing to give zero payment increases the difficulty of this calculation, but if the zero payment samples were directly screened out, the authenticity of the results would be reduced. Therefore, on the basis of calculating the positive willingness to pay, the spike model proposed by Kristrom was used to perform adjustment (Kristrom, 1997). The core idea of this model emphasizes that if there is a zero payment sample in the tender value, the overall mean value is multiplied by the tender probability of positive payment samples on the basis of the positive payment sample's *E* (WTP), namely,

$$E(WTP) = E(WTP)_{+} * (1 - P_0)$$

According to the above formula, the final WTP is 7.75 yuan.

RESULTS ANALYSIS

First of all, the possible influence of common method variance were designated to be excluded, and the scale's reliability, aggregate validity, and discriminant validity were tested, and the degree of fit for both the data and model had to be verified. Secondly, we verified the significance of the casual relationship and the path coefficient between the variables based on the structural equation model. The indirect effect of specific variables of each mediation path was then further analyzed by the Bootstrap method.

Measurement Validation

Common Method Variance

Since the collation and summary of the questionnaire data were carried out by the same person, after the implementation of the questionnaire survey, the issue of common method variance

(CMV) may occur. In this paper, Harman's single-factor method is used to test whether the common method variance is severe. Based on the software analysis of SPSS19.0, it was found that the characteristic values of the six factors were all higher than 1, thereby explaining 80.3% of the total variance. At the same time, the variance explanation rate of the first factor was 28.2%, and this is significantly lower than the critical value of 40%. This shows that common method variance is very small, and is not expected to significantly affect the research results (Harman, 1967).

Reliability and Validity

In this paper, we use Cronbach's coefficient to analyze the reliability of the scale. Generally speaking, a Cronbach's α reliability value above 0.7 is considered acceptable (Bagozzi, 1981; Nunnally and Bernstein, 1994). **Table 3** shows that the coefficients of all variables were greater than 0.7, which means that the internal consistency of the questionnaire was good, and the scale possesses high reliability (Chin and Marcoulides, 1998). Validity covers both polymeric validity and discriminant validity. Polymeric validity generally requires three conditions. The first involves all factors producing a significant positive load on variables above the level of 0.001 (Lin and Niu, 2018). The second requires that the factor load should be in the range of 0.5–0.95, and the third needs the average variance extracted (AVE) to be greater than 0.5 (Fornell and Larcker, 1981).

Table 3 shows that all factor loads were in the interval, the AVE was significantly greater than 0.5, and the combined reliability (CR) between the factors was greater than 0.7. Therefore, the aggregate validity passes the standard.

The discriminative validity needs to compare the size relationship between the square root of the AVE and the Pearson correlation coefficient between the variables (Park et al., 2014). **Table 4** shows that the square root of the AVE between each variable and its factor is greater than the Pearson correlation coefficient between variables, which means that all variables have good discriminant validity (Fornell and Larcker, 1981; Hair et al., 1998).

Model Fit

Amos software is used to verify the degree of fit between the questionnaire data and the hypothetical model. The results of the model fit are shown in **Table 5**. The results show that in the absolute fit results, the chi square value and freedom ratio is 3.142, which is less than the critical value of 5, and meets the fit standard (Carmines and McIver, 1981). The GFI is 0.907, which is greater than the critical value of 0.9, and the critical value of AGFI, close to 0.9 is acceptable. The RMSEA is 0.071, which is in the range of 0.05–0.08, and also meets the fit standard (Browne and Cudeck, 1993). In the value-added fitness results, the RFI was 0.895, which is very close to the critical value. Except for RFI, the other results all met the fit standard. This shows that there is a good fit between the model and the data.

Hypothesis Test Results

The maximum likelihood estimation method is used to test the hypotheses of the structural equation model, and the test results are shown in **Table 6**. It can be seen that the past experience has a significant impact on risk perception ($\beta = 0.430$, $P < 0.001$), behavioral attitude ($\beta = 0.145$, $P < 0.01$), subjective norm ($\beta = 0.181$, $P < 0.01$) and willingness to pay ($\beta = 0.140$, $P < 0.01$). Hypotheses H1a, H1b, H1c, and H1d were therefore all demonstrated to be all valid.

TABLE 3 | Reliability and convergent validity.

Construct	Item	Item loading	CR	Cronbach's Alpha	AVE	Skewness	Kurtosis
Perceptual behavior control	PBC1	0.839				−1.597	1.775
	PBC2	0.843	0.878	0.878	0.706	−1.053	−0.032
	PBC3	0.838				−1.300	0.679
Risk perception	RP1	0.903				−1.616	2.085
	RP2	0.893	0.930	0.930	0.815	−1.986	3.648
	RP3	0.912				−2.742	7.404
Past experience	PE1	0.825				0.542	−0.380
	PE2	0.780	0.861	0.859	0.673	0.150	−0.797
	PE3	0.855				0.588	−0.441
Behavioral attitude	BA1	0.696				−1.271	1.140
	BA2	0.863	0.830	0.821	0.620	−0.631	−0.337
	BA3	0.795				−1.810	2.744
Subjective norms	SN1	0.778				−0.309	−0.985
	SN2	0.835	0.865	0.864	0.681	−0.154	−1.005
	SN3	0.860				−0.266	−0.952
Willingness to pay	WTP1	0.795				−0.434	−1.158
	WTP2	0.841	0.833	0.840	0.626	−0.215	−1.163
	WTP3	0.733				1.438	0.067

CR, composite reliability; AVE, average variance extracted.

TABLE 4 | Discriminant validity: AVE and Pearson correlation coefficient.

	BA	PBC	SN	RP	PE	WTP
Behavioral Attitude (BA)	**0.787**					
Perceived Behavioral Control (PBC)	0.190	**0.840**				
Subjective Norms (SN)	0.175	0.173	**0.880**			
Risk Perception (RP)	0.284	0.126	0.063	**0.903**		
Past Experience (PE)	0.188	0.090	0.141	0.308	**0.820**	
Willingness to Pay (WTP)	0.440	0.339	0.289	0.244	0.261	**0.791**

The bold values mean that the average values are greater than relevant coefficient values, and there is sufficient discriminant validity among all dimensions.

TABLE 5 | Results of model fit.

	Fit indices	Judging criteria	Test result	Judgment
Absolute Fit Index	CMIN/DF	<5.0	3.142	Acceptable
	GFI	>0.9	0.907	Good
	AGFI	>0.9	0.871	Acceptable
	REMSEA	<0.08	0.071	Acceptable
Value-added Fitness Index	NFI	>0.9	0.915	Good
	IFI	>0.9	0.941	Good
	RFI	>0.9	0.895	Acceptable
	TLI	>0.9	0.926	Good
	CFI	>0.9	0.940	Good

Risk perception was therefore shown to significantly affect behavioral attitudes ($\beta = 0.143$, $P < 0.001$) and perceived behavioral control ($\beta = 0.135$, $P < 0.01$). Therefore, hypothesis H2a and H2c are shown to be tenable, but they are not statistically significant for subjective norms ($\beta = 0.013$, $P > 0.05$) or willingness to pay ($\beta = 0.055$, $P > 0.05$), so H2b and H2d are not confirmed by the results. In addition, behavioral attitude ($\beta = 0.431$, $P < 0.001$), subjective norms ($\beta = 0.170$, $P < 0.001$) and perceived behavioral control ($\beta = 0.243$, $P < 0.001$) were shown to significantly affect WTP. Hypothesis H3a, H4a and H5a were therefore verified, which further verified the applicability of the theory of planned behavior.

When testing multiple mediating effects, Amos is only able to analyze the total indirect effects, but cannot analyze the indirect effects of specific variables of each mediating path. Therefore, the Bootstrap method (Preacher and Hayes, 2008) was used to test the mediating role of behavioral attitudes, perceived behavioral control, and subjective norms affecting both risk perception and willingness to pay, and the mediating roles of risk perception, behavioral attitude, and subjective norms between past experience and willingness to pay. These effect values were sorted by value, and 95% confidence intervals for mediating effects were estimated using the 2.5th and 97.5th percentiles. If the 95% confidence interval of the mediating effect did not include 0, this indicates that the mediating effect is significant. In this paper, we set a sample of 5,000 times and set a 95% confidence interval to get the specific indirect effect and confidence interval of each intermediary path. The results of this test are shown in **Table 7**.

TABLE 6 | Hypothesis test results.

Hypothesis	+/-	Estimate	Judgment
H1a: Past Experience→Risk Perception	+	0.430***	Yes
H1b: Past Experience→Behavioral Attitude	+	0.145**	Yes
H1c: Past Experience→Subjective Norms	+	0.181**	Yes
H1d: Past Experience→Willingness to Pay	+	0.140**	Yes
H2a: Risk Perception→Behavioral Attitude	+	0.143***	Yes
H2b: Risk Perception→Subjective Norms	+	0.013	No
H2c: Risk Perception→Perceived Behavioral Control	+	0.135**	Yes
H2d: Risk Perception→Willingness to Pay	+	0.055	No
H3a: Behavioral Attitude→Willingness to Pay	+	0.431***	Yes
H4a: Subjective Norms→Willingness to Pay	+	0.170***	Yes
H5a: Perceivedl Behavioral Control→Willingness to Pay	+	0.243***	Yes

**P < 0.05 denotes significant, **P < 0.01 denotes relatively significant, and ***P < 0.001 denotes very significant.*

TABLE 7 | Bootstrap analysis results of the mediation effect test.

Intermediary path	Indirect effect	BootSE	Bootstrapping 95% CI	
			LLCI	ULCI
H2e: PE-RP-WTP	0.058	0.017	0.026	0.094
H3b: RP-BA-WTP	0.096	0.021	0.059	0.141
H3c: PE-BA-WTP	0.079	0.023	0.035	0.127
H4b: RP-SN-WTP	0.015	0.011	−0.006	0.037
H4c: PE-SN-WTP	0.038	0.015	0.011	0.068
H5b: RP-PBC-WTP	0.033	0.015	0.005	0.064

According to the criterion of whether the confidence interval contains 0 or not, we can see that risk perception as a mediating variable has a significant influence path on both willingness to pay and past experience [BC 95% CI = (0.026, 0.094)], assuming that H2e is true. Behavioral attitude is significant as a mediating variable in the path of risk perception [BC 95% CI = (0.059, 0.141)] and past experience [BC 95% CI = (0.035, 0.127)] on willingness to pay, assuming that H3b and H3c are true. The confidence interval of subjective norms as the mediating variable in the path of risk perception influencing willingness to pay [BC 95% CI = (−0.006, 0.037)] contains 0, and therefore the indirect effect of this variable is not significant, so H4b is not verified by this measure. However, subjective norms is significant as a mediating variable in the path of past experience influencing willingness to pay [BC 95% CI = (0.011, 0.068)], so H4c is shown to be verified. Finally, the confidence interval of perceived behavioral control as the mediating variable of risk perception's influencing path on willingness to pay [BC 95% CI = (0.005, 0.064)] does not contain 0, and the mediating effect is tenable, and the hypothesis H5b is verified.

Given these results, we drew a table of the total effects, indirect effects, and direct effects of latent variables and willingness to pay (**Table 8**). According to **Table 8**, risk perception and past experience do not directly affect willingness to pay. Past experience affects willingness to pay through risk perception and subjective norms, and risk perception affects willingness to pay through subjective norms and perceived behavioral control.

TABLE 8 | Direct effect, indirect effect, and total effect between latent variables and willingness to pay.

Regression path	Direct effect	Indirect effect	Total effect
Past Experience→Risk Perception	0.002	0.058	0.060
Past Experience→Behavioral Attitude	–	–	–
Past Experience→Subjective Norms	0.067	0.015	0.082
Past Experience→Willingness to Pay	–	–	–
Risk Perception→Behavioral Attitude	–	0.083	0.083
Risk Perception→Subjective Norms	0.085	0.015	0.100
Risk Perception→Perceived Behavioral Control	0.053	0.033	0.086
Risk Perception→Willingness to Pay	–	–	–
Behavioral Attitude→Willingness to Pay	0.087	–	0.087
Subjective Norms→Willingness to Pay	0.057	–	0.057
Perceived Behavioral Control→Willingness to Pay	0.058	–	0.058

"–" means that the effect is not significant.

A summary overview of the impact model of urban residents' willingness to pay for treatment of gutter oil is thereby shown in **Figure 2**.

Difference Analysis Based on Socio-Economic Characteristics

We also included socio-economic characteristics in the influencing factors, and explored the impact of socio-economic characteristics on willingness to pay through one-way ANOVA and multiple groups of comparative analysis of structural equation models. The one-way ANOVA was produced using SPSS software to explore whether there are significant differences in variables across different groups. The multi group comparative analysis of the structural equation model can assume the differences in paths between different groups, and these differences can be measured by the AMOS software. Due to the limitation of the length of the paper, we only show the calculation results here. In the analysis of the difference of willingness to pay based on gender characteristics, the impact of risk perception on subjective norms is significant in female group, is not found to be significant in male groups, and the impact of behavioral attitude on willingness to pay is significant in the male group and is not significant in female group. In the difference analysis of willingness to pay based on age characteristics, middle-aged and younger people show a higher willingness to pay. The willingness to pay of respondents under the age of 50 was more than seven RMB, and the willingness to pay of respondents over the age of 50 was less than five RMB. In the difference analysis of willingness to pay based on income characteristics, high-income groups and low-income groups showed significant differences in behavioral attitude risk perception, subjective norms risk perception, and subjective norms on willingness to pay. The impact of behavioral attitude on willingness to pay was significant in the high-income group, and the impact of past experiences on subjective norms was significant in the low-income group; In the education-based differential analysis of willingness to pay, the equally significant paths of the low- and high-education groups include the impact of risk perception on behavioral attitude, subjective norms and perceived behavior control, subjective norms on willingness to pay, past experience on risk perception and subjective norms. The impact of behavioral attitude on willingness to pay was significant in the high-education group, and the influence of past experience on behavioral attitude was also significant in this group.

DISCUSSION AND IMPLICATIONS

Conclusion and Discussion

Most previous studies on this topic only calculated the willingness to pay, but did not explore the specific related factors and influence paths of the willingness to pay. This paper added two variables: past experience and risk perception. The theoretical framework of extended TPB was used to study the impact mechanism of the willingness of urban residents' to pay for the treatment of gutter oil. The conclusions of this study can provide references for the making of relevant policy decisions.

Firstly, urban residents have a higher willingness to pay for treatment of gutter oil. Urban residents' willingness to pay for treatment of gutter oil is 7.75 yuan, which is close to urban residents' standard domestic garbage disposal fees (8 yuan per household per month). Nearly 80% of the respondents are willing to adhere to the principle of "the polluter pays" and to pay for a certain amount for the treatment of gutter oil. Consequently, they have a high willingness to pay. This means that urban residents have a high awareness of environmental protection, and also provides good opportunities for the expanded treatment of gutter oil in China.

Secondly, the hypotheses involved in the basic theoretical framework of the TPB show a good fit for the collected data. Behavioral attitudes, subjective norms and perceived behavioral control were found to significantly affect WTP, which is consistent with the TPB framework and the research conclusions of many scholars (Chen et al., 2016; Blaise et al., 2018; Kumar, 2019). This means that urban residents have a positive attitude toward the treatment of gutter oil, and show a certain degree of recognition and trust toward the process. Therefore, they are willing to pay a certain amount for the treatment of gutter oil. The variable of past experience added in the TPB framework achieves a good match for theoretical framework. The results show that residents' past experience have a great impact on their risk perception ($\beta = 0.430$, $P < 0.001$), and also have a direct positive impact on behavioral attitude and subjective norms (Forward, 2009; Gardner, 2009). However, one unexpected finding was that residents' risk perception showed no significant impact on their willingness to pay or subjective norms, which is inconsistent with the conclusions of some scholars (Covello et al., 2001; Simsekoglu, 2019). This paper believes that the reason for this result is that most humans cannot resist the temptation of food. For example, from past experience, people know that food with high fat will cause human obesity and cardiovascular disease (risk perception), but so many people

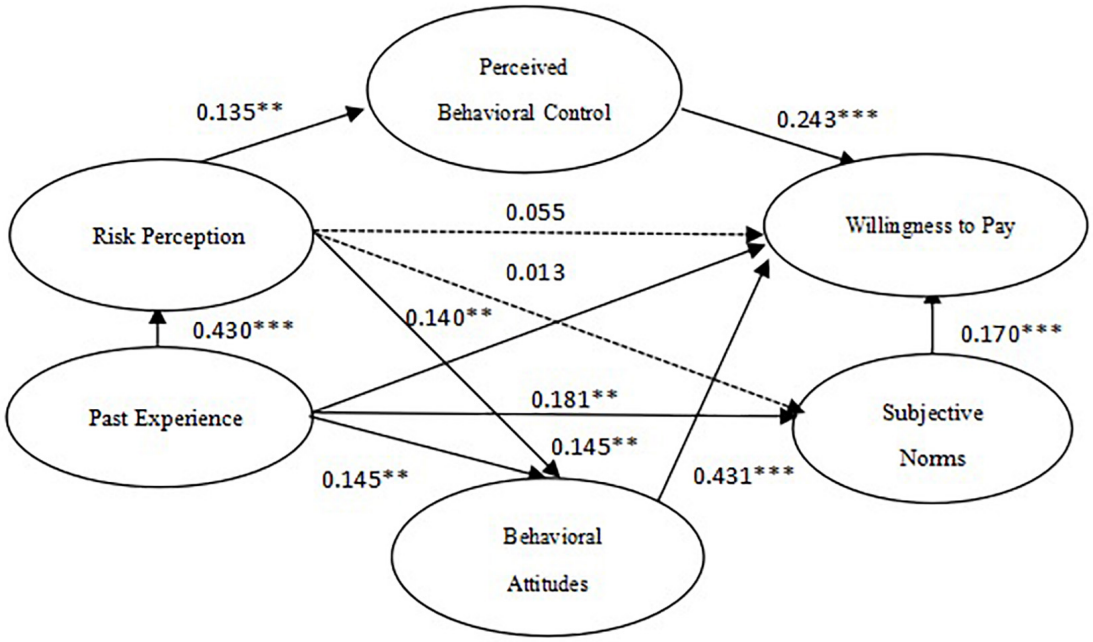

FIGURE 2 | Results of structural model. *$P < 0.1$, **$P < 0.05$, and ***$P < 0.01$.

still eat high fat food, especially hot pot. Although gutter oil is a waste and not a food, people eat gutter oil through food. Perhaps this is the reason why the risk perception of the gutter oil cannot have a significant impact on the willingness to pay and subjective norms.

Finally, results of the mediation effect test show that only one of the six paths of mediation effect in the structural equation model has not been verified. Residents' risk perception and past experience indirectly affect their willingness to pay for the treatment of gutter oil through the intermediary variable of behavioral attitude, which means that public risk awareness can be improved by vigorously publicizing the harmful effects of poor or non-existent gutter oil treatment, so as to improve residents' behavioral attitude toward the treatment of gutter oil. As a mediating variable, subjective norms have significant indirect effects on the influence path of past experience on willingness to pay, which reflects the important influence of subjective normative factors such as reference group and environment (Yadav and Pathak, 2017; Singh et al., 2018). Therefore, attention should be paid to the critical role of subjective norms. Meanwhile, risk perception was found to be a significant mediating variable in the influence path of past experience on willingness to pay, and perceived behavioral control was significant as a mediating variable in the influence path of risk control on willingness to pay. However, subjective norms were not a significant mediator in the impact of risk perception on willingness to pay.

Implications

First, the government should establish special funding channels for gutter oil recovery. In accordance with the research conclusions, the residents' willingness to pay for treatment of gutter oil averaged to 7.75 yuan, which is close to urban residents' existing standard charge for garbage treatment. It can be seen that urban residents show a relatively high willingness to pay and sense of social responsibility. Given these conditions, the government can establish a reasonable payment mechanism for the service and set up special funds to support it. The main purpose of these special funds is to provide financial subsidies for gutter oil recycling and treatment enterprises. Gutter oil recycling and treatment enterprises can provide free recycling and treatment services for residents, which is important as these services actually involve significant labor costs, transportation costs, and operating costs. Therefore, special funds should be focused on well-regulated and authorized gutter oil recycling and treatment enterprises to support them to better provide services related to the recycling and treatment of gutter oil. The government can also collect appropriately rated fees from residents according to the "polluter pays" principle. The collected funds can then be used to install oil-water separators for household kitchens to better facilitate the recovery and treatment by associated enterprises. The government can also use these special funds to help enterprises to improve their scientific and technological innovation capabilities and enable them to develop more new technologies for treating gutter oil.

Second, investments should be made in storage equipment and the tracking and management of transport routes. It can be seen from the research conclusions that residents have a rather high willingness to pay for these services. Therefore, some cities can be selected for initial pilot projects to install oil-water separators in urban households and special storage equipment in residential areas, and to instruct residents to

intentionally and autonomously put this filtered gutter oil into these special storage containers. As the residential gutter oil discharged locations are very widely distributed, the staff at these recycling enterprises should measure and collect the gutter oil at each point regularly every day, establish collection and transportation accounts for managing them, and form a rational and reasonable transportation route to collect from all containers regularly. The government regulatory department should install GPS units on the oil collection vehicles used for recycling, so as to effectively prevent recycling personnel from reselling the gutter oil illegally.

Third, a diverse array of publicity and educational activities should be carried out. As can be seen from the research conclusions, behavioral attitudes and subjective norms are the main direct factors affecting residents' willingness to pay. Publicity and education are still the preferred means to influence individuals' attitude toward environmental protection and their attitude toward the government, to adjust the public's environmental behavior, and to increase their attention and sense of urgency toward the issue of gutter oil. Therefore, the government should use a variety of methods and channels to carry out a broad publicity and education campaign, vigorously popularize a common awareness of the environmental pollution caused by the unregulated disposal, collection, and reuse of gutter oil, promote basic knowledge of edible oil identification and relevant legal knowledge. The goal of this campaign is to guide residents to proactively protect the environment and maintain healthier consumption habits, as well as to improve public awareness of health, food safety, and environmental protection concerns. Different means of public communications can be adopted for residents of different ages. For younger residents, we should popularize knowledge about the treatment of gutter oil by means of internet media, micro-blogs, and public WeChat accounts. For elderly and other residents who do not use social media, we should adopt a more multimedia and community-based approach to educate them about the treatment of gutter oil.

Finally, media exposure should increase and enhance public awareness of associated risks. People's risk perception is an indirect factor affecting their willingness to pay for these services, therefore law enforcement departments should regularly and publicly announce problems related to the disposal and recycling of "gutter oil" and kitchen waste, vigorous supporting the news media in their timely reporting of relevant topics and stories, measures taken, and their progress and results, and should expose any food service enterprises or illegal manufacturing or sales facilities that illegally use, produce, or sell gutter oil, and thereby improve public awareness of the risks of using untreated gutter oil.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

PC and LX: conceptualization. LX: methodology. GS: software and data curation. QY: resources. PC: writing—original draft preparation. PC and GS: writing—review and editing. All authors have read and agreed to the published version of the manuscript.

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Gender-Related Beliefs, Norms, and the Link With Green Consumption

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Although extant literature provided abundant evidence that men and women are different in their environmental behaviors, there is a lack of integration of gender differences in green consumption and the underlying mechanism that associates with these disparities. Therefore, to solve this existing gap, the current paper reviewed existing literature on green consumption with threefold purposes. First, presenting an integrated view of gender-different green consumption patterns along with the relationship of gender-related beliefs and individuals' pro-environmental behavior based on existing evidence. Second, interpreting how gender differences are generated based on the value-belief-norm (VBN) theory, and the theory of social roles. Third, analyzing previous studies, providing implications for future research, and then proposing suggestions for marketing practitioners in the green products industry. Accordingly, this article compared men's and women's different behavior in green consumption and discussed how and why they behave differently. Generally, women show a more positive green consumption intention, consume less carbon, and purchase green products more frequently. Whereas men are doing better than women in terms of environmental knowledge, and in some regions, they express higher concerns about environmental problems. It interprets individual differences in green consumption based on VBN theory from a unique insight—gender. It also identified some barriers for both men and women to participate in green consumption, and then proposed several suggestions to improve the public willingness of engaging in green consumption.

Keywords: green consumption, gender difference, value behavior norm, environment, sustainable, pro-environmental behavior

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INTRODUCTION

Green consumption is characterized by purchasing green products that are recyclable, renewable, and beneficial to the environment, or minimizes the negative effect on the environment and natural resources during the products' manufacturing process (McEachern and McClean, 2002; Mostafa, 2007). Unlike regular products, green products, such as biodegradable plastic containers, energy-saving light bulbs, electric cars, and natural perfumes, are less polluting to the environment. Currently, the environmental pollution and natural damage related to humans' daily consumption has become much more apparent than before (Choi et al., 2015; Han, 2015), which increases the urgency of saving natural resources and reducing the pollutions and greenhouse emission in daily consumption to improve the environment quality. Because

of this, converting public consumption into a more eco-friendly way has been considered an engageable and impactive method to reduce the artificial harm to nature, and both policymakers and researchers have been constantly making efforts to promote green consumption during the past few decades (Leonidou and Leonidou, 2011; Cholette et al., 2013). For example, to reduce the carbon emission from transportation and promote the operation of eco-friendly vehicles in the general public, many countries such as Japan, China, Belgium, and other European countries have already provided various subside methods for increasing electric vehicles sales such as bonuses and different levels' tax reduction for the consumption of incenting the electric vehicles (Ahman, 2006; Han et al., 2011; Hockenos, 2011). Other than promoting green products, researchers also devoted themselves to minimizing environmental costs in the market. As recently, Yavari and Ajalli proposed an effective strategy to decrease companies' total environmental costs by building up a more environmentally friendly supply chain and reducing carbon dioxide emission in the process of materials distribution (Yavari and Ajalli, 2021). In the investigation of public green consumption intention and behavior, most studies have suggested that women are more supportive of green consumption, whereas there are also arguments supporting that men perform better in some aspects of environmental behavior, such as environmental knowledge, environmental intention, etc. (Diamantopoulos et al., 2003; Pagiaslis and Krontalis, 2014; Rahim et al., 2017), which raises an interesting topic, gender difference.

However, most previous studies that explore the gender differences in green consumption admitted and emphasized the impact of gender-associated social stigma and norms on green consumption (Mohai, 1997; McCright and Sundström, 2013; Swim et al., 2020). For example, connecting green consumption with feminine behavior is an obstacle for men to engage in green consumption because they prefer to perform in a way that aligns with their masculine gender identity, and stay away from feminine characterized activities (Brough et al., 2016; Swim et al., 2020). Therefore, we believe that gender is a meaningful and interesting topic, but gender itself might not be the determining factor that induces distinct green consumption behavior of men and women. Instead, the effect of gender-related beliefs and norms on an individuals' green consumption is an essential part that deserves a deeper exploration in the entire pro-environmental field. An individuals' personal value is shaped by the longitude process of socialization and affected by the social stereotype of their own social identity. Since there are different traits of both men and women that society prefers, gender-different personal value has been formed (Di Dio et al., 1996). The personal value affects an individuals' attitude and willingness to engage in a particular behavior, such as higher altruism making individuals more likely to worry about the natural environment and would like to support activities involved with environmental protection, but egoistic personal orientation restricting an individual's engagement on green consumption (Blocker and Eckberg, 1997; Bogner and Wiseman, 2004).

Accordingly, men's and women's different personal values contribute to their attitude and motivation to green consumption. The attitude to green consumption is also greatly affected by social norms (Mohai, 1997; Stern, 2000; Frantz and Mayer, 2009; Alibeli and White, 2011; McCright and Sundström, 2013). Since based on social norms, women usually take more responsibility for caring for others, and play the altruistic and cooperative role, whereas, the social expectation on men is inclined to more aggressive characters (Alibeli and White, 2011; Gysbers et al., 2014). The green consumption behavior has a strong link with femininity and is represented by feminine characters, and behavior such as saving energy, reducing carbon consumption is less related to the masculine characters such as competence and ambition (Brough et al., 2016). Therefore, compared with women, men usually hold a more avoidable, instead of active attitude to green consumption behavior (Nanggong and Bandu, 2018; Swim et al., 2020). Besides, it is also necessary to clarify the definition of "gender" in this article. Unlike sex, an inborn, unchanged personal identity from a biological perspective, by saying gender, we refer to the identity that was determined by each person and varies based on an individuals' own social preferences. Also, as a social construct, gender involves or represents various social norms, beliefs, and behaviors that were considered appropriate by the public society for men and women (World Health Organization, 2002). This review aims to integrate previous studies' results and analyze the links between gender-related beliefs, social norms, and environmental behavior, manifested as green consumption. The necessities and wishes of this review are presented as follows.

First, the exploration of gender differences provides a unique perspective for explaining the individual differences in green consumption behavior. For now, most researchers have discussed green consumption from moral identity, psychological ownership, consumer attitude, and other related factors (Biswas and Roy, 2015; Wang et al., 2019), but overlooked the impact of demographic factors such as gender, age, region, etc. Robert once suggested that studies failed to consider the demographic factors are incomplete (Roberts, 1996). Gender, as suggested by Baker and Ozaki, is unignorable not only because it was an important reason behind these psychological differences affecting green consumption but also since that gender equality and different social stigma toward men and women have a huge effect on their green consumption and other related pro-environmental behavior (Pickett-Baker and Ozaki, 2008).

Second, by exploring the effects of gender-related beliefs and norms on green consumption behavior, we can analyze the popular theories that are used to explain pro-environmental behavior from one more perspective, gender. The Value-Belief-Norm (VBN) theory proposed by Stern is an authoritative theory used to interpret the effects of personal values on individuals' behavior under particular social circumstances. It emphasizes the critical roles of personal values, beliefs, and norms in stimulating individuals' pro-environmental behavior, as based on VBN theory, prosocial behaviors are more likely to happen when personal values, beliefs, and norms are activated together. The VBN theory is frequently used to explore individuals' differences in various social behavior. Egoistic, altruistic, and biospheric value orientations that previous studies typically use to discuss distinct environmental behavior also align with the belief in the VBN theory (Dietz et al., 2002; De Groot and Steg, 2007; Xu et al., 2021). Besides, the theory of green purchase behavior

that was established recently admits the role of the VBN theory in exploring green consumption behavior as well (Han, 2020). In the national survey conducted by Stern in 1994 toward 420 samples, among many of the environmental theories, the VBN theory provides a more precise prediction of individuals' support for environmental behavior (Stern et al., 1999). Accordingly, the current paper selects the VBN theory as the theoretical basement and suggests that it is also adaptive for interpreting the distinct gender-related beliefs and norms in green consumption behavior. After further exploration in this field, it will be possible for researchers to examine whether other popular theories can be explained from the gender dimension.

Third, even though researchers verified that men's and women's pro-environmental behavior are usually different, there are still some arguments and opposite findings in existing studies. Most studies claim that women are more eco-friendly than men since they engage in more pro-environmental behavior, and express stronger environmental concern (Krauss, 1993; Zelezny et al., 2000; Vainio and Paloniemi, 2014), but there are studies arguing that men's environmental attitude is more positive than women, and they also have more solid environmental knowledge regarding the comprehension about environmental information and issues (Banerjee and McKeage, 1994; Mostafa, 2007; Ping and Linxiao, 2020). Therefore, whether men or women are more eco-friendly has not come up with a conclusion yet. This review aims to provide an objective summary and discussion based on previous findings regarding the link between gender-associated beliefs and pro-environmental behavior, especially green consumption and related environmental intention.

Fourth, the current review wishes to provide guidance for green businesses on how to make effective publicization targeting various consumers, especially distinct marketing strategies to men and women through analysis of relevant studies about the relationship between gender and green consumption. Since men and women perceive the same advertisement or interpret the same information differently and their motivations of purchasing green projects also have discrepancies, merchants need to be aware of the gender differences regarding green products' preference when they design, produce and publicize products (Brough et al., 2016; Nanggong and Bandu, 2018).

In conclusion, this article not only summarizes the existing literature that discusses gender different behavior, intention, and attitude in green consumption but also integrates the social and personal triggers of this difference. It is novel to examine gender differences in green consumption from the perspective of the VBN theory and analyze the connection between gender-related social norms and green consumption behavior. Additionally, by comparing men's and women's behavior and exploring the reason behind this difference, this article identified several factors that are potentially disadvantageous to green consumption, and then proposed suggestions that specifically target these obstacles to the green products industry. The first part of this review synthesizes specific gender differences in green consumption behaviors and related aspects such as green consumption attitudes, environmental knowledge, etc. Next, we explain the distinct gender beliefs and norms from the VBN theory and then analyze the social mechanism behind this discrepancy in green consumption behavior. In addition to the brief comparison of green consumption between men and women, the current article focuses on discussing exactly how gender-related beliefs and norms play a role in green consumption. Besides, by analyzing the inconsistent findings in this field, we indicate potential factors that interact with gender to affect green consumption together. In the end, after a deep exploration of the association between gender-related beliefs and green consumption, we analyze men's and women's different preferences toward green marketing and provide some practical suggestions for future researchers and marketers.

METHODOLOGY

Multiple databases were used in the process of searching qualified articles for this literature review. Google scholar was the initial database that we used for getting an overview of the currently available literature, and then through the University of Washington Library search database selectors, we chose Science Direct, PsycInfo, Elton B. Stephens CO (EBSCO), and Taylor and Francis as our three primary databases, and part of the articles are searched from SAGE, CNKI, PubMed, SpringerLink, and JSTOR.

The terms used for searching literature include: *Pro-environmental Behavior; Environmental Behavior; Environmental Attitude; Environmental concerns; Environmental Knowledge; Environmentalism; Personal Value; Altruism; Eco-friendly Intentions; Green food; Green consumption; Green Marketing; Gender Differences; Gender identity; Green consumption; Green consumers; Social stereotype*. These words are combined in various ways with the AND as the connection. Most of these terms are generated from keywords of articles searched in Google Scholar using the initial term "*gender differences in green consumption*." Besides direct searching using keywords on the database, a part of the articles was selected through the Snowball method by identifying an article as a start point and selecting other articles derived from it, but each article includes at least one or more search terms that we indicated earlier.

The inclusion criteria for the selections are described as follows. First, the questions that these studies examined should correlate with the topic that the current review focuses on. Second, the articles have to be either from peer-reviewed journals or book chapters, except certain data and definitions are selected from the WHO. Third, the articles should be published within the year 1990 to 2021, and the data analyzed in each study should also be later than 1990, any articles published earlier than 1990 will be excluded. After considering these factors, 96 articles were selected and used as references for this current review.

COMPARISON OF GREEN CONSUMPTION BETWEEN MEN AND WOMEN

Green Consumption Intention

Gender differences in green consumption are significant with women expressing a stronger green consumption intention and

purchasing more eco-friendly products than men (Banerjee and McKeage, 1994; Rahim et al., 2017). On a daily basis, women are more inclined to use household green products such as eco-labeled products (Loureiro et al., 2002; Vermeir and Verbeke, 2006; Han et al., 2011), with a stronger willingness to accept ecological advertisement than men (Yu, 2020). It has been found that men not only show a lower acceptance of the benefits of green products, they are also more likely to suspect the effectiveness and ecological benefits of these products (Chekima et al., 2016). Men usually determine whether to purchase green products based on the function, utilization, and personal responsibility to nature (Tung et al., 2017). On the other hand, the primary drives of women's green consumption are the products' ecological impacts, instead of whether they are practical or not. Tung et al. (2017) indicated that except for environmental concerns, there are more factors promoting women's green consumption than men. For example, women might purchase eco-friendly apparel because its fabric looks good, or might express an obvious supportive attitude to green products due to the wish of strengthening their self-identity (Tung et al., 2017). Gender differences in green consumption do not only exist in adults but also appear at young ages with adolescent girls showing a stronger green consumption intention. Also, compared with boys, adolescent girls are more likely to be affected by peers on green consumption, which promotes them to perform even better (Han et al., 2011).

Carbon Consumption

Most previous researchers have proven that men usually consume more carbon than women, which is closely related to their traveling ways, eating habits, and substances usage, such as tobacco or alcohol (Räty and Carlsson-Kanyama, 2010; Waygood and Avineri, 2016; Liu et al., 2019). Studies conducted by Loureiro as well as other researchers within the US and many European countries' adults show that women tend to eat more vegetables or fruits, and spend more money on purchasing organic, seasonal, or chemical-free food (Loureiro et al., 2002; Vermeir and Verbeke, 2006). Women also waste less food than men, which might have a relationship with their frequent purchasing of organic food since some research suggests that individuals who buy more organic food tend to waste less (Barr, 2007; Principato et al., 2015). Whereas men's purchasing rate of meat, protein-rich products, extra-processed food, beverage, and other similar drinks is much higher than women, and men also report a higher frequency of eating at restaurants and using tobacco (Elmståhl et al., 1999; Biloukha and Utermohlen, 2000; Fraser et al., 2000; Liebman et al., 2003). Men's strong preference for protein-rich diets has a significant potential risk of increasing energy consumption and gas emission that contribute to global warming and the greenhouse effect (Carlsson-Kanyama et al., 2003).

Another aspect leading to men's higher energy consumption is their driving frequency. Generally, traveling through public transportation is more attractive to women, that is, they take public transportation such as trains, links, buses, or taxis more often than men (Marian, 2020), and women own fewer cars than men (Bernard et al., 1997; Linderhof et al., 2001; Sánchez and González, 2016). The gender-different travel pattern is affected by multiple factors such as access to cars, vehicle reliance, environmental norms, gender stereotypes, trip length, and the number of children, etc. For most countries, women have less access to private cars than men (Matthies et al., 2002; Colin et al., 2004), which limited their usage of private vehicles. However, even though the number of women who own cars or get driver's licenses increased, they are not as dependent on cars as most men have. For men who have been drivers for decades, they have developed a reliance on cars, which decreases their willingness to take public transportation even more (Matthies et al., 2002; Claudia and Barbara, 2004). Moreover, Matthies has demonstrated that since women are more concerned about environmental conditions and tend to have more safety or health concerns as well, they are more active in environmentally friendly behavior in their life, such as taking public transportation (Matthies et al., 2002). Whereas, women's driving frequency is higher than the average in some conditions. Since most women are taking responsibility for taking care of their children and family trivia, the number of children is a factor that might affect this common gender-different travel pattern. When examining how nursing children or taking care of family is associated with gender differences in transportation patterns, a concept called "trip chaining" was been used by researchers. The word "trip" always refers to a process that individuals go through from their start point to their destination. Similarly, trip chaining means when there are many stops between an individual's start point and their final destination (Nancy and Yukiko, 2004). In this article, we primarily focus on the stops within people's daily commute, and how that suggests gender differences. In the 2001 National Household Travel Survey, 4.3 million women drop their children off or pick them up on their way between their house and workplace, but only 2.7 million men are responsible for this. Also, most women's trip chaining is because of purchasing household stuff or dealing with family works, especially in the family having multiple children (Nancy and Yukiko, 2004). Self-driving is much more convenient for women to do these relevant jobs, and therefore gender differences in the frequency of taking transportation are less relevant in women who have more than one child (Strathman and Dueker, 1995). Gender different driving frequency and attitude to taking public transportation does not only exist in adults but as Matthies suggested, driving has been ingrained in men's minds since their childhood. Most boys have been hoping to drive at the age of 10, which contributes to their future usage of vehicles, instead of taking public transportation (Matthies et al., 2002). Other than driving frequency, Delhomme's investigation indicates that there is also a gender difference in driving habits, as women engage in more eco-friendly driving behavior such as using the accelerator in a more conversive way or controlling the driving speed to be as stable as possible (Delhomme et al., 2013). These traveling differences also include hotel choices, since compared with men, women travelers would like to pay a higher price to choose green hotels that enact eco-friendly managing ways and purchasing procedures, and they also are more willing to recommend these green hotels to others (Han et al., 2011). However, while men usually consume much more carbon relative to women, they do not feel as much guilty as women for their non-eco-friendly life (Räty and Carlsson-Kanyama, 2010).

Different Opinions

In contrast with the opinions supporting women's better performance on green consumption, some results suggest that men perform greater than women in some aspects. For example, in investigations about daily commuting, Heesch et al. (2012) indicate that compared with women, men are more likely to cycle to work or to school.

Pagiaslis and Krontalis (2014) also suggest that men are more knowledgeable in renewable energy, especially biofuels, and show a stronger purchasing intention of biofuels than women. Also, there are studies that argue that men show a stronger attitude toward sustainability, which encourages them to use less polluted products. Considering the consistency of individuals' environmental attitudes and their actual green consumption behavior, Banerjee and McKeage (1994) and Mostafa (2007) suggest that the linkage between environmental attitude and green consumption is significantly stronger in men than in women. Additionally, plenty of studies report that the performance of men in objective environmental knowledge is higher than women, and know more about various types of environmental problems (Schahn and Holzer, 1990; Diamantopoulos et al., 2003). The comparison of gender different behavior in green consumption, as well as the inconsistent findings, are all summarized in **Table 1**.

Factors to Explain the Inconsistent Findings

In the discussion of gender differences in green consumption, several potential factors have been identified for explaining the inconsistent results. Environmental attitude, which refers to an individuals' general emotions toward environmental protection and damages (Pe'er et al., 2007), has been frequently mentioned by previous studies as one of the strong predictors of consumers' green consumption and their choices between common products and green products (Abdul-Muhmin, 2007; Jansson et al., 2010). Consumers who hold a more friendly pro-environmental attitude usually engage in green consumption behavior more frequently, and for example, they report a higher likelihood to purchase electric vehicles instead of gasoline cars (Mostafa, 2007). Besides environmental attitude, environmental knowledge is also identified as a predictor of green consumption behavior because it has a critical effect on an individuals' green consumption and contributes to the establishment of personal norms favoring environmental protection and green consumption, and individuals who hold a deeper environmental knowledge would like to spend more money for eco-friendly products (Vining and Ebreo, 1990). Also, Xiao and Hong reported that men have more environmental knowledge and show greater environmental concern than women based on their investigation of the Chinese general public (Xiao and Hong, 2010), which then supports the positive relationship between environmental knowledge and environmental concern. However, in their follow-up study in 2017, they found that even though women's environmental knowledge was still lower than men's, their environmental concern is about at the same level as men's (Xiao and Hong, 2017). In Xiao's opinion, one factor accounting for the distinct result of these two experiments is education level. In his prior study, subjects were chosen from the general public in 2003 when men's average education years was significantly higher than women. Whereas, in the study in 2017, Xiao claimed that the educational discrepancy between men and women is appreciably smaller than before and even does not exist in populations under 30 years old. Zeng et al. (2014) also suggested that the gap between men's and women's education levels is consistently shrinking, and there is almost no difference in the educational attainment of men and women. Inequity has almost disappeared in the public chances of receiving primary and middle school education either, and what is noticeable is that in some urban areas, girls are likely to have more educational chances and get a higher average academic performance than boys (Zeng et al., 2014). Therefore, this disconnection that occurred in Xiao's two experiments might be because of women's increased education level, which contributes to their awareness of environmental behavior even at the relatively lower level of environmental knowledge.

From the previous studies comparing gender different green consumption, we found that inconsistent results are very likely to be generated when studies are conducted in different regions (Mostafa, 2007; Heesch et al., 2012; Ping and Linxiao, 2020). Because of the differences in social circumstances between developed and developing countries, the associated gender belief and social norms are clearly different, such as the seriousness of social stigma to men and women as well as the quality of education as mentioned earlier, which might generate opposite results when shifting the focus from developed countries to underdeveloped countries (Kunovich and Kunovich, 2008; Jones et al., 2014; Pulsipher et al., 2017). When choosing samples from the Arab countries, the result does suggest that men report a higher environmental concern and more positive attitudes toward green consumption, which contradicts with the findings in developed countries (Mostafa, 2007). Alibeli and White (2011) explained this difference from the perspective of opportunities of getting in touch with nature. They claimed that in these countries, the intense and longitude patriarchal social norm requiring women to be responsible for housework restricted their opportunities of connecting with nature and considering environmental problems, which then make them less likely to be aware of the environmental issues and the necessity of protecting the environment (Alibeli and White, 2011). Regional differences related to many social and individual differences might generate opposite results. For instance, women's environmental attitude is generally more positive than men's in Western countries, whereas, many studies conducted in China showed that men's environmental attitude is relatively more friendly than women due to the different levels of environmental knowledge (Xiao and Hong, 2010; Ping and Linxiao, 2020).

THEORETICAL FRAMEWORKS

As a specific branch of private pro-environmental behavior, green consumption is also considered as pro-social behavior. Mohai, Frantz, and other scholars explained the gender differences from the sociological perspective, which emphasizes the role

TABLE 1 | Comparison of gender differences in green consumption behavior and intention.

Sources	Subjects	Thesis	Findings
Banerjee and McKeage (1994)	Students from the Northeastern University	The relationship between environmentalism and materialism	Environmentalism negatively correlates with materialism, and women show a significantly higher environmentalism and value environmental significance much more than men in consumer behavior
Barr (2007)	U.K. residents	The effect of environmental attitude on household waste management	Women are more likely to intentionally reduce their waste than men
Biloukha and Utermohlen (2000)	Ukrainian citizen	Examine food perception and consumption across Ukrainian citizen	Men perceive food as less costly than women and less likely to value food
Blocker and Eckberg (1997)	U.S. general public	Explore the reason of why women are more concerns about environmental related issues than men from the social perspective	Women shows more personal concern to environment than men, also women who are more knowledgable or in a higher social status engage more environmental behavior. Women's caregiver role also positively affect their environmental behavior and concern
Brough et al. (2016)	American, U.K, and Chinese adults	Whether the stereotype of gender identity affect men's desire of conducting green behavior	The association between feminine and green products, green behavior increases men's concern about their masculine identity, which then drop their willingness of engaging green behavior.
Carlsson-Kanyama et al. (2003)	Swedish publics	Examine the pattern and result of daily food taken and energy input in Swedish population	Women consume more vegetables and fruits instead of meats than men
Chekima et al. (2016)	General public in Malaysia	Investigating effects of demographic factors on green consumption	Gender has significant effects on green consumption behavior where women are more trust to eco-label and purchase more green products
Delhomme et al. (2013)	French drivers	Examining the frequency of ecofriendly driving behavior	Women have more eco-friendly driving behavior
Diamantopoulos et al. (2003)	UK public	Whether there is an association between socio-demographics and green consumption	Women have a stronger attitude toward environmental quality, show "greener shopping habits," and are more active at recycling. Whereas no gender difference shown on environmental knowledge.
Ping and Linxiao (2020)	Chinese adults	The relationship between gender and proenvironmental behavior in China	Chinese women are more active in private pro-environmental behavior, whereas men involves more public pro-environmental behavior. Compared to men, women have a weaker environmental problem perception.
Han et al. (2011)	U.S. hotel consumers	How does customers' intention of visiting green hotel differ across gender and other social demographics?	Women think eco-friendly intention as more favorably than men, have a higher intention to purchasing ecofriendly products, and show more eco-friendly behavior
Han (2020)	U.S. hotel consumers	The association between customers' eco-friendly attitude and their intention to visit "green hotel," and exploring whether this intentions differ across gender	Eco-friendly attitude have a positive relationship with green purchasing intention. Women holds a more positive attitude toward green consumption and shows stronger desire to choose the green hotel
Heesch et al. (2012)	Adults from Queensland, Australia	Women' and men's recreational and transport cycling pattern	Men are more likely to ride bicycle in daily commute than women
Schahn and Holzer (1990)	German adults	Explore gender difference and environmental knowledge and attitude	Women are more environmentally concerned about household issue, but men know more environmental knowledge
Krauss (1993)	White, African American and Native American women working class	Examine women's attitude toward protests of toxic waste issues	Women's social identity, especially the mother role, closely relates with their motivation for supporting the toxic waste related protest.
Liebman et al. (2003)	Adults from rural community in six rural communities in Wyoming, Montana, and Idaho	Assess the gender different health eating pattern	Women are more likely to eat vegetables, fruits, and other fiber rich food than men. Also, they tend to prefer to eat at home rather than going out
Liu et al. (2019)	Chinese college	The low-carbon consumption intention and behavior in Chinese college students	Women have a higher intention on purchasing low-carbon products than men
Loureiro et al. (2002)	U.S. consumers	Investigating consumers' willingness to buy eco-labeled fruits	Women are more likely to buy ecolabeled fruits than men
Marian (2020)	General public from Auckland, Dublin, Hanoi, Helsinki, Jakarta, Kuala Lumpur, Lisbon, and Manila	Examining gender different transporting mode in eight different countries	Women prefer public transportation over driving than men.
McCright and Sundström (2013)	Swedish general public	The relationship between gender and environmental concern	Women show greater environmental concern than men, especially to environmental problems. This difference is associated with women social rules
Mohai (1997)	U.S. college students	Explore gender difference in concern and behavior of environmental related issues, and examine the explanation behind this difference	Women have a better performance and greater concern on resource conservation, nature preservation, pollution, global environmental problems, and neighborhood environmental problems. This difference may related with their social roles and identity. The interaction between race and gender also exist

(Continued)

TABLE 1 | (Continued)

Sources	Subjects	Thesis	Findings
Mostafa (2007)	University students in Egypt	The relationship between gender and environmental knowledge, perception, and green purchase attitude	Men are more concern to environmental and show more intention to purchase green product
Nanggong and Bandu (2018)	Indonesia public consumers	Investigating gender differences in environmental attitude and sustainable consumption in the use of paperless technology	Men tend to perceive more benefits of adopting paperless technology (etickets), whereas women are more likely to use paperless technology out of the concern for environment.
Ozanne et al. (1999)	U.S. homeowners	Explore gender difference in environmentalism	Women concern environment more than men, prefer eco-friendly and ecological certificated products. Women more active in household environmental behavior, but less likely to participate public environmental behavior than men
Pagiaslis and Krontalis (2014)	U.S. general public	The linkage between environmental concern and green consumption behavior, and the individual differences based on demographics	Environmental concern positively related to green consumption intention, and gender difference exists by showing that women are more concerned to environment but men show a higher intention of purchase reusable energy.
Rahim et al. (2017)	Facebook and Twitter adult users	Investigate effects of demographic factors on consumers' green product purchase intention	Women have a significantly higher green product purchasing intention than men
Räty and Carlsson-Kanyama (2010)	Data obtained from Swedish version of the Energy Analysis Program	Total energy use and gender different energy consumption pattern in European countries	Men consume more energy than women, especially in travel, eating outside, food intake pattern, alcohol and tobacco usage
Muralidharan and Sheehan (2018)	England general public	Examine gender differences in guilt perception and whether guilt related to reusable shopping bag usage	Economic concern is an obvious motivation for women to bring or use reusable shopping bags
Swim et al. (2020)	U.S. undergraduates	Social consequences of engaging gendered environmental behaviors	Both men and women prefer to engage activities that are consistent with their gender identity. Most of proenvironmental behavior are more feminine, which makes men are not likely to engage those behavior.
Tung et al. (2017)	General Public in the United States	Understanding gender different attitude to green consumption and the motivation behind their purchase of green products	Motivations of men and women's purchase behavior are different and women express more positive attitude to green consumption.
Vainio and Paloniemi (2014)	Adult in Nordic Countries	Examine whether the attitude toward science has effects on proenvironmental consumption	Positive attitude toward science increases the likelihood of ignoring the importance of proenvironmental behavior. The confidence that science decreases the necessity of pro-environmental behavior directly increases with pro-environmental consumption.
Waygood and Avineri (2016)	Adults from Brazil, China, Great Britain, Italy, and Spain	Gender difference in environmental knowledge and concern, and their different behavioral response to the climate change	Women has stronger and more positive behavioral reaction in their transportation way facing the climate change
Xiao and Hong (2017)	China general public	An update study of men and women's environmental knowledge and attitude	Different from the study of 7 years ago, women's environmental knowledge is still slightly lower than men, but the environmental attitude of men and women are almost equal
Xiao and Hong (2010)	Chinese general public	Examine existed gender difference in environmental knowledge, attitude, and concern in China	Women engage more household environmental behavior. Men show greater environmental concern as well as knowledge than women
Yu (2020)	General public	Examining effects of gender on the acceptance of green advertisement	Women are more easily to accept and how a more positive attitude than men toward green advertisement. In contrast, men tend to be more doubtful for green advertisement.
Zelezny et al. (2000)	Primary and secondary school students in California; Undergraduates from Europe, Latin America, and Unite States who speak English and Spanish	Whether the gender difference of environmentalism across-countries and whether it also exists in children	Gender related differences of environmentalism is an across countries issue, and also exists in children. Women's stronger environmentalism associates is possibly because of the socialization process.

of social expectation and social norms in shaping individuals' green consumption, as well as impacts of a particular social context on men's and women's pro-environmental behavior (Mohai, 1997; Frantz and Mayer, 2009; McCright and Sundström, 2013; Swim et al., 2020). As we discussed above, even though multiple causes contributing to the gender differences in green purchasing behavior were identified by previous studies, they have not been integrated and analyzed based on the specific social mechanism yet (Nolan and Schultz, 2015). To remedy this gap, we are novel to analyze gender differences from both internal and external dimensions, building on the VBN theory and social expectation separately.

Analyzing Gender Differences in Green Consumption From the Value-Belief-Norm Theory

The role of Stern's VBN theory in explaining pro-environmental behavior has been widely accepted, and because the value-belief-norm-theory derives from the norm activation model, we also include some opinions of the norm activation model in our analysis. Purchasing green products can be caused by feelings of obligation to engage the eco-friendly consumption. The VBN theory builds a connection between personal cognition and perception of the environmental problem to the emotional

reaction toward particular social circumstances and moral obligation. It also explains how they interact with each other and contribute to the personal norm and then cause individuals' green consumption behavior (Stern, 2000).

A considerable amount of studies have indicated that personality and the nurturing attitude are positively associated with a higher perception of consequences about environmental changes and stronger responsibility of protecting the environment (Ozanne et al., 1999; Zelezny et al., 2000). The nurturing attitude is a critical part of the social norms and social expectations of women. The feminine social norms have started to affect women since they were young, as girls were expected to purchase plush toys and pretend to play the caring role for their toys, such as building a home for their dolls or covering up stuffed animals for sleep (Gysbers et al., 2014). Girls are also being educated to value others' needs and take care of family members voluntarily (Betz, 2006). Due to the eagerness of being valued and accepted by society, women's behavior usually aligns with social expectations, and their personal value is shaped by feminine social norms (Hoffman, 2001; Gilbert and Kearney, 2006). Women's eco-friendly personal norm is closely related to the nurturing attitude to their children and family, and in turn, encourages their green purchasing behavior (McCright and Sundström, 2013; Brough et al., 2016). The nurturing attitudes toward their children and family members also strengthen their concerns about the environmental problems since environmental quality has a close relationship with their life and family's health, which lead researchers to indicate that women's green consumption behavior comes from the concern about their family members (Zelezny et al., 2000; Muralidharan and Sheehan, 2018; Migheli, 2021). Whereas, gender-different caring and protective intentions toward the environment also correspond with men's and women's different personal values. Corresponding with women's social norms, their personal value that is prone to the concerns of others (Mohai, 1997) improves their altruism, which cultivates the formation of their social-altruistic value.

Since green consumptions and other related pro-environmental behavior is a form of prosocial behavior, it was also more prevalent among individuals who hold altruistic personal values (Bogner and Wiseman, 2004). Social altruistic value is characterized by altruism in Stern's VBN theory, and under this social-altruistic orientation, pro-environmental behavior is motivated by the concern of others. The opposite of social-altruistic orientation is the egoistic orientation where people tend to prioritize their own needs. Men tend to report a higher egoistic orientation, in this case, they usually pay much attention to the benefits that environmental behavior can bring to themselves, and sometimes choose eco-friendly products because of their own needs (Dietz et al., 2002). For example, Nanggong and Bandu (2018) investigation of whether and why people will use electric tickets shows that men usually consider more about the lower price and higher convenience brought by E-tickets, but the benefits to nature such as saving paper and protecting the forest are always the top motivations of women to use E-tickets. In addition to the economic benefit, Griskevicious proposed that satisfying personal psychological needs may also be a reason why men engage in prosocial behavior since compared with women, they can feel much more personal value and self-satisfaction through prosocial behavior. This is partially why men would like to engage in public pro-environmental behavior in front of others (Griskevicius et al., 2010). Moreover, distinct social norms to men and women strongly influence their attitude not only to green consumption behavior but also to others who are involved in green consumption as well. Society tends to associate men with more aggressive characteristics, such as competence or authority, Swim's study shows that when it comes to supporting climate change policy, men tend to consider supporters who are motivated by protecting the climate as more feminine, but think those who are motivated by contributing to global economic sustainability as more masculine (Swim and Geiger, 2018). Thus, it is unavoidable that men will develop a more egoistic attitude toward green consumption and other pro-environmental behavior under the impact of social norms.

As proposed in Stern's VBN theory, all the constructs included in these value orientations are devoted to the formation of an individuals' norms and the consequences that they pay attention to Stern (2000). The value orientation that works most efficiently at encouraging green purchasing behavior is the biospheric orientation. Individuals who report a greater biospheric orientation are more sensitive to the negative consequences of products with higher risks of bringing potential contaminations to nature. Individuals with this value orientation not only engage more pro-environmental behavior but also insist on that for a significantly longer period than others. However, what has the weakest positive connection with environmental concerns and behaviors is egoism, which is more common among men. Even though some researchers argue that women's green purchasing behavior is also out of the consideration of themselves or their family instead of the biosphere (Muralidharan and Sheehan, 2018), generally, women's stronger social-altruistic and biospheric orientation with higher altruism make them concern nature for its own sake and take environmental protection as their own obligation, which improves their green purchasing behavior a lot (Bogner and Wiseman, 2004). Additionally, how much individuals value their interpersonal relationship also affect their attitude to the environment. Women take their relationship with others more seriously than men, which affects how they judge their relationship with nature and how much they would like to put themselves into it. Customers who have a closer relationship with nature are more likely to have a stronger feeling of obligation to protect the environment and therefore to purchase green products (Blocker and Eckberg, 1997; Ping and Linxiao, 2020). In contrast, men's intense egoistic orientation decreases their activism and persistence in green consumption.

The Effect of Social Expectation on Men's and Women's Green Consumption Behavior

Besides the impact of personal values and norms, the external factor, social expectation, also has a significant effect on gender

differences in green consumption. The distinct social expectation of men and women comes from the long socialization process and the derived social roles that assign to them since their childhood (Blocker and Eckberg, 1997; McCright and Sundström, 2013). As we have already mentioned, women are socialized to be nurturing to others, and in the family, they are usually assigned the "caring" role, and society expects them to show more motherhood characteristics and consider more welfare of others.

Instead, men's social roles are more prone to making money, providing the economic foundation, controlling others, and occupying, so under the socialization pressure, men are more willing to conquer nature and utilize the natural resources for the development of the economy rather than considering the needs of the environment (McCright and Sundström, 2013). Besides, the social stereotype of men and women also has a huge impact on their choice of green products. Characteristics such as caring, protective, friendly, concerned, voluntary, and compassionate, were attributed to women, and as mentioned above, behavior that corresponds with these characteristics is labeled as feminine behavior (Krauss, 1993; Zelezny et al., 2000). In contrast, behavior expressing the traits of fighting, proactive, conquering, and leadership has been aligned with masculine characteristics. Under the social gender stereotypes, it is less likely for men to ascribe environmental protection as their own responsibility and then generate related eco-friendly personal norms. From this gender role alignment perspective, green consumption is closely associated with feminine features. As we expected, individuals are all more likely to be gender conformity by conducting the behaviors that align with their gender role (Swim et al., 2020), and the existence of this gender stigma of green consumption keep men from purchasing ecological products even more (McCright and Sundström, 2013). For example, men would not like to choose organic food and use reusable shopping bags to keep themselves from feminine traits (Brough et al., 2016), but women's social roles bond them together with these behaviors, which even encourage their green consumption. Because of this deep gender social stereotype, the public prefers individuals who conduct the behavior corresponding to their social identity and tend to keep the distance from those who have opposite behaviors or hold misunderstandings to them, which usually refers to the punishment of gender-bending. An interesting finding showed that compared with men, women who refuse to engage in eco-friendly consumption will more likely be avoided by others, and similarly, men who constantly use recyclable shopping bags might be socially distanced or considered as gay (Swim et al., 2020). Thus, from the dimension of distinct social roles and individuals' desire of conforming the social expectation, it is much easier for women to engage in green consumption and take other related pro-environmental behavior as their own obligation, but there are more social and psychological obstacles for men to show as big willingness as women toward green purchasing behaviors. Despite the strong negative role that social gender stereotypes play in men's eco-friendly consumption, Brough suggested that engagement of green consumption behaviors are also affected by the personal sensitivity about the maintenance of their gender identity. Individuals who are seriously concerned about their gender identity and are being more careful about their behavior that is associated with feminine characteristics may hold more intensive resist attitudes toward green consumption than men who care less about gender identity (Brough et al., 2016).

CONCLUSION AND FUTURE STUDIES

In recent decades, byproducts of the explosive growth of the global economy, such as air and land pollution, forest degradation, reduction of freshwater, have caused a severe threat to the environment and led to a public health problem (Walker et al., 2014). Household material consumption accounts for almost 50% percent of total global material consumption, with a lot of them coming from food process and packaging manufacture industries. In addition to the energy consumption and overexploitation of natural resources, non-green consumption also leads to the severe contamination of the environment (Wang et al., 2014; Li et al., 2019). It is well-known that the carbon dioxide emission caused by driving significantly speeds up the greenhouse effect (Ivanova et al., 2016). Also, in the non-organic food planting, the usage of fertilizers and pesticides causes many emissions of greenhouse gas such as nitrous oxide and ammonia (Scheehle and Kruger, 2006; Webb et al., 2006), and the phosphorous from fertilizers leads to water eutrophication (Shenoy and Kalagudi, 2005), which damages the quality of water and causes the death of species living there. Considering the huge negative impact of manufacturing and retailing industries on the environment, researchers such as Tseng kept working on improving industrial sustainability from multiple perspectives such as technology and proposed many applicable suggestions to the current retailers and factories (Tseng et al., 2021). With the significant influence of gender on promoting public green consumption as we talked about earlier, this article made a comprehensive integration of the existing studies about the rationale behind gender different green consumption behavior, and therefore assisted the green marketing to design or promote green products following men's and women's preference respectively. Besides, since this article interpreted the VBN theory from the perspective of gender and analyzed how it affects gender different behavior on green consumption, future researchers can further explore what kind of factor that emerged from gender different beliefs and social norms can contribute to green consumption.

Academic Contribution and Suggestions to Future Studies of Green Consumption

This article provides a comprehensive comparison of gender differences in green consumption behavior by integrating the previous findings and examining multiple reasons behind this difference from both personal and social aspects. Besides, by analyzing the men's and women's distinct green consumption from the VBN theory, we not only provided theoretical support for exploring individual differences in green consumption from the gender perspective but also found a unique insight to interpret the VBN theory. While an increasing number of

scholars have started to pay attention to the gender differences in green consumption, current studies still have a lot of limitations and some aspects still need further exploration. First, this article revealed that gender differences in green consumption can be explained by the VBN theories, thus future studies can explore more about how to improve men's green consumption from personal values aspects such as how to adjust men's strong egoistic value to a more social-altruistic or biospheric value orientation, which then promotes their green consumption. Moreover, it is also critical to examine whether there are other contributing factors or any other ways to explain the gender differences. Since we found more influencing factors, more possible perspectives are available for us to explore the strategies of improving the green consumption of both men and women. In addition, as this article indicated, a large part of distinct results are generated in studies conducted in different countries, but for now, most data is still selected from developed regions. Thus, future researchers should increase the variety of the targeted population, that is, conducting studies in multiple regions especially those that are less-developed, and examine what kind of gender-related beliefs and norms exist in those regions.

Green Marketing Implications

Among all the difficulties needed to be overcome in the process of accelerating worldwide green consumption, a crucial work is to increase men's average green consumption intention and behavior, and to cultivate individuals' ecological personal norm. Hence, it is important to strengthen the communication between academia and green marketing to prompt the publics' green consumption based on the guidance of the VBN theory. This article reviewed gender-related beliefs and their linkage to green consumption, which provided some suggestions that might be helpful to green marketing. Based on previous researchers, there are several barriers to men's green consumption, so following suggestions that intend to encourage men's green consumption might be helpful for green marketers or policymakers. First, considering men's worries about the effectiveness and practicality of green products, marketers must establish an explicit conversation with consumers to demonstrate the effectiveness of green products directly and therefore decrease men's worries about the products' effectiveness. Besides men's concerns about the effectiveness of green products, their stronger egoism can also be used as an aspect to promoting green consumption. When advertising green products, instead of only focusing on their benefits to nature, they should also emphasize more about what kind of favors that green products can bring to men directly, such as saving energy or getting economic benefits. Another factor preventing men's green consumption is that they tend to associate green products with femininity and show less preference about the products with green characteristics. Hence, setting a more masculine brand or product name is effective to attract men's interest in green products and then increase their willingness to purchase these products. For example, a study in green business shows that after changing the traditional ecofriendly name of an electric car, BMW i3, to a more masculine phrase, "BMW Protection Model," men become much more curious to know more about it (Brough et al., 2016). Therefore, future researchers can spend more energy on designing the brand name of eco-friendly products. Furthermore, because men usually worry about whether green consumption will affect their gender identity, exploring the direct or potential benefits that green consumption brings to men's identity and publicizing these benefits in the community is also essential. For example, there is some research suggesting that men's green consumption is one of the indicators of their reliability, and those who consume in an eco-friendly way tend to be favored and perceived as more reliable by women (Borau et al., 2020). Thus, we suggest that in the future, these related opinions should be presented as a public advertisement to reduce the impacts of the negative social stereotype of men's environmental behavior on green consumption.

On the other side, to increase the frequency of women's green consumption, emphasizing the benefits of green products to their family and the natural world, and improving women's environmental knowledge are two unignorable points. Due to women's higher altruism and their nurturing role in the family, it is effective to improve their green consumption by publicizing how green products directly or indirectly benefit their parents' health and their surrounding environment. Moreover, as Lin suggested, individuals with a higher environmental knowledge are more likely to engage in green consumption (Lin and Niu, 2018). Therefore considering women's relative weaker environmental knowledge (Diamantopoulos et al., 2003), government or academic institutions should pay attention to popularizing more environmental knowledge to women, which might improve and solidify their green consumption. Besides, in underdeveloped countries, the government should focus on taking action to improve both men's and women's environmental knowledge, such as popularizing environmental education in the whole society. Whereas, considering the environmental knowledge education is more generalized in the developed countries, promoting gender equality even further might be more helpful for these countries to increase the general public's green consumption since it positively relates to the social engagement of green consumption (Li et al., 2019).

AUTHOR CONTRIBUTIONS

ZZ and YS: idea generation and validation. ZZ and YS: literacy searching. ZZ, YG, and YS: conceptualization. ZZ: writing—original draft preparation. ZZ, YG, YS, YL, and LZ: writing—review and editing. YS: funding acquisition and supervision.

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REVIEW
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Concepts Describing and Assessing Individuals' Environmental Sustainability: An Integrative Review and Taxonomy

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The need to encourage individuals as active change agents for sustainability transitions has led researchers across disciplines to conceptualize over 70 constructs to assess relevant dispositions to environmental protection and green consumption behaviors. The generated knowledge is, however, fragmented by an unconsolidated set of constructs developed within parallel literature streams. We, hence, use an integrative review method to capture conceptual and operational similarities and distinctiveness of constructs across disciplines in the literature, attempting to unify the knowledge base. Thereby, we identify 34 conceptually distinct constructs (along with 38 synonyms and 76 scales) relevant for the thematic synthesis on individual-level constructs framing contributions to environmental measures and issues. We followingly propose a taxonomy, systemizing constructs based on their concept type(s) (e.g., value, attitude, behavior) and contextual scope(s) of the environmental challenge (e.g., product choice, household practice) addressed. We capture these dimensions in critically assessing relevant and salient conceptual and operational features. We thus create a consolidated picture of extant constructs capturing individual-level environmental sustainability by which we intend a three-fold contribution to the interdisciplinary field. First, the taxonomy and guiding framework for the choice of constructs should assist substantive researchers in identifying appropriate constructs of interest. Second, the systematic integration of (dis)similar concepts available in parallel literature streams should assist future endeavors aiming at integrating substantive findings with regard to antecedents, consequences, and other relevant variables. Finally, the taxonomy revealed that conceptualizations mainly scatter around specific combinations of types and scopes while others remain unaddressed. Based on our critical assessment of the relevant features and resulting taxonomy, we identify avenues for future research dedicated to (i) enhancing conceptual rigor and measurement quality in the field and (ii) introducing concepts addressing missing but potentially valuable combinations of types and scopes (e.g., antecedents capturing green consumption contexts). We conclude that researchers engaging in

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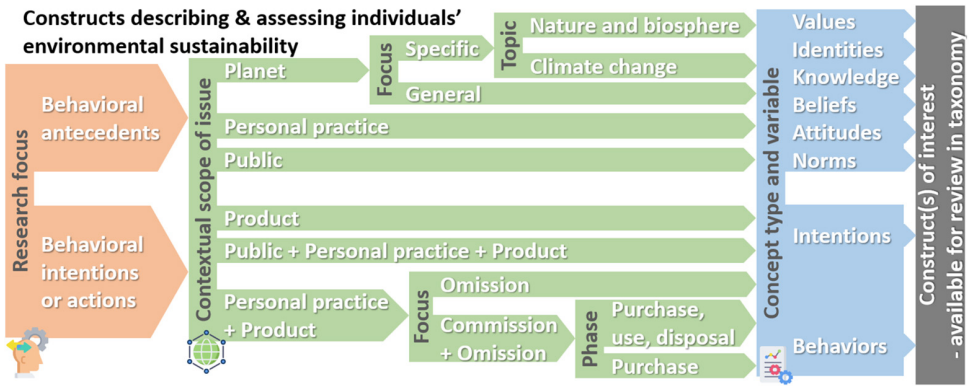

GRAPHICAL ABSTRACT |

the proposed avenues with conceptual, methodological, or empirical contributions should consider four critical aspects to advance knowledge accumulation and prevent fragmentation in the interdisciplinary field. We thereby hope to pave the way for a collective, interdisciplinary knowledge base of concepts used to describe and assess individual's pro-environmental dispositions and practices of green consumption.

Keywords: human-nature relationship, pro-environmental behavior (PEB), green consumption, sustainability, pro-environmental dispositions, interdisciplinary, behavior, measurement

INTRODUCTION

Changing individuals' consumption patterns holds a considerable potential to mitigate climate change (Cinner, 2018; Nielsen et al., 2021). In their roles as consumers, investors, participants in organizations, members of communities, and citizens, individuals further affect both the supply and demand side of greenhouse gas (GHG) producing goods and services (Nielsen et al., 2021). The consumption from private households alone accounts for about 60% of the consumption-based GHGs and assumes 50–80% of the global use of land, material, and water (Ivanova et al., 2016). Efforts to reduce these emissions, however, continue to be insufficient in order to meet the 1.5° temperature rise target set in the Paris Agreement and, thus, demand more immediate and fundamental changes of individual and household behavior (IPCC, 2018). Thereby, understanding psycho-social factors or competencies which motivate individuals to change their consumption and lifestyle-related choices becomes a central task of psychological and educational research (Bamberg et al., 2021).

As a response, researchers from various backgrounds within and beyond the expanding breath environmental psychology engaged in the conceptualization of constructs to describe and assess individuals' dispositions and behaviors in reference to a wide range of environmental challenges (for reviews see, e.g., Steg and Vlek, 2009; Schanes et al., 2016; Geiger et al., 2018; Trudel, 2018). As our interdisciplinary and integrative review will show, indeed more than 70 concepts have been introduced across disciplines to frame environmental sustainability from an individual's perspective aiming to explain how and why individuals might adjust their activities for the benefit of the planet and future generations. Early examples include the belief of an ecological worldview, assessed with the new environmental paradigm (NEP) scale (Dunlap and Van Liere, 1978), and the general ecological behavior construct (Kaiser et al., 1999a). More recent examples include constructs focusing on climate change or the human-nature relationship specifically, i.e., climate change risk perception (van der Linden, 2015), and ecological identity (Walton and Jones, 2017), to name but a few. Behavioral constructs recently emphasize the importance of consumption reduction, i.e., environmentally oriented anti-consumption (EOA) (García-de-Frutos et al., 2018), and environmentally motivated consumption reduction (EMCR) (Lasarov et al., 2019). With a growing number of conceptualizations of relevant dispositions and behaviors, literature also witnesses an increase in substantive research incorporating these concepts to advance knowledge about their drivers, conditions, and consequences (for recent examples see Geiger et al., 2019; Zeiske et al., 2020; Welsch et al., 2021).

On the positive side, this particular attention to individuals and their role in sustainability transitions is topical and should provide relevant knowledge to foster green consumption for a sustainable development. On the negative side, however, the current use of numerous and unconsolidated concepts (and measurement scales) impedes knowledge integration about individuals as focal change agents. This range of concepts includes, for example, concepts capturing similar to identical conceptual domains despite carrying different construct names. At the same time, other constructs carry

identical names while capturing divergent conceptual domains. To make things worse, numerous measurement scales considerably diverge from the underlying construct's domain, endangering content validity by measuring something else than intended. From a research perspective, these and other problematic aspects make an informed choice from the plethora of available constructs and operationalizations difficult. From an institutional and managerial perspective, the lack of overview and knowledge accumulation limits their practical implementation to promote green consumption and further sustainability interventions and strategies. In short, both researchers and practitioners are currently confronted with a large number of potentially promising constructs for describing and assessing individuals' pro-environmental dispositions and practices of green consumption but at the same time, lack guidance on how to handle them. An improved interdisciplinary and integrated understanding of *(ir)responsible* environmental dispositions and behaviors, however, is critical in the face of the increasingly complex nature of sustainability challenges resulting from consumption and lifestyle-related choices (Rodríguez-Casallas et al., 2020; Bamberg et al., 2021).

This review thus aims to provide an overview and systemization of extant constructs, developed across disciplines, describing and assessing concepts of individual-level environmental sustainability. For this purpose, we engage in an integrative review approach comprising three stages, i.e., (1) an interdisciplinary review of concepts and their key characteristics to reveal overlaps and differences, (2) the development of a taxonomy allocating these concepts based upon salient characteristics, i.e., their concept type and contextual scope of the framed environmental issue to facilitate the overview and guidance, and (3) a critical assessment of the concepts' conceptual development and measurement instruments. In this way, our intended contribution to this interdisciplinary field is three-fold: First, the taxonomy should assist substantive researchers in identifying appropriate constructs to assess individual-level dispositions toward environmental sustainability and green consumption behaviors. Second, the systematic integration of (dis)similar concepts available in parallel disciplines should assist future endeavors aiming at integrating substantive findings with regard to antecedents, consequences, and other relevant variables. Finally, the critical assessment of the concepts' conceptual development and operationalization identifies avenues for future research dedicated to enhancing conceptual rigor and measurement quality in the field.

Hereafter, we first describe our methodological approach to identify and synthesize relevant constructs for our review. Next, we introduce the taxonomy and critically review the allocated concepts with regard to theoretical, conceptual, and measurement aspects. We then highlight key issues from a conceptual perspective on constructs assessing individual-level environmental sustainability and discuss their implications for two proposed future research avenues and practice. We conclude with recommendations for further research.

METHODS

We applied an integrative review method, as this is acknowledged as particularly suitable for synthesizing knowledge across scientific communities within a growing research field (Snyder, 2019; Cronin and George, 2020). The method includes two main steps, namely (i) the literature review and (ii) the thematic synthesis (Cronin and George, 2020). Following Torraco (2005), we first conceptually structured the focal research domain to ensure our review contributes to a consolidated picture of the extant concepts. We, therefore, employed a preliminary literature scan focusing on research fields (i.e., environmental psychology, sustainability science, ecological economics, and marketing) and leading theories incorporating individual-level environmental sustainability concepts [i.e., Theory of Planned Behavior (TPB) (Ajzen, 1991), Value-Belief-Norm (VBN) Theory (Stern et al., 1999; Stern, 2000)]. Based on this scan, we derived and specified relevant literature streams and sources, other relevant theories, and conceptual domains for the (i) review and (ii) synthesis.

Literature Review

In the following step, we pursued the search strategy depicted in **Figure 1** to identify relevant concepts. It indicates the number of constructs (c) identified, screened, defined as eligible, and finally included in the taxonomy.

We thus defined (i) search terms, (ii) information sources (e.g., databases), and (iii) eligibility criteria for articles and concepts. Concerning (i), we used a combination of frequently used terms referring to five aspects identified from the preliminary conceptual structuring (see **Supplementary Appendix Table 1** for a list of these aspects, with search terms and their hierarchy in the relevant search strings). We then searched for articles with titles, abstracts, and keywords related to the relevant terms using relevant databases, namely *Scopus*, *Web of Science*, and *Google Scholar*. We complemented the databank search with a forward and backward search (Fischer et al., 2017b) based upon reference lists of identified papers and review articles (e.g., Geiger et al., 2018). We then refined the search to include only relevant subject areas derived from the preliminary literature scan. We exclusively considered peer-reviewed journal articles available in English that introduced new concepts, contributing to the conceptual development of existing concepts or developing measures to assess concepts, respectively. We furthermore regarded the quality of papers based on a combination of citation counts, journal ranking within the relevant subject areas, recency, and relevance (as employed by, e.g., Dowling et al., 2020). Purely empirical articles adopting concepts and measures were excluded from further screening. This search resulted in an initial set of 96 constructs describing or relating to individual-level environmental sustainability, with related articles found in the *Journal of Environmental Psychology* and *Environment and Behavior*, and *AMS Review*, to name but a few.

In the next step, we screened relevant articles' sections on theory, construct definition, and operationalization to assess the eligibility of the initial set of 96 constructs. We, therefore, determined relevant inclusion and exclusion criteria at a concept level. A concept was *included* if (1) its conceptual domain

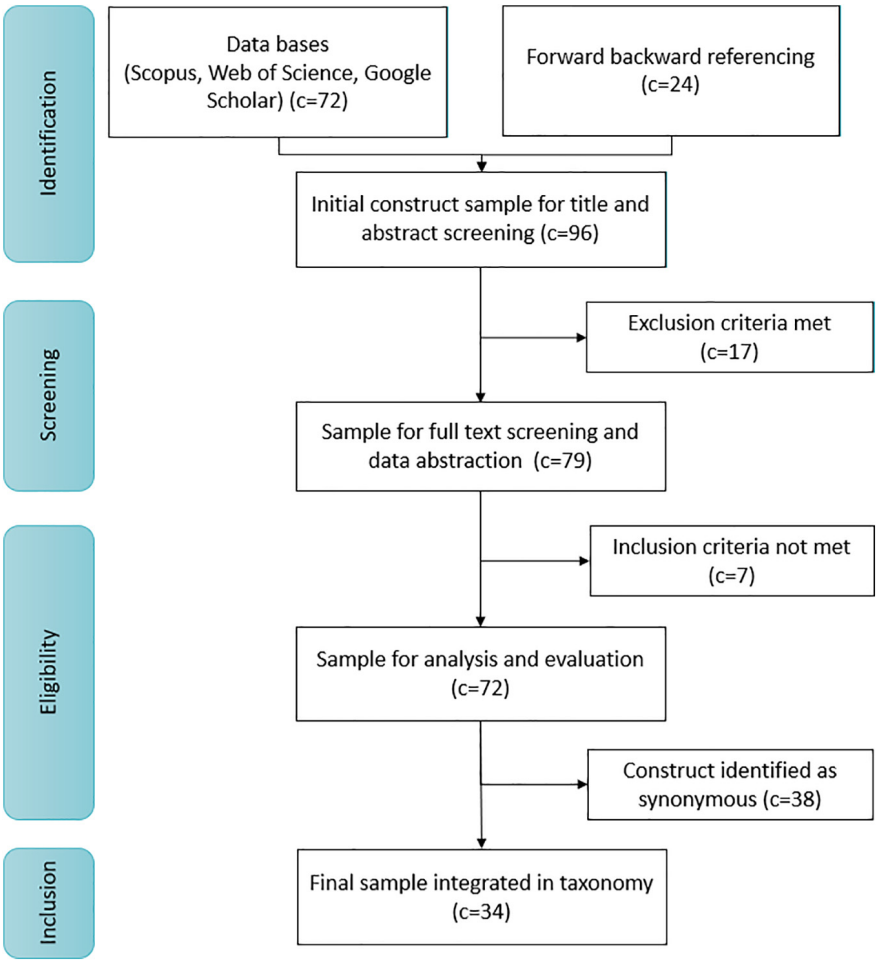

FIGURE 1 | Concept search and selection strategy.

relates to environmental sustainability as defined by Goodland (2017), *and* (2) it is based on a thorough conceptualization (MacKenzie, 2003) rather than being loosely introduced as an *ad hoc* term in a paper. Seven constructs failed to meet these criteria and were thus excluded from further consideration. Further, a concept was *excluded* if (1) it addresses a group-level rather than a personal-level phenomenon (O'Brien, 2018), *or* (2) it is used as an umbrella term rather than a distinct construct as defined by, e.g., MacKenzie (2003), MacInnis (2011), and Podsakoff et al. (2016). We thus excluded 17 constructs from further screening.

Having purified the set of concepts, we next identified concepts, sharing identical conceptual core, despite using different construct names, thus representing what we call "synonyms." We, therefore, contrasted concept definitions and items of available measurement instruments across the 72 remaining constructs to identify identical or very close conceptual domains (see, e.g., MacKenzie, 2003; Podsakoff et al., 2016). We, for example, initially identified 12 concepts capturing the conceptual domain of human-nature relationships. By a first conceptual analysis, we identified groups of concepts capturing different facets of the relationship. By the second analysis of key features (i.e., theoretical background, conceptual dimensions, measurement items) and use of the constructs or terms within literature, we identified five specific conceptual cores, shared by 12 constructs. The conceptual core of, i.e., environmental self-identity (Van der Werff et al., 2013) is addressed by three further constructs, which are operationalized with similar to identical items and used as synonyms in the literature. By further examining citation patterns and temporal periods (Cronin and George, 2020), we found that the contribution of Van der Werff et al. (2013) first introduced the conceptual idea, and authors often referred to the paper to support their (synonymous) concept. Environmental self-identity (Van der Werff et al., 2013) thus presents what we distinguish as a core concept, stemming from a seminal paper that introduces a conceptual idea with a clear conceptual definition (Podsakoff et al., 2016), leading to subsequent research. Consequentially, this procedure revealed 38 synonymous constructs. In the taxonomy, such groups of synonymous concepts are represented by the more established, most referenced concept name (i.e., used in seminal papers), while the additional concept names are listed

in **Supplementary Appendix Table 2**.[1] Hence, the taxonomy focuses on a final set of 34 distinct concepts.

Thematic Synthesis

In the last stage, we aimed at synthesizing the final set of 34 constructs to provide an integrative overview and guidance of extant conceptualizations. We allocated the 34 constructs to a taxonomy comprising of two dimensions, i.e., (1) concept type (based on definitions in **Table 1**) and (2) contextual scope (based on definitions in **Table 2**), which we identified as salient characteristics of concepts in this research domain. The first dimension represents latent theoretical individual-level variables describing the nature of the phenomenon to which the focal concept refers (see Podsakoff et al., 2016). The second dimension represents interdisciplinary perspectives taken on the role of individuals in contributing to environmental impacts and measures through their respective disposition(s) and behavior(s). This dimension integrates the views and approaches of the various disciplines regarding individual-level environmental sustainability, reflected by the different scopes of interest (i.e., an individual's product choice, lifestyle, civic engagement, relation to nature). As Nielsen et al. (2021) stated, the appreciation of roles can bridge the gaps between different approaches and facilitate an interdisciplinary understanding of the concepts. We thereby respond to the need for more interdisciplinary and systems perspectives to understand the promotion behavioral changes, e.g., toward green consumption (Whitmarsh et al., 2021). The development of this taxonomy and the subsequent critical conceptual review, as in other synthesis processes (see, e.g., Sample et al., 2020), entailed an iterative process. For each construct, we derived the type and scope based upon their conceptual definition and, if available, operationalization (DeVellis, 2016), which yielded a preliminary taxonomy. Aiming at externally validating our construct allocation and dimensions defined for the thematic synthesis, we subsequently invited four senior researchers for an expert screening (adopted from Anderson and Gerbing, 1991). We provided them with a list of construct definitions and exemplary measurement items and asked them to assign each construct to (i) one (or more) concept type(s) and (ii) one (or more) contextual scope(s). The experts were able to allocate each construct to each of the suggested dimensions, thus confirming the applicability of the dimensions for the thematic synthesis of individual-level environmental sustainability concepts. This screening further confirmed the concept types as preliminarily derived. Concerning the contextual scope, expert meanings diverged from the preliminary allocation for two constructs. For these constructs, we re-evaluated the scopes based upon additional literature research and analysis. The expert screening thus yielded minor changes for the final taxonomy, which will be introduced and elaborated in detail in what follows.

[1]Further details will be discussed later in the following chapters. An overview of the synonyms for the relevant constructs, construct definitions, and measurement instruments are provided in the **Supplementary Table S1**. A list of the initial set of constructs is provided by the authors upon request.

TABLE 1 | Dimension A: Conceptual definitions of salient conceptual types.

Concept	Definition
Values	"*(a) Concepts or beliefs, (b) about desirable end states or behaviors, (c) that transcend specific situations, (d) guide selection or evaluation of behavior and events, and (e) are ordered by relative importance*" (Schwartz and Bilsky, 1987, p. 551)
Identities	"*Relatively stable socially embedded meaning attached to the self that positions individuals within a web of socioecological relationships, based on shared personal characteristics, roles, and group memberships*" (Walton and Jones, 2017, p. 3)
Knowledge	"*The result of a person's lifelong learning process, i.e., the voluntarily accessible and organized accumulation of veridical information (facts, rules, etc.)*" (Geiger et al., 2019, p. 2)
Beliefs	"*Understandings about the state of the world; they are facts as an individual perceives them*" (Dietz et al., 2005, p. 346)
Attitudes	"*A psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor*" (Eagly and Chaiken, 1993, p. 1)
Norms (subjective)	"*The perceived social pressure to perform or not to perform the behavior*" (Ajzen, 1991, p. 188)
Intentions	"*Intentions are assumed to capture the motivational factors that influence behavior, they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform a behavior*" (Ajzen, 1991, p. 181)
Behaviors	"*A highly specific single act*" (Heberlein, 1981, p. 21)

OVERVIEW OF TAXONOMY

The 2-dimensional taxonomy (see **Figure 2**) includes 34 distinct individual-level concepts addressing environmental sustainability. We summarize the key features of each construct in **Supplementary Table S1** to provide an overview. A guiding framework for the choice of the constructs of interest, based upon conceptual features such as the focal type of behavior (i.e., commission and/or omission) and consumption phase (i.e., purchase, use, disposal) can also be found in the **Supplementary Figures S1, S2**. Overall, the distribution of concepts within the taxonomy indicates a predominant focus on behavioral concepts within a personal practice and product scope. It further shows that the literature has introduced numerous concepts with a planet scope to describe individuals' sustainability-related identities, knowledge, and beliefs. On the contrary, literature offers few or even no individual-level concepts for particular concept types (such as norms) and contexts (i.e., public). Given the nature of the included concepts, our taxonomy reveals that affective concepts received little attention in the reviewed literature compared to cognitive and conative variables.

In the following, we provide a detailed review regarding the conceptual development, identified synonyms, potential overlaps, and conceptual-operational divides of the 34 constructs. The following sections present the results of our thematic synthesis, structured by the concept types (i.e., columns of the taxonomy). Each section includes a detailed discussion of the constructs that refer to the same concept type and highlights their commonalities and differences regarding, e.g., the perspectives that are taken on the individual's role and contextual scopes of the environmental issues addressed, as a result of the synthesis process.

TABLE 2 | Dimension B: Salient contextual scopes of environmental issues framed by concepts.

Context	Description
Planet	Concepts that address a planetary scope contextualize an individual's contribution to environmental issues and measures from a global perspective. This perspective assumes a collective view of how individuals affect the environment on a global scale (Dunlap et al., 2000). Frequently addressed issues include the nature and environment in general, biophysical systems (i.e., ecological systems), climate change, and the conservation and preservation of natural resources.
Public	Concepts that address a public scope contextualize an individual's contribution to environmental issues and measures from a civic engagement perspective. This perspective assumes a participatory view of how individuals affect the environment by their civic and political engagement (Alisat and Riemer, 2015). Examples include activism (demonstrations, advocacy) and non-activist support for the environmental movement (memberships, voting behavior, donations).
Personal practice	Concepts that address a personal practice scope contextualize an individual's contribution to environmental issues and measures from a household perspective. This perspective assumes a lifestyle-driven view on how individuals affect the environment (Arnold et al., 2018). Frequently addressed issues are mobility, food, and shelter (Ivanova et al., 2016); and generally acting environmentally friendly within a private sphere.
Product	Concepts that address a product scope contextualize an individual's contribution to environmental issues and measures from a perspective of product choice. This perspective assumes a consumption-specific view on how individuals affect the environment (Balderjahn et al., 2013). Frequently addressed issues include the purchase of green products, green consumerism, and the disposal of products.

Values

"*Values function as standards by which actions, groups and individuals are evaluated.*" (Bouman et al., 2020, p. 1). The taxonomy includes three value concepts, i.e., biospheric values, environmental consequences, and green consumption values. While the former two relate to the planet scope, the latter addresses a product scope.

Biospheric values describe a "*concern with non-human species or the biosphere*" (Stern et al., 1993, p. 326) and are also referred to as biospheric personal values (Bouman et al., 2020). The construct, included in the VBN-Theory (Stern et al., 1999; Stern, 2000), bases upon the Norm-Activation Model (NAM) (Schwartz, 1977) and the Theory of Basic Human Values (Schwartz and Bilsky, 1987; Schwartz, 1992, 1994). Biospheric values, together with altruistic, egoistic, and hedonistic value constructs, are most relevant for environmental research (e.g., the prediction of environmental beliefs, preferences, and actions) (Stern et al., 1998; de Groot and Steg, 2008; Steg et al., 2014a). Accordingly, these four values are often jointly measured based on the Schwartz Value Survey (SVS) (Schwartz, 1994; Stern et al., 1998), typically using the Environmental Schwartz Value Survey (E-SVS) methodology (Steg et al., 2014b), or, most recently, the alternative Environmental-Portrait Value Questionnaire (E-PVQ) methodology (Bouman et al., 2018). Judging upon the face validity of the conceptual definition and operationalization of biospheric values, similarities to the concept of environmental values (Kaiser et al., 1999a,b), described as individuals' social and moral values regarding the environment become apparent. However, the two concepts show different levels of specification. Biospheric values address a more general environmental context (with items such as "It is important to [him/her] to respect nature"; Bouman et al., 2018), whereas environmental values address topics such as animal rights and natural preservation more specifically (with items such as "I agree that animals should have legal rights"; Kaiser et al., 1999a,b).

The second value construct, i.e., green consumption values (GCV), is defined as a "*tendency to express the value of environmental protection through one's purchases and consumption behaviors*" (Haws et al., 2014, p. 337). It was developed to measure green consumption values exclusively, as opposed to broader aspects such as environmental consciousness or attitudes toward socially responsible behavior in general (Haws et al., 2014). The conceptual development includes references to the Theory of Basic Values (Schwartz and Bilsky, 1987; Schwartz, 1992, 1994) and the Self-perception Theory (Bem, 1972). GCV overlap with the environmental dimension of the construct of sustainability-focused value orientation (Buerke et al., 2017). While per definition, GCV explicitly refer to values related to products, the operationalization with the GREEN-scale relates to additional aspects including personal practices (e.g., "I consider the potential environmental impact of my action when making many of my decisions"), identities (e.g., "I would describe myself as environmentally responsible"), and intentions (e.g., "I am willing to be inconvenienced in order to take actions that are more environmentally friendly"). As such, the operationalization of the construct is wider than its conceptual definition, which should be considered when applying the construct in empirical studies.

The product context is also addressed by the third value concept, i.e., environmental consequences, defined as "*concerns on how a product affects the environment, forest depletion, and energy usage in producing the product*" (Ramayah et al., 2010, p. 1421). The concept consequentially aims to assess an individual's concern for various environmental issues related to the purchase, use, and disposal of products (e.g., air, water, and soil pollution). Being embedded within the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1980), it thus contextualizes values with a clear focus on consumption, which renders the concept distinct from the above. To empirically assess environmental consequences, Ramayah et al. (2010) used a 3-item *ad hoc* measure.

In sum, all three value constructs address the importance individuals attribute to the environmental impacts of their activities within different contexts.

Identities

Identities are ways of organizing information about the self (Clayton, 2003, in reference to Rosenberg, 1981). The proposed taxonomy includes five identity constructs, namely environmental identity, connectedness to nature, nature relatedness, ecological identity, and environmental self-identity. All five constructs cover different facets of the human-nature

Contextual scope (2nd dimension)	Concept type (1st dimension)								
	Values	Identities	Knowledge	Beliefs	Attitudes	Norms	Intentions	Behaviors	Legend: Constructs
Planet	1 *33*	4* 5* 6* 7*	9* 10 *34*	12 13 15 *33*	16(*) *33* *34*	18 *34*			1 Biospheric values 2 Green consumption values 3 Environmental consequences 4 Environmental identity 5 Connectedness to nature 6 Nature relatedness 7 Ecological identity 8 Environmental self-identity 9 Environmental knowledge 10 Knowledge about climate change 11 Green product knowledge 12 Ecological worldview 13 Awareness of consequences 14 Ascription of responsibility 15 Climate change risk perception 16 Environmental attitudes 17 Attitude towards green purchase 18 Personal pro-environmental norms 19 Personal norms to act pro-environmentally 20 General pro-environmental intention 21 Consciousness for sustainable consumption 22 Green purchase intentions 23 Ecological behavior 24 Environmentalism 25 Sustainable consumption behavior 26 Environmentally responsible consumption 27 Sustainable lifestyles 28 Ecologically conscious consumer behavior 29 Environmentally motivated consumption reduction 30 Environmentally oriented anti-consumption 31Environmental action 32 Environmental citizenship *33 Environmental concern* *34 Environmental consciousness*
Public		8			*34*	*34*		23 24 31 32 *34*	
Personal practice		8	10 20	14 *33*	16 *33*	18 19	16 20 *33*	23 24 25 26 27 29* 30 *33* *34*	
Product	2* 3	8	11*		17		21* 22 *33*	23 24 25 26 27 28* 29* 30 *33*(*) *34*	

Note: *italic* indicates multi-conceptual construct; *…construct is subject to a conceptual-operational divide; (*) …construct included with two exemplary conceptualizations of which one is subject to a conceptual-operational divide

FIGURE 2 | Taxonomy of constructs addressing individual-level environmental sustainability.

relationship (for a review, see, e.g., Balundë et al., 2019), which describe the connection and inclusion of nature as part of the self on the one hand, and the self-view as an environmentally friendly person on the other. While the former four constructs all address the planet scope, environmental self-identity indicates a personal practice context.

Literature of environmental psychology and environmental sociology understand the first identity concept in our taxonomy, i.e., environmental identity, in different ways. Social psychologists such as (Clayton, 2003) define environmental identity as:

[. . .] one part of the way in which people form their self-concept; a sense of connection to some parts of the non-human natural environment, based on history, emotional attachment, and/or similarity, that affects the way in which we perceive and act toward the world; a belief that the environment is important to us and an important part of who we are (Clayton, 2003, pp. 45–46).

Whereas environmental sociologists such as Stets and Biga (2003) conceptualize environmental identity as "*meanings that one attributes to the self as they relate to the environment*" (p. 406). The former conceptualization (Clayton, 2003) has received much attention throughout environmental psychology literature and has frequently been referred to by other conceptualizations of human-nature relationships (see, e.g., Mayer and Frantz, 2004; Nisbet et al., 2009; Brügger et al., 2011; Van der Werff et al., 2013; Walton and Jones, 2017). To measure environmental identity, Clayton (2003) developed the unidimensional environmental identity scale (EID). Reviews on the EID scale showed that it covers both facets of connecting to and identifying with nature (see, e.g., Olivos and Aragonés, 2011; Tam, 2013), thus characterizing the environmental identity concept as the broadest of the discussed identity constructs.

The second identity concept, i.e., connectedness to nature, is defined as "*individuals' trait levels of feeling emotionally connected to the natural world*" (Mayer and Frantz, 2004, p. 503). It emphasizes the above-discussed aspect of individuals' connecting to nature and seems widely established within the environmental psychology and sustainability literature. Still, literature also offers numerous other conceptualizations of this affective human-nature relationship. Examples include concepts of emotional affinity toward nature (Kals et al., 1999), the inclusion of nature in self (INS) (Schultz, 2002), implicit association with nature (Schultz et al., 2004), connectivity to nature (Dutcher et al., 2007), disposition to connect with nature (Brügger et al., 2011), and identification with nature (Schmitt et al., 2019). Against this background, a number of researchers have reviewed similarities and differences among these concepts (for details, see, e.g., Brügger et al., 2011; Balundë et al., 2019). With regard to measuring connectedness to nature, Mayer and Frantz (2004) provide the connectedness to nature scale (CNS) that addresses identities and attitudes within a planet scope. Similar to the

EID-scale mentioned above, it overlaps with environmental concern rather than exclusively measuring its conceptual domain (Brügger et al., 2011). Literature also offers scales for the numerous other concepts listed above. On the positive side, Brügger et al. (2011) empirically demonstrate convergent validity of these scales, which means that all scales measure the same conceptual domain.

Turning to the third identity construct, nature relatedness is defined as "*individual levels of connectedness with the natural world*" (Nisbet et al., 2009, p. 718). It was developed to capture an experiential aspect of the human-nature relationship - in addition to the affective and cognitive aspect - which was seen as neglected by the connectedness to nature concept. The concept is operationalized by the 3-dimensional NR-Scale (Nisbet et al., 2009), which addresses more concept types (i.e., beliefs, behaviors) than included in the construct definition. Judging upon the scale's face validity, two of the dimensions (labeled as NR-Self and NR-Experience) further overlap with Mayer and Frantz (2004) CNS. Recently, both concepts were summarized using the term "nature connection" (Mackay and Schmitt, 2019). In a later version of the NR-Scale, Nisbet and Zelenski (2013) drop the NR-Experience dimension from the scale. In this light, it seems that the NR-Scale might benefit from additional conceptual and psychometric work. Our review further shows that the NR-Scale is rather established in the health- and well-being literature, while the CNS has been frequently used in environmental psychology and sustainable consumption research (see Dong et al., 2020 for a recent study).

The fourth identity construct is the recently introduced ecological identity, defined as "*the extent and ways by which an individual views himself or herself as being a part of an integrated social and biophysical (i.e., ecological) system characterized by mutually beneficial processes and nested webs of relations*" (Walton and Jones, 2017, p. 10). The construct bases on both the Identity Theory and the Social Identity Theory (see Stets and Burke, 2000) with an elaborate conceptual development. It is specified as a 3-dimensional construct comprising aspects of *sameness*, *differentiation*, and *centrality* (for more details, see Walton and Jones, 2017), which are reflected in the ecological identity scale accordingly. However, the measurement instrument extends the focal planetary context in further addressing a product, personal practice, and public scopes.

The final identity concept is environmental self-identity, defined as "*the extent to which one sees oneself as a type of person whose actions are environmentally friendly*" (Van der Werff et al., 2013, p. 1258). Literature offers multiple synonymous concepts, such as pro-environmental self-identity (Dermody et al., 2018), environmentalist identity (Kashima et al., 2014), and green self-identity (Lalot et al., 2019). The concept overlaps with the *sameness* dimension of ecological identity (Walton and Jones, 2017), in regard to seeing oneself as an environmentally friendly person. Correspondingly, the measurement items of environmental self-identity relate to an individual's identification with an environmentally friendly person (Van Der Werff et al., 2013). Judging upon both the concept definition and the items, the focal context seems vague and might be interpreted to stretch from product and personal practice to a public scope.

In sum, many of the reviewed identity concepts use different labels for measuring the same idea or conceptually overlap with each other. Connectedness to nature and nature relatedness both emphasize the affective and experiential facet of the human-nature relationship, while ecological identity and environmental self-identity focus on self-perceptions. The construct of environmental identity summarizes all these aspects in its conceptualization. Four of the five value constructs address a planet scope; however, their measurement instruments often include additional scopes, which requires careful consideration when used in substantive research.

Knowledge

Individual's knowledge about environmental issues is perceived as relevant cognitive variable driving pro-environmental behavior (see, e.g., Kollmuss and Agyeman, 2002; Bamberg and Möser, 2007). The proposed taxonomy includes three knowledge constructs, i.e., environmental knowledge, knowledge about climate change, and green product knowledge. Following the differentiation by Schahn and Holzer (1990), these constructs cover factual and abstract knowledge as well as action-related or concrete knowledge. The constructs differ in their contexts and measurement approaches. Environmental knowledge and knowledge about climate change measure knowledge about environmental topics (such as greenhouse gases and the energy transition), while green product knowledge specifically measures knowledge about the environmental impact of product use. Regarding measurement in general, knowledge can be measured as objective knowledge (i.e., correct answers to factual questions) (Geiger et al., 2019 refer to Cronbach, 1949) or as subjective knowledge (i.e., self-evaluation about personal level of know-how about a focal topic) (Geiger et al., 2019). Environmental knowledge and knowledge about climate change use objective, while green product knowledge uses subjective measures.

The concept of environmental knowledge has received considerable attention across the environmental psychology, business, and consumer studies literature (see, e.g., Lo and Fryxell, 2003; Frick et al., 2004; Chang and Wu, 2015; Geiger et al., 2019) and has been defined and conceptualized from different angles. Lo and Fryxell (2003) provide an inclusive definition covering both factual and action-related facets describing environmental knowledge as:

> [. . .] a general knowledge of facts, concepts, and relationships concerning the natural environment and its major ecosystems. [. . .] environmental knowledge involves what people know about the environment, key relationships leading to environmental aspects or impacts, an appreciation of "whole systems," and collective responsibilities necessary for sustainable development (p. 48).

However, this definition is subject to an ongoing debate about the empirical differentiation of the concepts' knowledge facets, despite the theoretical plausibility of the multifaceted structure of environmental knowledge (for a review, see Geiger et al., 2019). While Lo and Fryxell (2003) neglect to conceptualize the facets as separate dimensions, Frick et al. (2004) distinguish between dimensions of system-related (e.g., natural laws and ecological system), action-related (e.g., procedures

aiming at environmental conservation), and effectiveness (i.e., of different environmentally friendly behaviors) knowledge. Accordingly, the available measurement instruments reflect the literature's disagreement about the uni- or multi-dimensional nature of environmental knowledge. As such, operationalizations range from unidimensional scales (for examples see, e.g., Maloney et al., 1975; Kaiser et al., 1999b; Lo and Fryxell, 2003; Geiger et al., 2019) to three-dimensional scales (Frick et al., 2004). The unidimensional scales primarily relate to objective knowledge at the planet scope, whereas the multi-dimensional scales mainly embrace the product and personal practice scope.

Knowledge about climate change can be described as "*knowledge of causes and negative consequences of climate change,*" and is regarded as a "*cognitive aspect of risk judgments*" (Sundblad et al., 2007, p. 98). According to Leiserowitz et al. (2010), the construct can be divided into several general and overlapping categories, further described as "*knowledge about how the climate system works; specific knowledge about the causes, consequences, and potential solutions to global warming; contextual knowledge placing human-caused global warming in historical and geographic perspective; and practical knowledge that enables individual and collective action*" (p. 4). The concept is operationalized by three sub-scales measuring objective cause-, impact-, and response knowledge (van der Linden, 2015). While the above description suggests the construct relates to the planet and personal practice scopes, the measurement items appear to cover all four contextual scopes to varying degrees. The literature additionally offers the climate-related knowledge scale (Tobler et al., 2012b), which includes four subscales measuring knowledge about (i) physics, (ii) climate change and causes, (iii) expected consequences, and (iv) climate-related actions. Judging upon the face validity of both measurement instruments, Tobler et al. (2012a) address a more general knowledge level, while van der Linden (2015) provides more specific examples for the assessment.

The final construct in this section is green product knowledge, defined as "*subjective knowledge that is the consumers' understanding of the environmental attributes and environmental impacts of green products*" (Wang et al., 2019, p. 2). It is theoretically based within the ABC-Theory (Guagnano et al., 1995) and is commonly used within sustainability and consumer research (for examples, see Liobikiene et al., 2016; Kumar et al., 2017). The construct partly overlaps with the concept of green product information (Ritter et al., 2015; Cheung and To, 2019). Both currently available operationalizations of green product knowledge (Kumar et al., 2017; Wang et al., 2019) use items adopted from extant measures. Kumar et al. (2017) adapted their operationalization from the recycling-centered measure of Ramayah et al. (2012), whereas Wang et al. (2019) employed the scales from Kanchanapibul et al. (2014) and Liobikiene et al. (2016), which focus on general ecological issues and the purchase and use of green products, respectively. Thus, these operationalizations fall short on covering the conceptual domain of green product knowledge within all consumption phases (purchase, use, and disposal) and relevant environmental consequences.

Summarizing, the three included knowledge constructs present different types of knowledge framing environmental issues spanning from planetary (such as mechanisms of climate change and ecosystems), over public related aspects, to the effectiveness of the own environmentally friendly actions. It can be observed that more recent conceptualizations put particular attention to contexts within one's scope of action (e.g., product, personal practice, and public).

Beliefs

Beliefs describe how individuals understand the world and depict facts as an individual perceives them (Dietz et al., 2005). As such, the first three constructs discussed in this section, i.e., ecological worldview, awareness of consequences (AC), and ascription of responsibility (AR), were introduced within the context of the VBN-Theory (Stern et al., 1999; Stern, 2000). The fourth concept, i.e., climate change risk perception (CCRP), was introduced more recently in the context of climate change (van der Linden, 2015).

The most established belief within the environmental psychology literature is that of an ecological worldview [also known as the New Environmental/Ecological Paradigm (NEP)]. The concept reflects "*fundamental views about nature and humans' relationship to it*" focusing on "*[. . .] beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature*" (Dunlap et al., 2000, p. 427). It bases upon different social theories, challenging the dominant social paradigm (Pirages and Ehrlich, 1974). The ecological worldview is measured with the NEP-Scale, developed by Dunlap and Van Liere (1978) and later revised by Dunlap et al. (2000). The scale reflects five facets of an ecological worldview that address beliefs within a planet scope, e.g., about the fragility of nature's balance. Although Dunlap et al. (2000) conceptualized the scale as unidimensional, they also discussed the possibility to treat it as multidimensional, depending on the context and population. This has led to the application of the NEP-Scale in a number of different contexts, which according to Stern et al. (1999), has rendered the NEP-Scale to one of the most applied social-psychology measures in the environmentalism literature. Indeed, it is frequently used to measure other concepts, such as environmental concern, values, and attitudes; see Dunlap (2008), Friías Armenta et al. (2010), and Hawcroft and Milfont (2010) for a review.

The second construct, i.e., the awareness of consequences (AC) of environmental conditions, is defined as "*key beliefs [. . .] that a particular condition has harmful consequences for other people*" (Stern et al., 1995b, p. 1614). Compared to the ecological worldview (Dunlap et al., 2000), it encompasses more specific consequences on a planet scope. As such, it addresses individuals' anticipations of future environmental conditions for the self, for others, and the biosphere (Stern et al., 1995b). These three dimensions are also reflected in the construct's operationalization by the general awareness of consequences (GAC) scale (Stern et al., 1995a). In detail, the scale's *ACbio* dimension, which relates to the biosphere, partly overlaps with the concepts of societal consumer instrumentality awareness (Buerke et al., 2017), environmental beliefs (Kilbourne et al.,

2002; Kilbourne and Pickett, 2008), as well as with the NEP-Scale (Dunlap et al., 2000). Concerning the latter, Stern et al. (1995b) conclude that the NEP-Scale and GAC-Scale are empirically similar in their relation to behavioral intentions, while they differ in their relation to values.

The third belief included is the ascription of responsibility (AR) for changing environmental conditions, defined as "*key beliefs [. . .] that the individual is responsible for those consequences in the sense that he or she can take action that would prevent them*" (Stern et al., 1995b, p. 1614). AR differs from the other constructs in this section, as it measures ascribed responsibility, which is a specific kind of belief directed toward one's own action. A synonym to AR describing the same phenomenon is the concept of perceived responsibility for environmental damage (Peloza et al., 2013) operationalized by Wu and Yang (2018). Furthermore, AR conceptually overlaps with the concept of perceived consumer effectiveness (PCE) when applied within an environmental context (see Kim and Choi, 2005; Lee et al., 2014). In terms of AR measurement, Steg and Groot (2010) provide a scale that focuses on an individual's feeling for *doing something to reduce problems*. In parallel, Wu and Yang (2018) adopt a scale from marketing literature (Peloza et al., 2013) and rather emphasize an individual's feeling of *causing the problem*.

The final belief construct, i.e., climate change risk perception (CCRP), is described as "*a function of cognitive factors (i.e., knowledge about climate change), experiential processing (i.e., affective evaluations and personal experience) and socio-cultural influences (including social norms and broad value orientations)*" (van der Linden, 2015, p. 117). Its key dimensions relate to personal and societal risk judgments, respectively. Numerous authors provide numerous theoretical perspectives on risk perceptions in general as well as risk perceptions toward complex global issues, such as climate change, specifically. Examples include the Focus Theory of Normative Conduct (Cialdini et al., 1990) and the VBN-Theory (Stern et al., 1999; Stern, 2000). The construct conceptually and operationally overlaps with climate change belief (Brick et al., 2017), which assesses concerns and perceived risk of climate change. CCRP has received much attention across disciplines in both conceptual research (e.g., Lee et al., 2015; van der Linden, 2015) and substantive research relating to its role to engage individuals for climate change mitigation (e.g., Lacroix and Gifford, 2018). The measurement of CCRP (van der Linden, 2015) bases upon items developed by Bord et al. (2000) and Leiserowitz (2006), assessing the perceived likelihood of climate change events taking place in two dimensions (personal and global/societal). In addition, the literature offers scales measuring similar concepts of concern about climate change (Tobler et al., 2012a), concern for climate (Zhu et al., 2020), and climate concern (Alcock et al., 2017).

Overall, three of the four included beliefs share a planetary contextual scope with different degrees of specificity. As such, they assess an individual's beliefs in an overall paradigm (NEP), the influence of humans in the environment (AC), and the likelihood of climate change (CCRP). In contrast to this societal perspective, the concept of the ascription of responsibility (AR) more specifically assesses beliefs concerning one's responsibility for environmental issues. The review showed that current literature has not yet addressed such responsibility ascriptions specific to contexts of personal practices and product consumption, though this might be a relevant addition.

Attitudes

Attitudes can be defined as "*the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question*" (Ajzen, 1991, p. 188). The taxonomy comprises two attitudinal constructs, namely environmental attitudes and attitudes toward green products. While the former is an established construct within the environmental psychology literature and addresses the planet and personal practice scopes, the latter is a construct often used within the marketing literature and addresses the product scope.

The concept of environmental attitudes has received attention from numerous authors in parallel efforts (see, e.g., Kaiser et al., 1999b; Schultz et al., 2004; Milfont and Duckitt, 2004, 2010). This interest has resulted in two established approaches to model its attitude structure. One follows the more traditional three-component model conceptualizing cognitive, affective, and behavioral aspects as components of the attitudinal concept (see, e.g., Cottrell, 2003). The other approach perceives cognition, affect, and behavior as the bases from which the general evaluative summary of a particular psychological object derives, instead of being constituents of attitudes (Fabrigar et al., 2005). Based upon the first approach, Schultz et al. (2004) define environmental attitudes as "*the collection of beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues*" (p. 31). Based upon the second approach, Milfont (2007) refer to environmental attitudes as "*a psychological tendency that is expressed by evaluating perceptions of, or beliefs regarding the natural environment, including factors affecting its quality, with some degree of favor or disfavor*" (p. 12). The conceptualization of Milfont (2007) and Milfont and Duckitt (2010) bases on norm-related theories, while Schultz et al. (2004) neglect to refer to a specific theoretical foundation. While both definitions address the planet scope, Schultz et al. (2004) further include the personal practice context. Regarding the measurement, Schultz et al. (2004) borrowed items of four extant environmental measures, i.e., NEP-Scale (Dunlap et al., 2000), Environmental Motives Scale (EMS) (Schultz, 2001), a self-reported pro-environmental behavior scale (Schultz and Zelezny, 1998), and a revised version of Aron et al. (1992) Inclusion of Other in Self. Most recently, Kaiser et al. (2018) constructed a set of five specific-objectivity-based measures of environmental attitudes. Milfont and Duckitt (2010) developed a 12-dimensional environmental attitudes inventory (EIA), which covers beliefs, attitudes, and behaviors in reference to personal practices, publicly relevant actions, and planet-wide environmental issues. The operationalization thus seems broader than the underlying conceptual definition. Moreover, the dimensionality of the environmental attitudes concept has been intensively debated in the literature, with a tendency toward consensus for a multidimensional over a unidimensional conceptualization (see Milfont and Duckitt, 2010, for a summary). Further, the horizontal structure has been discussed and non-conclusively addressed in empirical research.

As such, the EIA's 12 dimensions have been modeled to load on a single second-order factor (i.e., Generalized Environmental Attitudes) or alternatively on two (correlated) second-order factors (i.e., preservation and utilization attitude) (Milfont and Duckitt, 2010; see also Kaiser et al., 2013 in a similar vein).

Turning to the second attitudinal concept, i.e., attitude toward green purchase, Chan (2001) neglects to provide an explicit conceptual definition. Instead, he refers to the definition of attitudes by Eagly and Chaiken (1993). The concept aims to capture individuals' attitudes toward environmentally friendly products in specific. Hence, its conceptual domain is narrower than that of environmental attitudes discussed above. This narrow domain is also reflected in Chan (2001) three items-scale to assessing individuals' (dis-)like of purchasing green products (based upon Taylor and Todd, 1995, global attitudinal measure).

Overall, this section demonstrates the variety of conceptualizations of individuals' attitudes toward different environmental issues, dependent on the evaluated object. This is in line with the early findings on environmental attitudes by Heberlein (1981), who argued that having the environment as an attitudinal object is challenging, as it is difficult to define and can thus lead to different interpretations of the concept type and contextual scope.

Norms

Norms are "*the perceived social pressure to perform or not to perform the behavior*" (Ajzen, 1991, p. 188). Our review shows that numerous norms are used to explain pro-environmental behaviors, even though some of these norms were originally conceptualized for studies on altruism (Schwartz, 1977) or behavior in general (Ajzen, 1991); for a review on personal norms, see Thogersen (2006). The taxonomy includes the two norms that specifically relate to environmental sustainability, which are personal pro-environmental norms (PPEN), and personal norms to act pro-environmentally. While the later construct specifically focuses on perceptions an individual holds toward own obligations, the former (PPEN) further includes perceptions on corporate and governmental obligations.

Personal pro-environmental norms (PPEN) are defined as "*the belief that the individual and other social actors have an obligation to alleviate environmental problems*" (Stern et al., 1999, p. 31) within the VBN-Theory (Stern et al., 1999; Stern, 2000). Other social actors include the government and businesses (Stern et al., 1999). The definition above does not allow to pinpoint the contextual scope as the focal actions individuals perceive as relevant to alleviate the environment are not defined. However, judging upon the face validity of the items included in Stern et al. (1999) unidimensional measure of PPEN, the normative actions touch a personal practice scope by addressing one's own perceived obligation toward environmental protection (i.e., of tropical forests), as well as a planet scope by addressing the obligations of social actors. Conceptually, PPEN overlaps with the two constructs of ecological (Seyfang, 2005) and sustainable citizenship (Barry, 2006) from the environmental politics literature.

Personal norms to act pro-environmentally are defined as "*personal feeling of obligation to act pro-environmentally*" (Bouman et al., 2020, p. 4). The concept bases upon the personal norms concept, i.e., "*feelings of moral obligation to perform or refrain from specific actions*" as defined within the norm activation model (NAM) (Schwartz and Howard, 1981, p. 191). It conceptually overlaps with PPEN (Stern et al., 1999) regarding the norms individuals hold toward their own contributions to environmental problems and solutions. Literature fails to provide a dedicated personal norms scale. Instead, it borrows items from general personal norm measures (e.g., Steg et al., 2011; Van der Werff et al., 2013), which it relates to study-specific environmental actions [as, for example, household energy use (Steg et al., 2011; Bouman et al., 2020); participating in demonstrations (Steg and Groot, 2010); consuming sustainable products (Van der Werff et al., 2013); and water use (Verplanken and Roy, 2016)].

Summarizing, both included personal norms focus on the obligation of individuals to prevent harmful behaviors and conduct beneficial behaviors toward the environment. While both conceptual definitions fall short on delineating the context of these behaviors, the accompanying operationalizations reveal a contextualization along the spectrum of the product, personal practice, and public scopes. The PPEN measure specifies the environmental problems (i.e., climate change and loss of tropical forests) by contrast, the measures of personal norms to act pro-environmentally specify the particular behaviors.

Intentions

Individuals' intention to behave in particular ways depicts a central factor in both the TRA (Fishbein and Ajzen, 1980) and the TPB (Ajzen, 1985, 1991). In general, empirical research frequently measures intentions as a proxy for actual behavior. In the context of environmental sustainability, the review identified three concepts that can be classified into two types of intentional concepts, namely (a) intentions toward general behaviors (i.e., general pro-environmental personal intention), and (b) intentions toward specific purchase behaviors [i.e., consciousness for sustainable consumption (CSC) and green purchase intention (GPI)].

Regarding the first type, the construct of general pro-environmental personal intention is defined as "*[. . .] a more general intention to make efforts to protect the environment [. . .]*" (Lalot et al., 2019, p. 83). It is based on the TPB (Ajzen, 1985, 1991) as well as the Self-competition theory (Gollwitzer et al., 1982). While the above definition neglects to indicate a specific context, judging upon the face validity of Lalot et al. (2019) unidimensional scale, the focal intention refers to personal practices such as adopting more pro-environmental behaviors and decreasing "anti"-environmental behaviors.

Regarding the second type, CSC is defined as "*an intention to consume in a way that enhances the environmental, social and economic aspects of quality of life*" (Balderjahn et al., 2013, p. 182). Consequentially, it addresses not only environmental but also social and economic sustainability dimensions referring to the triple bottom line (Elkington, 1999). The construct was developed within the marketing literature, reflecting an intention within a product scope. In its operationalization, however, the CSC-Scale asks respondents to also rate statements such as "*I buy a*

product only if I believe that…" and "*How important is it for you personally that…*," thus additionally addressing behaviors and values. Along these lines, the authors note that the "*CSC model combines a consumer's beliefs about the environmental (ENV), social (SOC) and economic (ECON) consequences of purchasing a product with the importance or personal concern the consumer attaches to these three consequences*" (Balderjahn et al., 2013, p. 184). Hence, it seems that the authors understand and operationalize CSC in a broader sense than indicated in the construct definition. Therefore, we highlight this three-fold scope accordingly – encompassing beliefs, values, and intentions – in our taxonomy (see **Figure 2**).

The construct GPI is defined as "*the likelihood that a consumer would buy a particular product resulting from his or her environmental needs*" (Chen and Chang, 2012, p. 507). It is derived from the classical "intention to buy" concept established in the marketing and retail literature. GPI differs from CSC by focusing exclusively on the product purchase rather than the whole product life cycle. The later introduced construct of purchase intention for environmentally sustainable products (PI) (Kumar et al., 2017) represents a similar conceptual core and thus a synonym to GPI. To measure GPI, several authors adapt classic "intention to buy" scales (see, e.g., Chan, 2001; Kanchanapibul et al., 2014; Sreen et al., 2018).

Summarizing, this section shows that the intentional concepts mainly address behaviors performed within a personal practice and product scope.

Behaviors

In his review on environmental attitudes, Heberlein (1981) concludes that behaviors are highly specific, single acts. These acts are often specified as dependent variables in conceptual models [for example, in the TPB (Ajzen, 1985, 1991) or the VBN-Theory (Stern et al., 1999; Stern, 2000)]. Contextually, the 10 behavioral concepts included address actions or activities within the product, personal practice, and public scopes. Given the number of extant concepts and contexts, we further categorize the behavioral constructs into three groups based on the number of contextual scopes addressed. The first group addresses *all* scopes and includes two concepts, the second group encompasses six concepts addressing both within a product and personal practice scope, the third group comprises two concepts addressing the public scope exclusively.

Regarding the first group, ecological behavior describes "*Actions which contribute toward environmental preservation and/or conservation*" (Axelrod and Lehman, 1993, p. 153 as cited by Kaiser et al. (1999a), p. 72). In the construct development, the authors mainly refer to the TPB (Ajzen, 1985, 1991). It overlaps with a number of other behaviors that reviewed for this taxonomy, i.e., goal-directed conservation behavior (Kaiser and Wilson, 2004), environmentally responsible behavior (Thøgersen, 2004), pro-environmental behavior (Bamberg and Möser, 2007), environmental behavior (Steg and Vlek, 2009) and environmentally friendly behavior (Liobikiene and Juknys, 2016). Among the numerous scales available to measure ecological and pro-environmental behavior, the Generalized Ecological Behavior (GEB) measure might be considered as the most established given its frequent use and its sound psychometric properties (for a review, see Lange and Dewitte, 2019). The GEB-Scale was originally developed by Kaiser (1998) and encompassed seven subscales, later, Kaiser and Wilson (2004) revised it into a measure with six subscales (i.e., energy conservation, mobility and transportation, waste avoidance, consumerism, recycling, and vicarious social behaviors toward conservation) reflecting different difficulty levels of enacting behaviors. The scale items strongly focus on the product and personal practice scope, while only a few items address the public scope. GEB-Scale items have also been used to assess other concepts such as environmental engagement (Kaiser and Byrka, 2011), ecological lifestyles (Arnold et al., 2018), environmental attitudes (Kaiser et al., 2007), and sustainable behavior (Corral-Verdugo et al., 2015). Consequentially, literature provides research on concepts with different labels but using identical measures. This situation results in an unconsolidated overall picture of substantive findings and leaves readers unclear on conceptual (dis)similarities among introduced concepts.

The second construct in the first group is environmentalism, "*defined behaviorally as the propensity to take actions with pro-environmental intent*" (Stern, 2000, p. 411). Environmentalism is part of the VBN-Theory (Stern et al., 1999; Stern, 2000) and is widely used in the literature. It is synonymous with the concepts of non-activist support for the environmental movement (Stern et al., 1999) as well as environmentally significant behavior (Stern, 2000). Environmentalism, by definition, describes not only a behavior but also an intention (i.e., a propensity to act). The specific context cannot be clearly derived from the definition, as the scope of the actions is not outlined. However, judging upon the face validity of the items (Stern, 2000), the three conceptual dimensions, i.e., consumer behavior, willingness to sacrifice, and environmental citizenship, cover behaviors in both a product and public scope as well as intentions within personal practice scope. As the intentions are not measured using propensity measures, a minor divide between conceptualization and operationalization becomes apparent. In contrast to the GEB-Scale, which primarily focuses on the product and personal practice scope, the environmentalism scale balances the number of items addressing the product, personal practice, and public scope. A more recent measure, with a similar balance of items, is provided with the pro-environmental behavior survey (Larson et al., 2015).

The behaviors in the second group of behavioral constructs can further be differentiated based on (a) the type of behavior addressed (i.e., commission behaviors and/or omission behaviors), and (b) the focal consumption phase (i.e., purchase, use, and/or disposing of products).

Three constructs in this group, i.e., sustainable consumption behavior (SCB), environmentally responsible consumption, and sustainable lifestyles, most comprehensively capture both commission and omission behavior within all three consumption phases. The constructs essentially differ in their conceptualization and the degree to which each consumption phase is addressed.

In detail, first, sustainable consumption behavior (SCB) is defined as "*individual acts of satisfying needs in different areas of life by acquiring, using and disposing goods and services that do not compromise the ecological and socio-economic conditions of all people (currently living or in the future) to satisfy their*

own needs" (Geiger et al., 2018, p. 5). Sustainable consumer behavior (Trudel, 2018) is a synonymously used term. SCB is grounded in a number of theories and frameworks (including theories of planetary boundaries, ecological footprint, capability approach, and fundamental human needs, see Geiger et al., 2018) and includes socio-economic aspects in addition to the environmental aspects of sustainability. The construct has been operationalized by numerous authors (see, e.g., scales by Wang et al., 2014; Watkins et al., 2016; Fischer et al., 2017a). These measures, however, mainly capture the purchase and disposal phase whereas neglecting the sustainable use of products or services.

Second, environmentally responsible consumption is defined as "*any consumption-related behavior, namely, acquisition, use, and disposal, undertaken in a manner such that it reduces the negative impact of consumption on the environment*" (Gupta and Agrawal, 2018). The authors do not refer to any specific theory. In contrast to SCB, this concept does not include socio-economic aspects. The ten-dimensional scale (Gupta and Agrawal, 2018, p. 525) addresses the purchase, use, and disposal phase of products, and services in a more balanced way than SCB and sustainable lifestyles scales (as discussed below).

Third, the construct of sustainable lifestyles, defined as "*patterns of action and consumption, used by people to affiliate and differentiate themselves from others, which: meet basic needs, provide a better quality of life, minimize the use of natural resources and emissions of waste and pollutants over the lifestyle, and do not jeopardize the needs of future generations*" (CSD, 2004, p. 48) is conceptually similar to ecological lifestyles (Arnold et al., 2018) and green lifestyles (Lorenzen, 2012). It differs from the above concepts by (i) putting practices into focal interest and (ii) reflecting individuals' potential use of behaviors to form identities. Accordingly, sustainable lifestyles are understood to encompass both pro-environmental behavior and a green self-image (Welsch et al., 2021). This specific focus is also reflected in the construct's basis within the Theory of Actions and Habitus (Bourdieu and Nice, 1984) and the Pragmatists action theory (Giddens, 1991). However, the conceptual premise that lifestyles are identity-driven behaviors is not reflected in the currently available operationalizations of sustainable lifestyles (for examples, see Barr and Gilg, 2006; Gatersleben et al., 2010; Starcic et al., 2018), as the latter captures solely actual behaviors neglecting any identity aspect.

Fourth, the construct of ecologically conscious consumer behavior (ECCB) by Roberts and Bacon (1997), for which the authors define an ecologically conscious consumer as "*one who purchases (avoids) products and services which he or she perceives to have a positive (negative) impact on the environment*" (Roberts and Bacon, 1997, p. 84). Literature provides multiple conceptualizations of the construct, using terms such as green purchase behavior (Chan, 2001), green product consumer choice behavior (Lin and Huang, 2012), and responsible consumer behavior (Buerke et al., 2017). These concepts base on different theories, including Pirages and Ehrlich (1974) dominant social paradigm (Roberts and Bacon, 1997), Fishbein (1979) TRA (Chan, 2001), Sheth et al. (1991) theory of consumption values (Lin and Huang, 2012), and the Stern (2000) VBN-Theory (Buerke et al., 2017). Despite these differences, all these concepts share the same conceptual core and are thus summarized in the taxonomy (see **Figure 2**) under the umbrella term ECCB. To measure ECCB, Roberts and Bacon (1997) use a scale that not only addresses the product scope (as suggested by the above definition) but also the personal practice scope. The literature further provides scales for the previously mentioned synonyms (Chan, 2001; Lin and Huang, 2012; Buerke et al., 2017), which all exclusively assess purchase behavior within the product scope.

The final two behaviors in the second group, i.e., environmentally motivated consumption reduction (EMCR) and environmentally oriented anti-consumption (EOA) show a specific focus on the omission of harmful behavior to the environment, which differentiates them conceptually from the previously discussed concepts. The constructs differ among themselves in their focus on either reducing or rejecting consumption, respectively. EMCR is defined as "*the extent to which consumers lower their consumption in certain domains with the explicit intent to protect the environment*" (Lasarov et al., 2019, p. 282), while environmentally oriented anti-consumption (EOA) is defined as "*acts directed against any form of consumption, with the specific aim of protecting the environment*" (García-de-Frutos et al., 2018, p. 413). EMCR bases upon the motivated reasoning framework and sustainable consumption (see Lasarov et al., 2019), whereas EOA builds upon consumer resistance and anti-consumption manifestations (see Black and Cherrier, 2010; Cherrier et al., 2011; Chatzidakis and Lee, 2013). Contextually, EMCR addresses all three consumption phases on a personal practice and product scope, although using a unidimensional four-item scale in its operationalization. Judging upon face validity, it appears questionable whether these items can to fully reflect the underlying conceptual domain. Hence, construct validity should be addressed by future research. EOA has not yet been operationalized. Instead, a recent study uses behavioral measures from the five Eurobarometer studies on climate change (see Gesis-Leibniz Institute for the Social Sciences, 2020) to approximate EOA (Ortega Egea et al., 2020). These borrowed measures refer to avoidance behaviors such as the purchase of local products, car use, and short-haul flights, indicating a focus on the product and personal practice scope. Both EMCR (Lasarov et al., 2019) and EOA (García-de-Frutos et al., 2018) are rather recent behavioral constructs that focus on different levels of consumption reduction, ranging from a partial to a complete reduction of consumption. For establishing these concepts in future research, however, further methodological work including rigorous scale development (Netemeyer et al., 2012) appears warranted.

The third group of behavioral constructs, i.e., environmental actions and environmental citizenship, exclusively addresses (different levels of) public action. Environmental actions are defined as "*intentional and conscious civic behaviors that are focused on systemic causes of environmental problems and the promotion of environmental sustainability through collective efforts*" (Alisat and Riemer, 2015, p. 14). The construct conceptually and operationally overlaps with the environmental citizenship dimensions of the environmentalism concept (Stern, 2000). Environmental action is assessed with a two-dimensional

scale, i.e., anticipatory action and leadership action. The items range from the assessment of low-level civic actions (such as educating oneself about environmental issues) to high-involvement political activism (such as organizing a protest) (Alisat and Riemer, 2015). The construct has been applied in conceptual and empirical research across the literature of environmental psychology, education, and sustainability within conceptual research (see, e.g., Riemer et al., 2016; Jia et al., 2017; Gkargkavouzi et al., 2019).

Environmental citizenship is defined as "*the engagement in political activities aimed at supporting environmental causes*" (Takahashi et al., 2017, p. 114). While the construct is often conceptualized as a dimension of pro-environmental behavior (see, e.g., Stern, 2000; Markle, 2013; Larson et al., 2015), a number of studies examine the concept of environmental citizenship individually (e.g., Steg et al., 2011; Schmitt et al., 2019; Song et al., 2019). Synonyms referring to the core idea of environmental citizenship comprise green citizenship (Dean, 2001), environmental citizenship behavior (Song et al., 2019), pro-environmental activist behavior (Schmitt et al., 2019), and environmental activism (Steg et al., 2011; Lee et al., 2019). Arguably, the concept overlaps with environmental action (Alisat and Riemer, 2015). The difference, however, can be seen in the type and level of individuals' participation in environmental discourses and the perceived political pressure resulting from these actions (Alisat and Riemer, 2015). While environmental citizenship specifically addresses non-activist behaviors, environmental actions additionally include activism elements. To date, the literature fails to provide a well-developed scale for assessing environmental citizenship. Therefore, substantive research either borrows items from the environmentalism construct (Stern, 2000) or uses *ad hoc* measures capturing individuals' activities such as donating, voting, or participating in demonstrations (Takahashi et al., 2017).

Given the plethora of similar concepts and problematic measures (including non-impactful behaviors and/or excluding conceptually relevant aspects), behavioral concepts to be used in substantive research should be selected with care. Interested readers are further referred to detailed reviews of behavioral concepts and measures by Markle (2013), Geiger et al. (2018), and Lange and Dewitte (2019).

Multi-Conceptual Constructs

Finally, our taxonomy includes multi-conceptual constructs, which we define as constructs that encompass multiple concept types within their conceptual domain. This is the case for environmental concern and environmental consciousness.

An inclusive definition of environmental concern is provided by Fransson and Gärling (1999), who view the concept as ranging from "*a specific attitude toward environmentally relevant behavior to a more encompassing value orientation*" (p. 370). The authors theoretically ground the concept with reference to the NAM (Schwartz, 1977), the TPB (Ajzen, 1985, 1991), the VBN-Theory (Stern et al., 1999; Stern, 2000), and Self-Competition Theory (Gollwitzer et al., 1982). Social sciences show particular interest in environmental concern, which has led to the introduction of numerous concepts carrying the same label but basing upon diverging interpretations and conceptual domains (for reviews on conceptualizations and measurements see, i.e., Stern et al., 1995a; Fransson and Gärling, 1999; Dunlap and Jones, 2002; Rodríguez-Casallas et al., 2020). Overall, the concepts differ in two key aspects, i.e., (i) the specification of the relationship between environmental concern and environmental attitude, and (ii) the number of concept types included in the conceptual domain. Regarding (i), our review reveals three different interpretations, i.e., (1) environmental concern as an integral component of environmental attitudes (see Stern and Dietz, 1994; Bamberg, 2003; Schultz et al., 2004, 2005), (2) environmental attitudes as an affective component of environmental concern (see Dunlap and Jones, 2002), and (3) environmental concern as a synonym for environmental attitudes (Milfont and Duckitt, 2010).

To discuss (ii), we relate to two exemplary conceptualizations by Dunlap and Jones (2002) and Schultz et al. (2004). Schultz et al. (2004) define environmental concern as "*the affect (i.e., worry) associated with beliefs about environmental problems*" (p. 41), indicating a purely attitudinal nature of construct. In contrast, Dunlap and Jones (2002) define environmental concern as "*the degree to which people are aware of problems regarding the environment and support efforts to solve them and/or indicates a willingness to contribute personally to their solution*" (p. 485), indicating a four-fold concept type including attitudes, beliefs, intentions, and behaviors. Hence, both conceptualizations share the affective component, as one includes non-attitudinal aspects within the concept, and the other models them as related but distinct constructs.

With regard to measuring environmental concern, Schultz and colleagues use the environmental motives scale (EMS) (Schultz, 2001; Schultz et al., 2005), indicating a personal practice and planet scope. In contrast, Dunlap and colleagues measure cognitive, conative, and behavioral expressions of environmental concern with reference to all four scopes [e.g., banning products, green lifestyle behaviors, involvement in environmental movements, and worries about poor air quality; see Xiao and Dunlap (2007) and Xiao et al. (2013)]; for a review on measures of environmental concern see Rodríguez-Casallas et al. (2020). Both measures show overlaps with other, previously discussed operationalizations. The EMS (Schultz, 2001; Schultz et al., 2005) shares items with the EIA (Milfont and Duckitt, 2010) and the AC measure (Stern et al., 1995b). The measurement instrument of Xiao and Dunlap (2007) and Xiao et al. (2013) strongly relates to NEP-Scale. It is to note that the same applies to many other environmental concern measures in the literature (e.g., Bamberg, 2003; Kilbourne and Pickett, 2008; Marquart-Pyatt, 2012; Lee et al., 2014; Mohd Suki, 2016). In sum, there is not one established environmental concern scale, but a number of measures developed based on the environmental issue at the interest of the study (topic) and the way in which the concern is expressed [see Dunlap and Jones (2002) classification of environmental concern measures]. To accordingly reflect the different perspectives on environmental concern as reflected in literature, our taxonomy assigns environmental concern to values, beliefs, attitudes, intentions, and behaviors within multiple contextual scopes.

The second multi-conceptual construct, i.e., environmental consciousness, stems from the marketing literature and describes

a "*multi-dimensional construct, consisting of cognitive, attitudinal and behavioral components*" (Schlegelmilch et al., 1996, p. 41). This description indicates that the construct comprises three conceptual types, i.e., knowledge, attitude, and behavior. The context is not clearly indicated in the conceptual definition but may be derived from the construct's measure. The three dimensions are assessed through five positively correlated sub-scales (see Bohlen et al., 1993; Diamantopoulos et al., 2003). One sub-scale measures (subjective) knowledge of selected environmental problems within a planet scope. A second sub-scale measures individuals' concerns about environmental quality using items that address attitudes, beliefs, and norms within a public and planet scope. Finally, the behavioral dimension is measured by three sub-scales capturing the level of environmentally sensitive behavior in a product, personal practice, and public scope, respectively. We indicate these derived contexts in the taxonomy (**Figure 2**).

In sum, the aspect of concern is central to both multi-conceptual constructs. From a conceptual perspective, beliefs and attitudes seem to be a focal domain to assess individuals' awareness of environmental issues within all four contexts and their expected consequences for the self, others, and nature.

DISCUSSION

In this paper, we used an integrative review approach to synthesize the knowledge about over 70 extant concepts developed within different literature streams to describe and assess individual's pro-environmental dispositions and practices of green consumption. As a result, we developed a two-dimensional taxonomy that synthesizes a set of 34 distinct concepts based on identical conceptual domains, conceptual overlaps, and multiple conceptualizations, identified through a critical assessment of the concepts' conceptual development and operationalization. Through this knowledge synthesis, we aim to facilitate the overview and systematization of a so far unconsolidated set of conceptualizations capturing individual-level environmental sustainability and followingly contribute to the interdisciplinary research field in three ways.

As a first contribution, the insight provided on conceptual definitions, measurement instruments, and synonymously used concepts in combination with our guiding framework can assist substantive researchers in identifying appropriate constructs of interest. As a second contribution, the systematic integration of (dis)similar concepts, often developed parallelly within different streams of literature, can assist future endeavors, such as meta-analyses, aiming at integrating substantive findings with regard to antecedents, consequences, and other relevant variables. Based on our review, we recognize the need for future reviews dedicated to providing an additional overview of empirical findings concerning the focal concepts in our taxonomy and their nomological networks. Such an overview would assist stakeholders in their efforts to foster environmental sustainability at an individual level and at the same time benefit the research field by identifying directions for additional empirical research. The integration of the focal concepts into a consolidated picture, see **Figure 2**, further revealed extant conceptualizations to center around specific combinations of concept types and contextual scopes, framing particular environmental challenges. These refer to (a) broad and abstract environmental challenges (such as global warming or natural degradation), conceptualized by behavior-distal psychological concepts such as values, identities, knowledge, beliefs, and attitudes, and (b) narrow and practical routines related to daily activities and the purchase, use, and disposal of products conceptualized as individual norms, intentions, and behaviors. This gap between the contextual scopes of behavioral-distal and behavioral-proximal concepts could indicate the different views on an individual's roles for environmental measures and challenges. It thus opens the ground for future research to investigate whether this gap, for example, impacts the use of behavioral-distal constructs as behavioral antecedents and relates to the value-action gap (Kollmuss and Agyeman, 2002). Other combinations of context types and contextual scopes than the ones referred to above seemingly received less or no attention in the literature. These "blind" spots in our taxonomy can provide a starting point for the introduction of relevant constructs. In contrast, the "crowded" spots can be the basis for research dedicated to enhancing conceptual rigor and measurement quality. As a third contribution, we thus discuss four critical aspects for the prevention of knowledge fragmentation, which we derived from the assessment of the constructs' conceptual development and measurement instruments, to assist researchers who engage in the proposed research avenues. These aspects regard (i) the state of the conceptual development of particular constructs; (ii) the lack of discriminant validity among concepts developed in parallel efforts; (iii) the existence of conceptually distinct concepts carrying identical or similar names; and (iv) measurement instruments that appear inconsistent with concepts' underlying conceptual domains; which we elaborate in the following.

The conceptual development of the focal constructs ranges from concepts that have gone through thorough development processes [e.g., biospheric values (Stern et al., 1999)] to concepts with scant development in reference to underlying theories and conceptual domains [e.g., attitude toward green purchase (Chan, 2001)]. Both theory and domain do, however, provide the basis for the subsequent construct development and operationalization (MacKenzie, 2003; Netemeyer et al., 2012). The lack of a theoretical foundation and/or a precise conceptual definition is thus problematic for multiple reasons (Podsakoff et al., 2016), which relate to the remaining three critical aspects. Consequentially, many of the revealed shortcomings that we reiterate in the following originate from this neglect at the very beginning of construct development[2].

Firstly, it endangers the establishment of discriminant validity toward related constructs. We thus recommend future research aiming to introduce additional concepts, to explicitly delineate them at a conceptual level from extant concepts (i.e., behavioral concepts within the product and personal practice scopes, see

[2]We additionally provide a section that includes more detailed guidance with examples using the constructs of our taxonomy in the supplementary material dedicated to interested readers (p. 15).

Figure 3) for which our taxonomy provides an overview, before engaging in the development process. This process should include tests of discriminant and convergent validity as proposed by scale development literature (DeVellis, 2016). For existing concepts, we encourage empirical research to examine discriminant validity among similar or overlapping concepts to better understand their similarities and distinctiveness (MacKenzie, 2003). This understanding would facilitate an informed choice of concepts for substantive research and contribute to developing an integrated knowledge base.

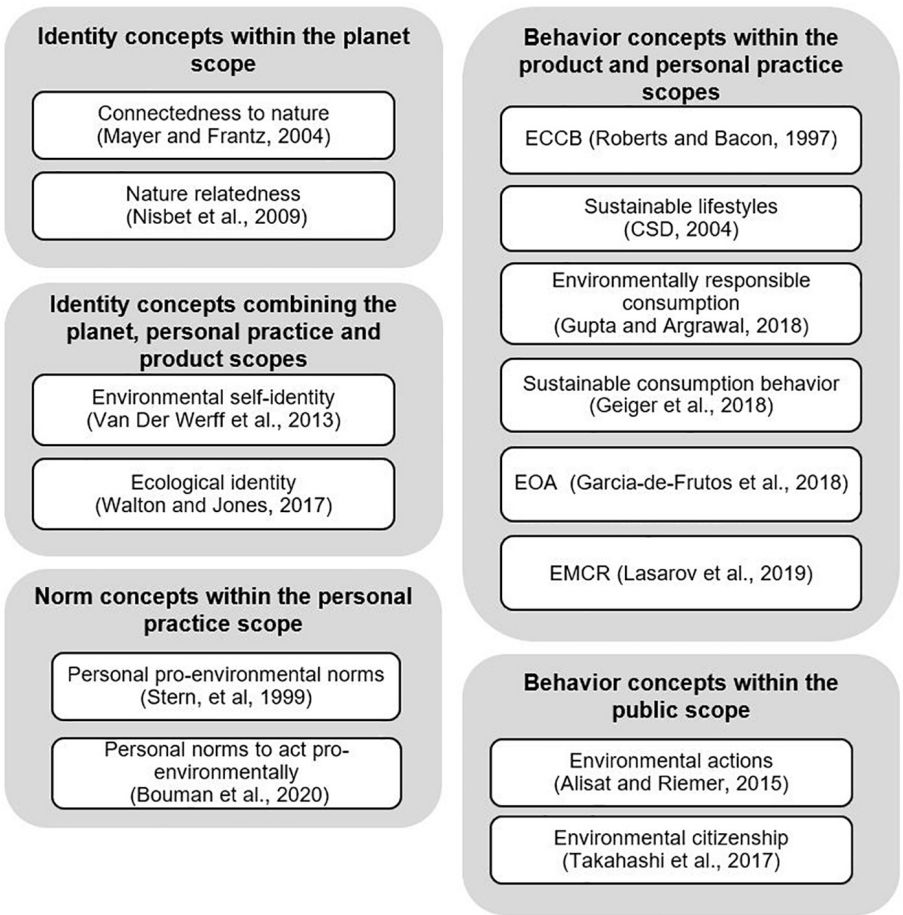

FIGURE 3 | Overlapping conceptual domains.

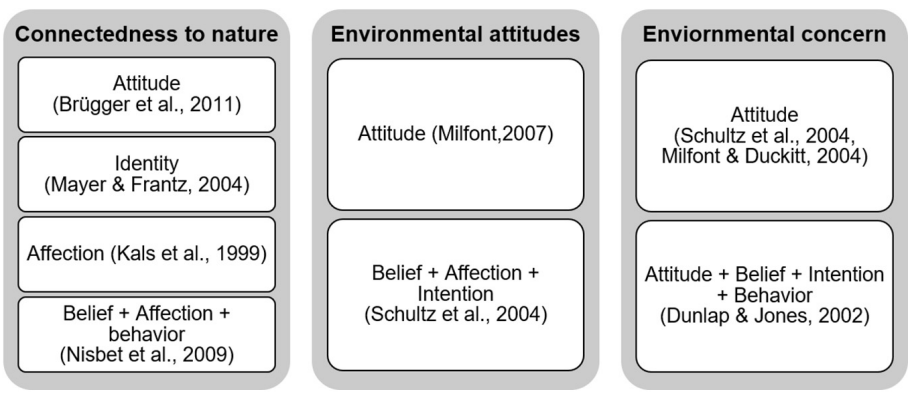

FIGURE 4 | Concepts with multiple and inconsistent conceptualizations.

Secondly, it prepares the ground for conflicting interpretations of the concept's meaning. Literature would thus benefit from additional research aiming at theoretically delineating divergent conceptualizations for the relevant concepts in our taxonomy (i.e., connectedness to nature, environmental attitudes, and environmental concern, see **Figure 4**). This endeavor would require theoretical and conceptual work on the one hand and empirical research to establish discriminant or divergent validity on the other hand (MacKenzie, 2003; Netemeyer et al., 2012). Such efforts might be complemented by empirical studies aiming to examine the concepts' relative and/or complementary predictive power (MacKenzie, 2003) for relevant outcome variables. These insights would assist the advancement of the field by providing a clear picture of the unique contribution of these concepts and their adequate use in empirical models.

Thirdly, it jeopardizes the development of sound measurement scales (DeVellis, 2016). To prevent conceptual ambiguity and measurement misspecification, we urge future research to carefully delineate the type of construct for the development and/or adaption of scales from previous research when introducing new concepts (see MacKenzie, 2003). Following established guidelines, it is essential to provide a precise definition of the conceptual domain(s) and framed environmental problem(s) to ensure that measures closely reflect the conceptual meaning of the construct. This definition should consequentially build the basis for the process of scale development. Referring to extant concepts suffering from a conceptualization–operationalization divide, see **Figure 2**, further methodological work aiming at strengthening construct validity would be welcome. As such, one might need to engage in fresh scale development basing upon the extant conceptual definition, tightly following scale development guidelines, and engaging in rigorous scale validation (De Vellis, 2003). This methodological work is crucial as the validity of empirical findings is directly affected by the quality (i.e., reliability and validity) of the used measures. The indicated divides further hint at the fact that the scale development process and reporting of psychometric properties for reviewed concepts are, in some cases, limited. A detailed review of the identified 76 scales available to measure the 34 concepts would thus be valuable to enhance measurement quality and consequently empirical validity in the research field.

In emphasizing the relevance of knowledge integration by considering the critical aspects introduced, we aim to foster conceptual advances in this interdisciplinary field, relevant for sustainable transitions. These advances can be critical to both academics and practitioners, as they can facilitate connecting members of knowledge communities and further foster knowledge diffusion and sharing (MacInnis, 2011). Our taxonomy revealed potential entry points for such advances, for example, by indicating that most of the behavioral constructs address a product or personal practice scope, respectively. The public and planet scopes, however, become relevant when considering the role consumers play as activists and global citizens to combat the increasingly pressing environmental challenges (Thiermann and Sheate, 2020; Bamberg et al., 2021; Nielsen et al., 2021). In contrast, most behavioral antecedents capture the role of individuals for relevant challenges from a more collective, global perspective. An evidence-based design of green consumption interventions thus demands a more integrated understanding of environmental dispositions and behaviors that drive agency toward environmental sustainability. This can be facilitated by the integration of knowledge about relevant concepts (and measurement scales), i.e., values, beliefs, and behaviors, which we attempted with this interdisciplinary overview, review, and synthesis of more than 70 extant concepts. We thus hope to encourage future research and reviews that bridge and unify the domain knowledge on individual-level concepts relevant to fostering green consumption practices.

AUTHOR CONTRIBUTIONS

LW contributed to the conceptualization, methodology, investigation, and writing – original draft. PR contributed to the conceptualization, methodology, writing – review and editing, and supervision. Both authors contributed to the article and approved the submitted version.

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Understanding Waste Management Behavior Among University Students in China: Environmental Knowledge, Personal Norms, and the Theory of Planned Behavior

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Previous studies have confirmed that individual waste management behavior is influenced by both rational-based and altruistic-oriented beliefs and attitudes. Scholars incorporated personal norms in Ajzen's theory of planned behavior and confirmed its usefulness in predicting waste management behavior. However, limited attention has been paid to the interactions between the variables in the model. Scholars also commented that the cognitive dimension was largely neglected in the current socio-psychological framework of waste management behavior. This study intends to address this issue by incorporating environmental concern and environmental knowledge in the model and examining the psychological paths linking these variables to waste management behavior within the expanded model of planned behavior. Based on a cross-sectional survey among 434 university students in China, the results showed that subjective norms, perceived behavioral control, personal norms, and environmental knowledge were essential predictors of waste management behavior, whereas the direct effect of attitude was not statistically significant. Environmental concern and subjective norms could influence waste management behavior through personal norms. Environmental knowledge could influence waste management behavior indirectly through environmental concern, personal norms, and perceived behavioral control. Moreover, perceived behavioral control served as a mediator between the relationship of personal norms and waste management behavior.

Keywords: theory of planned behavior, value-belief-norm theory, environmental knowledge, pro-environmental behavior, recycling

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INTRODUCTION

Solid waste issue is one of the major issues in most countries at a global scale today (Abdel-Shafy and Mansour, 2018). It is estimated that global annual waste will reach 3.4 billion tons by 2050 (Kaza et al., 2018). If not collected or disposed appropriately, waste would pose significant threats to public health and the environment (Kaza et al., 2018). With an emerging consumer society and

a large population of over 1.4 billion, China is among the countries facing the most serious effects of solid waste pollution (Zhou et al., 2017). To address this issue, China has implemented a series of laws and regulations on solid waste management, and initiated national programs to promote energy conservation awareness and environmentally responsible lifestyle in recent years. In 2017, the Chinese government issued the *Implementation Plan of the Household Waste Classification System*, which was regarded as a milestone for the institutionalization of public participation in recycling nationwide. One year later, a wider spectrum of waste management behavior which includes reduction, reuse, and recycling was highlighted in the trail version of *Citizen's Ecological Environment Behavior Standard* (the Ministry of Ecology and Environment, 2018) to guide environmental education practice in China. If the most effective educational intervention is to be guaranteed, socio-psychological factors that are critical as well as the mechanisms through which these factors contribute to predicting waste management behavior should be studied.

In the field of environmental psychology, Ajzen (1991) theory of planned behavior (TPB) and Stern (2000) value-belief-norm model of environmentalism (VBN) represents two influential yet distinct approaches to understand pro-environmental behavior. The TPB explains pro-environmental behavior as a rational choice based on deliberate calculation of the expected costs and benefits of as well as the ability to perform the given behavior under certain social pressure. In contrast, the VBN understands pro-environmental behavior as a moral behavior determined by personal norms (i.e., internalized moral norms) with the latter being activated by environmental concern/beliefs and pro-social and/or environmental values. Nevertheless, pro-environmental behavior involves a complex decision-making process that is usually driven by multiple motives (Steg and Vlek, 2009; Onel and Mukherjee, 2017). Scholars have incorporated personal norms in the TPB and examined its role in predicting residents' recycling in a variety of culture settings, such as in the United States (Onel and Mukherjee, 2017), in Australia (Chan and Bishop, 2013), and in China (Tang et al., 2011; Shen et al., 2020). The results from these studies consistently indicated that personal norms significantly predicted recycling intention or behavior over and beyond the TPB variables. However, the importance of personal norms in predicting recycling behavior in comparison with as well as the interactions between personal norms and the TPB variables has not yet been fully understood.

Recently, Morren and Grinstein (2021) examined the role of personal norms in the TPB in predicting pro-environmental behavior in different cultures using a meta-analytic structural equation modeling based on 255 samples. Their study suggests that rather than an antecedent of attitudes or a full mediator between subjective norms and intention, it would be more plausible to theorize personal norms as an antecedent of both intention and behavior; moreover, the relationship between personal norms and intention seems to be weaker in collectivistic than in individualistic cultures. Yet, previous research on waste management behavior in China mainly integrated personal norms as an antecedent of attitude in the TPB and focused largely on intention (Zhang et al., 2015; Xu et al., 2017; Shen et al., 2020). The direct effect of personal norms on waste management behavior in comparison with the TPB variables has rarely been addressed. To our best knowledge, only Tang et al. (2011) examined the importance of personal norms in the TPB model in predicting household recycling behavior in rural China. The population in their study was by large extent in pre-middle age (35–45 years) with a median level of education (i.e., 69% completed junior middle schools). Given the fact that young adults (aged 15–24 years) are identified as major targets for necessary interventions to foster a sustainable future (Fien et al., 2008), the present study intended to examine an expanded TPB model with personal norms as an antecedent variable of behavior in a specific young adult population (i.e., university students) in China. By focusing on this target population, the present study also attempted to provide a case with which the robustness of the relationship between personal norms and waste management behavior could be examined in well-educated young adult populations in China. Drawing on Stern (2000) VBN model, environmental concern was also included in the expanded model as an antecedent variable of personal norms.

Moreover, scholars have criticized that the role of environmental knowledge in shaping pro-environmental behavior was largely underestimated (Kaiser and Fuhrer, 2003; Steg and Vlek, 2009; Geiger et al., 2019). It is generally believed that although environmental knowledge *per se* is not a motive of pro-environmental behavior, it provides as essential cognitive basis upon which pro-environmental behavior can be developed (Stern, 2000; Schultz, 2002; Bamberg and Möser, 2007). Empirically, past research differentiated and identified two types of environmental knowledge that appeared to be critical in predicting pro-environmental behavior: environmental- and action-oriented knowledge. Environmental-oriented knowledge refers to an understanding of both ecological and social dimensions of the environment and environmental issues (also known as system or declarative knowledge, see Kaiser and Fuhrer, 2003 and Geiger et al., 2019), whereas action-oriented knowledge refers to knowledge of using action strategies to address environmental issues (i.e., knowledge of action strategies, see Hungerford and Volk, 1990) such as procedural and effectiveness/impact knowledge (Schultz, 2002; Kaiser and Fuhrer, 2003; Geiger et al., 2019). However, only very limited studies examined the role of environmental knowledge in shaping waste management behavior. More importantly, there is a paucity of research on the psychological path concerning how environmental knowledge contributes to shaping pro-environmental behavior. Recently, Geiger et al. (2019) examined the structure of environmental knowledge and found that environmental- and action-oriented environmental knowledge shared much in common and appeared to be a unidimensional factor associated tightly with the general knowledge of individuals. Thus, the present study intended to address this issue by integrating environmental knowledge (that comprises both environmental- and action-oriented knowledge) in the expanded TPB model and examining the indirect effect of this cognitive variable on waste management behavior

through more specific attitudes in the expanded TPB model. The expanded TPB model to be tested is presented in **Figure 1**.

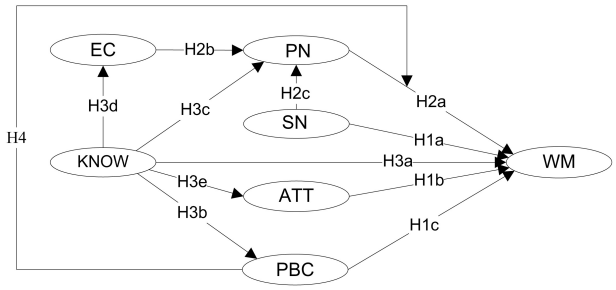

FIGURE 1 | The expanded TPB model to be tested. WM, waste management behavior; SN, subjective norms; ATT, attitudes; PBC, perceived behavioral control; PN, personal norms; EC, environmental concern; KNOW, environmental knowledge.

THEORETICAL FRAMEWORK

Theory of Planned Behavior and Its Application in Waste Management Research

The TPB developed on the basis of Fishbein and Ajzen (1975) Theory of Reasoned Action (TRA). In the original model of TRA, intention plays the central role in determining a planned behavior; this variable is influenced by two critical factors including subjective norms and attitudes toward behavior. Subjective norms refer to perceived social pressure to perform the behavior in question, and attitudes toward behavior refer to personal evaluation of the behavior from a rational perspective (i.e., based on perceived benefits and costs the behavior may impose on individuals). Theoretically, the more intensive social pressure one perceives, and the more favorable consequence one expects a behavior can result in, the more intention one may have to perform the behavior, and hence, the more likely he or she would actually perform the behavior. Ajzen (1991) introduced the construct of perceived behavioral control (i.e., perceived ease or difficulty of performing the behavior) in the TPB as an antecedent variable of both intention and behavior. As this variable is based on an individual's perception about both personal and environmental factors that would facilitate or hinder their ability to perform a behavior, the TPB is superior to the TRA in predicting behaviors in more specific and complicated contexts (Ajzen, 1991). Previous studies have applied the TPB and confirmed the usefulness of this model in predicting both intention to recycle (Taylor and Todd, 1995; Mannetti et al., 2004; Greaves et al., 2013; Botetzagias et al., 2015; Wan et al., 2017; Passafaro et al., 2019; Tian et al., 2019; Fedi et al., 2021) and recycling behavior (Tang et al., 2011; del Aguilar-Luzón et al., 2012; Onel and Mukherjee, 2017; Passafaro et al., 2019). Based on these studies, the following hypotheses are proposed:

H1a: Subjective norms positively predict waste management behavior.

H1b: Attitude positively predicts waste management behavior.

H1c: Perceived behavioral control positively predicts waste management behavior.

Personal Norms and Environmental Concern

Personal norms refer to an individual's feelings of moral obligation to perform a behavior (Schwartz, 1977). In contrast to the TPB, personal norms represent an altruistic perspective to human behaviors. As pro-environmental behaviors can be understood as altruistic behaviors with the purpose of either improving the well-being of living beings or conserving nature for its own sake or both, personal norms have been viewed as an essential factor in shaping pro-environmental behaviors (Van Liere and Dunlap, 1978; Stern, 2000). The relationship between personal norms and waste management behavior has been examined in different adult populations from a variety of cultures, for example in the United States (Thøgerson, 1996), in Brazil (Bertoldo and Castro, 2016), in Australia (Chan and Bishop, 2013), in European settings such as in Sweden (Hage et al., 2009; Andersson and von Borgstede, 2010), in Spain (del Aguilar-Luzón et al., 2012), and in Portugal (Bertoldo and Castro, 2016), and in Asian settings such as in China (Tang et al., 2011) and in Thailand (Janmaimool and Denpaiboon, 2016). It was found that personal norms significantly predicted waste management behavior in general (Janmaimool and Denpaiboon, 2016) or recycling behavior (Andersson and von Borgstede, 2010; Tang et al., 2011; Bertoldo and Castro, 2016) in specific even when the effects of the TPB variables were accounted for. Thus, the following hypothesis is proposed:

H2a: Personal norms positively predict waste management behavior.

Environmental concern (also known as the new ecological paradigm) is another critical factor influencing pro-environmental behavior from the altruistic perspective (Dunlap et al., 2000; Stern, 2000). This variable can be interpreted as a set of general beliefs about the environment and the relationship between humans and the environment (Dunlap et al., 2000). According to Stern (2000) value-belief-norm model of environmentalism, environmental concern provides a "folk" theory based upon the specific beliefs such as awareness of consequences (i.e., the perception of others' welfare or needs) and ascription of responsibility (i.e., the apprehension of a sense of connection with others in need as an actor) are developed. As such, it contributes to the development of personal norms through awareness of consequences and ascription of responsibility. Previous studies have supported the sequential chain linking environmental concern to personal norms, and suggested environmental concern influences pro-environmental behaviors through personal norms (Kaiser et al., 2005; Onel and Mukherjee, 2017; Fornara et al., 2020; Zhang et al., 2020). Thus, the following hypothesis is proposed:

H2b: Environmental concern positively predicts personal norms.

Besides environmental concerns, social norms also provide an essential basis for the development of personal norms (Thøgerson, 1996; Bamberg and Möser, 2007). Social norms are common behavior standards that specify what is acceptable or appropriate within a society or reference group. They can be internalized and transmitted into personal norms through the process of socialization and social interaction (Schwartz, 1977). As subjective norms are felt social norms in a specific context held by a given reference group, it is reasonable to expect that subjective norms (including both injunctive and descriptive norms) would play a critical role in shaping personal norms. Some studies have examined the relationship between subjective norms and personal norms and found that subjective norms significantly predicted personal norms (Klöckner, 2013; Han et al., 2017; Fornara et al., 2020). Thus, the following hypothesis is proposed:

H2c: Subjective norms positively predicts personal norms.

Environmental Knowledge

The importance of environmental knowledge has been emphasized widely in the field of environmental education (UNESCO-UNEP, 1977; Simmons, 1995; Hollweg et al., 2011). Hines et al. (1987) and Hungerford and Volk (1990) made initial efforts to incorporate environmental knowledge within a socio-psychological framework of pro-environmental behavior. Based on a meta-analysis of 128 studies on pro-environmental behavior, Hines et al. (1987) recognized knowledge of environmental issues and of action strategies as critical factors influencing pro-environmental behavior. The importance of these two specific kinds of environmental knowledge was highlighted once again in Hungerford and Volk (1990) model of citizenship behavior, as ownership, and empowerment variables in predicting pro-environmental behavior, respectively. Besides these two knowledge variables, they also integrated ecological knowledge as an entry-level variable of pro-environmental behavior. Both of their models were examined in a variety of adult populations both within and out of the United States (Sia et al., 1986; Sivek and Hungerford, 1990; Hsu and Roth, 1998; Marcinkowski, 1998; Cottrell, 2003). The results of these studies consistently showed that knowledge of action strategies or knowledge of environmental issues appeared to be a significant predictor of pro-environmental behavior, whereas the effect of ecological knowledge on pro-environmental behavior was relatively weak or insignificant. In the context of waste management, Janmaimool and Denpaiboon (2016) reported a significant effect of knowledge of action strategies on waste management behavior in a Thailand adult population. It was also found that environmental knowledge, either in general (Izagirre-Olaizola et al., 2015) or in association with environmental issues (Tang et al., 2011), significantly predicted recycling behavior even when the effects of the TPB variables were controlled for. Vining and Ebreo (1990) comparative study on recyclers with non-recyclers reported that recyclers were more knowledgeable about local recycling programs such as what items can be recycled and how to recycle these items (i.e., action-oriented knowledge). Based on these studies, the following hypotheses is proposed:

H3a: Environmental knowledge positively predicts waste management behavior.

In addition, it is theoretically plausible that environmental knowledge may also influence pro-environmental behavior indirectly through perceived behavioral control. In general, the status of having a comprehensive knowledge of environment science and actions based on past learning experience would lead to an increase in one's confidence in performing pro-environmental behavior in a similar context (i.e., perceived behavioral control) in future. In particular, the more knowledgeable one perceives he or she is concerning how to make action strategies for issue-solving in a specific context (e.g., recycling), the more likely one may feel he or she has control over that action in that context. Thus, the following hypothesis is proposed:

H3b: Environmental knowledge positively predicts perceived behavioral control.

Environmental knowledge would also influence pro-environmental behavior indirectly through environmental concern. Since interrelatedness is a central concept of environmental knowledge (Enger and Smith, 2017), it is reasonable to expect that the more environmental knowledge one gains, the more likely he or she will understand environmental issues (including the causes and consequences) from a systematic perspective, and hence the more likely he or she would perceive nature and human-nature relationship from an ecological perspective. Two studies (Teksoz et al., 2012; Zhu, 2015) examined the relationships between environmental knowledge, environmental concern, and pro-environmental behavior, and found that environmental knowledge influenced pro-environmental behavior via environmental concern. Therefore, the following hypothesis is proposed:

H3c: Environmental knowledge positively predicts environmental concern.

Environmental knowledge (especially knowledge of environmental issues) would also foster a sense of responsibility for environmental improvement (Hungerford and Volk, 1990; Han et al., 2017), which would in turn contribute to the development of pro-environmental behavior. Empirically, Teksoz et al.'s (2012) study on environmental literacy found that environmental knowledge significantly predicted personal norms among university students. Bamberg and Möser (2007) meta-analysis also suggest that environmental knowledge would influence pro-environmental behavior through personal moral norms. Thus, the following hypothesis is proposed:

H3d: Environmental knowledge positively predicts personal norms.

Lastly, understanding of environmental issues in general and of waste issues in particular provides an essential cognitive

basis upon which attitudes toward waste management behavior develop. For instance, the more knowledgeable one is about the impacts of waste pollution on environmental quality and human health, the more likely he or she would hold strong beliefs in the benefits of waste management behavior (e.g., reducing health risks because of waste pollution), and hence, the more favorable attitudes he or she would have toward waste management behavior. Empirically, a significant effect of environmental knowledge on attitudes was reported by Pivetti et al. (2020), who focused on recycling among an adult population in the Italian context. Therefore, the following hypothesis is proposed:

> H3e: Environmental knowledge positively predicts attitudes.

Perceived Behavioral Control and the Relationship Between Personal Norms and Waste Management Behavior

The relationship between personal norms and recycling can be influenced by contextual variables such as convenience. In light of the attitude-behavior-context (ABC) theory proposed by Guagnano et al. (1995), personal norms will play a critical role in determining recycling when only external barriers are at an intermediate level; in situations where recycling is too easy or too difficult, most people will recycle or not recycle no matter how weak or strong moral obligations they feel. Since perceived behavioral control captures a set of beliefs that "deal with the presence or absence of requisite resources and opportunities" (Ajzen, 1991, p. 196), it is reasonable to assume that this variable might influence the role of personal norms in predicting waste management behavior via *subjectively perceived* barriers. In particular, the more resources and opportunities one believes there are to support waste management behavior (i.e., less perceived barriers), the more likely personal norms would have a profound effect on waste management behavior, especially when external conditions make such behavior very difficult. Thus, the following hypothesis is proposed:

> H4: Perceived behavioral control moderates the relationship between personal norms and waste management behavior.

MATERIALS AND METHODS

Sampling

The present study took full-time undergraduate students in Jiangsu province in Eastern China as the case. Jiangsu represents one of the most developed provinces in China. By the end of 2019, Jiangsu had a resident population of 80.7 million, and reached a GDP scale of 9.96 trillion CNY (1.4 trillion USD), ranking first in GDP per capita and second in comprehensive competitiveness at the provincial level (Li et al., 2021). The sample was recruited from an online survey company (i.e., Wenjuanxin)[1] via its survey system (Ma et al., 2019). The survey lasted for 1 week with a target of receiving at least 400 usable questionnaires. To encourage high response rate, participants were informed along with the consent letter at the beginning of the questionnaire that they had 25% chances to be rewarded with money of 5 CNY (approximately 0.775 USD) by lottery drawing after they completed the questionnaire. By the time the survey was terminated, 451 valid questionnaires were collected (71.2% of 625 questionnaires). Invalid questionnaires were excluded in light of the following criteria: questionnaires with (1) linearly/diagonally responses on all items throughout the entire set of the measures; (2) respondents beyond the undergraduate level (e.g., graduate students) or studied in a university/college outside of the target region; (3) questionnaires with either unknown or oversea IP addresses. At last, 434 usable questionnaires were obtained for data analysis. The final sample included 145 male (33.4%) and 289 female (66.6%) participants with ages ranging from 18 to 25 years (M = 20.50, SD = 1.28). The percentages of freshman, sophomores, juniors, and seniors were 44.7, 24.9, 20.3, and 10.1%, respectively. Among the participants, 53.9% had a major in science or engineering academic fields, whereas 46.1% had a major in social science or humanities academic fields. Basic characteristics of the final sample are shown in **Table 1**.

Survey Design

The questionnaire comprised seven individual scales measuring waste management behavior (WM) and the independent variables, which include subjective norms (SN), attitudes (ATT), perceived behavioral control (PBC), environmental concern (EC), personal norms (PN), and environmental knowledge (KNOW). Prior to the formal survey, a small-scale pilot survey was administered among two classes of undergraduate students (N = 56) who registered in a statistics and data analysis course taught by the first author. Feedback was collected to examine whether there were any problematic items with ambiguous meanings or incorrect expressions. Some minor modifications were done based on these feedbacks. The seven measures with item description are shown in **Table 2**.

TABLE 1 | Basic characteristics of the samples.

Characteristics	Frequency	Percentage
Sex		
Male	145	33.4
Female	289	66.6
Age		
Mean ± *SD*	20.50 ± 1.28 (18–25)	
Grade level		
Freshman	194	44.7
Sophomore	108	24.9
Junior	88	20.3
Senior	44	10.1
Academic field		
Science or engineering	234	53.9
Social science or humanities	200	46.1

[1] www.wjx.cn

TABLE 2 | Item description on the measures.

Constructs	Items	Factor loading
Recycling behavior	REC1: Reuse recyclable materials in my daily life	0.793
	REC2: Classify recyclable waste, and then, properly dispose of them in the waste containers or sell them out in my daily life	0.813
	REC3: Reduce using/purchasing disposable products in my daily life	0.761
Subjective norms	SN1: Most people who are important to me think that I should reuse and/or recycle waste in daily life	0.858
	SN2: Most people who are important to me think that I should refuse to use or purchase disposable products in daily life	0.860
	SN3: Most people who are important to me are reusing and/or recycling waste in their daily life	0.813
	SN4: Most people who are important to me are taking steps to refuse to use disposable products in their daily life	0.843
Attitudes	ATT1: Reuse and/or recycle waste in daily life (*good* vs. *bad*)	0.653
	ATT2: Reduce using/purchasing disposable products in daily life (*good* vs. *bad*)	0.797
	ATT3: Reuse and/or recycle waste in daily life (*pleasant* vs. *unpleasant*)	0.821
	ATT4: Reduce using/purchasing disposable products in daily life (*pleasant* vs. *unpleasant*)	0.884
Perceived behavioral control	PBC1: Reuse and/or recycle waste in daily life (*have control* vs. *have no control*)	0.825
	PBC2: Reduce using/purchasing disposable products in daily life (*have control* vs. *have no control*)	0.879
Ecological worldview	EW1: The number of people living on earth is approaching the limit the earth can support	0.502
	EW2: When humans interfere with nature, it often produces disastrous consequences	0.731
	EW3: Humans are severely abusing the environment	0.594
	EW4: The balance of nature is very delicate and easily upset	0.617
	EW5: If things continue on their present course, we will soon experience severe ecological catastrophes	0.798
Personal norms	PN1: I feel I have personal obligation to reuse and/or recycle waste in my daily life for a better environment	0.920
	PN2: I feel I should take steps to prevent environmental problems by avoiding the usage of disposable products in my daily life	0.906
Environmental knowledge	KNOW1: Basic concepts of ecological system (such as energy flow and cycle of matter)	0.858
	KNOW2: Earth system science (such as ocean currents and earth climate)	0.868
	KNOW3: Natural resource and energy management (such as renewable and non-renewable resource)	0.894
	KNOW4: Environmental issues (such as marine pollution, air pollution, global warming, white pollution and related causes and consequences)	0.886
	KNOW5: Action strategies to address waste issues (such as ways of recycling/reuse and waste reduction)	0.851

Waste management behavior was measured using three items taping reuse, recycling, and reduce based on Swami et al. (2011). Participants were asked to evaluate how often they engaged in the three aspects of recycling in their daily life over the past year on a five-point Likert scale ranging from "never" to "always." An earlier study showed that these three WM items together with green purchase behavior could be empirically differentiated from reducing energy use, conserving water, and choosing public transportation when going out, and could be regarded as high-cost pro-environmental behavior for university students in China (Wu and Zhu, 2021). Similarly, Wei et al. (2021) also differentiated waste reduction such as bringing reusable bags when shopping from electricity and water saving, and identified the former as costly saving behavior for Chinese university students.

Subjective norms, attitudes, and perceived behavioral control were assessed using self-developed items based on Ajzen (2002). Subjective norms were measures in terms of *injunctive* (i.e., the extent to which they believe that most people who are important to them think they should engage in waste management behavior) and *descriptive* (i.e., the extent to which they believe that most people who are important to them engage in waste management behavior) norms. For both types of norms, two items were developed and rated on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." For attitudes, participants were asked to assess their overall evaluation of waste management behavior in daily life on two five-point semantic differentials scales. These included (1) harmful/beneficial, which reflects the *instrumental* quality of recycling, and (2) unpleasant/pleasant, which pertains to the *experiential* quality of recycling. Perceived behavioral control was measured in a direct way using two items, which were rated on a five-point Likert scale ranging from "no control at all" to "complete control."

Personal norms were measured using two items adapted from Thøgersen (2006). Environmental concern was measured using five items (i.e., NEP1, NEP3, NEP5, NEP13, and NEP15) from the revised Chinese version of NEP Scale (Wu and Zhu, 2021). These items pertain to balance of nature, limits-to-growth, and eco-crisis on the original NEP scale. Previous studies have demonstrated that these items were quite consistent and stable in representing an individual's general belief of the environment and severity of eco-crisis across different populations in China (Wu and Zhu, 2021; Xu et al., 2021). The items were rated on a five-point Likert scale ranging from "strongly disagree" to "strongly agree."

Environmental knowledge was measured in an indirect way (i.e., *perceived* knowledge) using items adapted from *the second author* (2015). Five items were used to assess the extent to which participants believe that they are knowledgeable about basic concepts of ecology, earth system science, natural resource and energy management, environmental issues, and action strategies in association with waste management. The items were rated on a five-point Likert scale ranging from "to little extent" to "to an extremely large extent."

Data Analysis

STATA 16.0 was used for basic descriptive analysis. The SmartPLS version 3.3.2 was used to test the hypotheses. Partial least squares structural equation modeling (PLS-SEM) was chosen because this approach makes no restrictive assumptions about the data distribution and has advantage to test more complex models with smaller sample sizes in comparison with covariance-based structural equation methods (CB-SEM) (Hair et al., 2019). In light of Hair et al. (2010) two-stage procedure for SEM analysis, the reliability and validity of the measurement model was examined in the first stage; then, the paths in the structural model were accessed in the second stage. Moderating effect was evaluated using a two-stage approach with mean-centered data. Significance of path coefficients in the models was examined using a bootstrap test with 5,000 subsamples.

RESULTS

Measurement Model

Construct reliability and validity of the measurement model were firstly evaluated. As item NEP1 had a low loading (barely close to 0.5), the model was adjusted by removing this item. The results are shown in **Table 3**. Cronbach's alphas and the values of composite reliability ranged from 0.627 to 0.921 and from 0.782 to 0.941, respectively, indicating acceptable construct reliability (i.e., above 0.6) (Hair et al., 2019). Convergent validity was examined using the average variance extracted (AVE). The AVE values for all but one construct (i.e., environmental concern) exceeded the threshold value of 0.5 (Hair et al., 2019); for the construct of environmental concern, the value (0.476) was quite close to 0.5, hence providing evidence for convergent validity.

The discriminant validity was assessed using Fornell-Larcker and heterotrait-monotrait (HTMT) estimates. For a construct with good discriminant validity, the value of the square root of AVE for this construct should be greater than the correlations of this construct with any other constructs and the value of the HTMT ratio should be smaller than 0.85 (Hair et al., 2019). As shown in **Table 3**, all constructs had acceptable discriminant validity, with the values of the square root of AVE for any given construct were greater than the corresponding correlations in question, and the values of the HTMT ratio ranging from 0.230 to 0.725. Moreover, the variance inflation factors (VIF) of all constructs (i.e., inner VIF values) ranged from 1.000 to 1.832 (lower than the recommended value of 5), suggesting that multicollinearity was not a severe issue in this study.

Structural Model

The primary purpose of this study was to examine the role of personal norms in predicting waste management behavior within the expanded TPB model among the young adult population in China. The importance of environmental knowledge in shaping waste management behavior as well as the psychological path that links environmental knowledge to waste management behavior within the expanded TPB model was also explored. For comparative purposes, three models were established. The original model included the three TPB variables only; the second model included personal norms as an antecedent variable of waste management behavior based on the first model; the third model (i.e., the complete model) integrated environmental knowledge as an antecedent variable of waste management behavior, perceived behavioral control, environmental concern, personal norms, and attitudes based on the second model. The complete model explained 31.8% of the variance in waste management behavior, indicating weak-to-moderate explanatory power (Hair et al., 2019).

Basic measures of model fit in PLS-SEM include the standardized root mean square residual (SRMR), the unweighted least squares discrepancy (d_{ULS}), the geodesic discrepancy (d_G), and the normed fit index (NFI). The values of SRMR, d_{ULS}, d_G, and NFI for the estimated and the saturated models were 0.139 and 0.066, 5.836 and 1.301, 0.655 and 0.520, and 0.684 and 0.726, respectively. Although the SRMR for the estimated model exceeded 0.08 (a threshold indicating a good fit for CB-SEM) and the values of NFI for both estimated and saturated models were smaller than 0.9 (a threshold indicating acceptable fit for CB-SEM), Hair et al. (2019) suggest these guidelines should be regarded as very tentative for PLS-SEM. The reason lies in that the PLS-SEM algorithm is not based on minimizing discrepancy between observed and estimated covariance matrices as it does in CB-SEM; rather, the primary aim of model estimation in PLS-SEM is to maximize the explained variance of endogenous constructs (Hair et al., 2019). Hence, a global fit measure (*GoF*) for PLS-SEM, which is defined as the geometric mean of average AVE and average R^2 for endogenous constructs (Wetzels et al., 2009), was used as supplementary evidence of model fit in the present study. The *GoF* value was 0.34 for the complete model, which is close to the cut-off value of 0.36 for large effect size of R^2 (the cut-off value for medium effect size is 0.25), suggesting acceptable model fit of the complete model (Wetzels et al., 2009). The direct and indirect effects of the variables in the complete model are shown in **Table 4**.

Three Theory of Planned Behavior Variables as Predictors of Waste Management Behavior

To begin with, attitude had no significant effect on waste management behavior when only the three TPB variables were included in the model (see **Figure 2**). The effects of subjective norms ($\beta = 0.28$, $p = 0.000$) and perceived behavioral control ($\beta = 0.17$, $p = 0.000$) remained significant after personal norms and environmental knowledge were added to the model. The results of the bootstrap test also indicated significant effects of these two TPB variables on waste management behavior. Hence, hypotheses H1a and H1c were accepted, but H1b was rejected.

TABLE 3 | Reliability and validity of the measurement model.

Construct	α	CR	AVE	1	2	3	4	5	6	7
1. WM	0.698	0.832	0.623	**0.790**	0.600	0.363	0.537	0.259	0.504	0.464
2. SN	0.865	0.908	0.712	0.466	**0.844**	0.569	0.587	0.324	0.691	0.357
3. ATT	0.809	0.870	0.629	0.289	0.490	**0.793**	0.725	0.371	0.680	0.267
4. PBC	0.627	0.842	0.727	0.358	0.437	0.516	**0.852**	0.380	0.600	0.326
5. EC	0.645	0.782	0.476	0.188	0.264	0.284	0.269	**0.690**	0.460	0.230
6. PN	0.800	0.909	0.833	0.377	0.576	0.536	0.428	0.352	**0.913**	0.352
7. KNOW	0.921	0.941	0.760	0.378	0.323	0.234	0.251	0.195	0.304	**0.872**

Data indicating Fornell-Larcker criterion is shown below the diagonal; data indicating Heterotrait-monotrait (HTMT) is shown above the diagonal. CR, composite reliability; AVE, average variance extracted. The values of square root of AVE are shown in the diagonal in bold. WM, waste management behavior; SN, subjective norms; ATT, attitudes; PBC, perceived behavioral control; PN, personal norms; EC, environmental concern; KNOW, environmental knowledge.

TABLE 4 | Standardized path coefficients of direct and indirect effects in the structural model.

Paths	β	*t*	*p*	Bias-corrected 95%CI[a]		Hypothesis Check
				LB	UB	
Direct effects						
WM ← SN	0.276***	4.656	0.000	0.164	0.392	H1a: Supported
WM ← ATT	−0.035	0.641	0.521	−0.139	0.073	H1b: Not supported
WM ← PBC	0.172**	2.832	0.005	0.051	0.287	H1c: Supported
WM ← PN	0.132*	2.374	0.018	0.025	0.243	H2a: Supported
PN ← EC	0.202***	4.778	0.000	0.116	0.282	H2b: Supported
PN ← SN	0.487***	13.009	0.000	0.411	0.555	H2c: Supported
WM ← KNOW	0.216***	4.539	0.000	0.123	0.306	H3a: Supported
PBC ← KNOW	0.253***	5.501	0.000	0.154	0.337	H3b: Supported
PN ← KNOW	0.108**	2.580	0.010	0.028	0.190	H3c: Supported
EC ← KNOW	0.195***	4.260	0.000	0.098	0.278	H3d: Supported
ATT ← KNOW	0.244***	5.609	0.000	0.157	0.326	H3e: Supported
WM ← PN × PBC	0.106**	3.030	0.003	0.033	0.169	H4: Supported
Indirect effects						
WM ← PN ← SN	0.065*	2.350	0.019	0.013	0.121	
WM ← PN ← EC	0.027*	2.061	0.039	0.006	0.057	
WM ← PBC ← KNOW	0.043*	2.324	0.020	0.012	0.084	
WM ← PN ← KNOW	0.014^{+}	1.653	0.098	0.002	0.038	
WM ← PN ← EC ← KNOW	0.005^{+}	1.779	0.075	0.001	0.013	

*$^{+}p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. [a]Bias-corrected 95%CIs were calculated using a bootstrap test with 5000 subsamples. WM, waste management behavior; SN, subjective norms; ATT, attitudes; PBC, perceived behavioral control; PN, personal norms; EC, environmental concern; KNOW, environmental knowledge.*

Personal Norms as Predictor of Waste Management Behavior

Personal norms positively and significantly predicted waste management behavior (β = 0.16, $p = 0.004$). Adding this variable in the original model could increase the explanatory power from 24.8 to 27.8%. The bootstrap test showed that its effect remained significant (β = 0.13, $p = 0.018$) after environmental knowledge was added into the model. Thus, hypothesis H2a was supported. This research also examined the relationships of personal norms with environmental concern and subjective norms. The results show that both environmental concern (β = 0.20, $p = 0.000$) and subjective norms (β = 0.49, $p = 0.000$) positively and significantly influenced personal norms in the complete model. The bootstrap test showed the effects of these two variables on personal norms were significant. So, hypotheses H2b and H2c were supported.

Environmental Knowledge as Predictor of Waste Management Behavior

As expected, environmental knowledge positively and significantly predicted waste management behavior (β = 0.22, $p = 0.000$). The bootstrap test showed its effect was significant. Thus, hypothesis H3a was accepted. In addition, this variable also significantly influenced perceived behavioral control (β = 0.25, $p = 0.000$), environmental concern (β = 0.20, $p = 0.000$), personal norms (β = 0.11, $p = 0.010$), and attitudes (β = 0.24, $p = 0.000$). The results of the bootstrap test showed similar results. Thus, hypotheses H3b, H3c, H3d, and H3e were supported. Moreover, the bootstrap test also indicated that the indirect effect for the path from environmental knowledge through perceived behavioral control to waste management behavior (i.e., KNOW → PBC → WM) was significant (**Table 4**). The indirect effects for the paths of KNOW → PN → WM and KNOW → EC → PN →

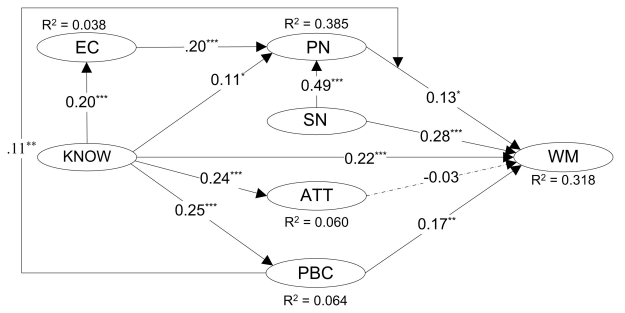

FIGURE 2 | Standardized estimates for the paths in SEM model. Insignificant effects are illustrated in dashed line. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. WM, waste management behavior; SN, subjective norms; ATT, attitudes; PBC, perceived behavioral control; PN, personal norms; EC, environmental concern; KNOW, environmental knowledge.

WM appeared to be significant though very weak at a significant level of 0.1, too. The three paths jointly accounted for 20% of the total effect of personal norms on waste management behavior.

Perceived Behavioral Control as a Moderator

Finally, this study examined the role of perceived behavioral control as a moderator influencing the relationship between personal norms and waste management behavior. It was found that the interaction term of PN × PBC had a positive and significant effect on waste management behavior ($\beta = 0.11$, $p = 0.003$). In particular, the result of the slope analysis illustrates that personal norms are important to individuals who have a relatively high level of perceived behavioral control. The significance of the effect was confirmed by the result of the bootstrap test. Thus, hypothesis H4 was supported.

DISCUSSION

This study integrated personal norms, environmental concern, and environmental knowledge in the TPB model and applied this model to understand waste management behavior among university students in China. The results showed that subjective norms, perceived behavioral control, personal norms, and environmental knowledge significantly predicted waste management behavior. Attitudes had no significant effect on waste management behavior. Environmental concern influenced waste management behavior through personal norms. The effect of subjective norms on waste management behavior were partially mediated by personal norms. Environmental knowledge could also influence waste management behavior indirectly through environmental concern, personal norms, and perceived behavioral control. Moreover, perceived behavioral control moderated the relationship between personal norms and waste management behavior. The results suggested that waste management behavior of university students in China could be viewed as context-dependent and morally driven practice. The results also added new evidence to support the importance of personal norms and environmental knowledge in shaping waste management behavior.

To begin with, it is interesting that among the three TPB variables, attitudes had no significant effect on waste management behavior, even when only the three TPB variables were taken into consideration. This finding differs from that in Tang et al. (2011), in which a significant effect of attitude was reported on household recycling behavior in rural China, but was consistent with Wan et al. (2017), who applied the TPB in understanding the public's intention of recycling in Hong Kong, China. In comparison with Tang et al. (2011), the insignificant effect of attitudes on waste management behavior in both the present and Wan et al. (2017) studies might be partly attributed to a ceiling effect in measuring attitudes given the specific institutional contexts of waste management in these studies. Unlike Tang et al. (2011), who reported recycling had not yet been put forth by the local government upon the time their study was carried out, waste reduction and recycling had been formally emphasized and subsidized for both the present and Wan et al. (2017) studies. This means that the samples in these two studies were situated in a much more favorable context for waste reduction and recycling, hence they would have more positive attitudes toward such practices. Actually, the samples in the present study reported consistently high scores (i.e., 4.24–4.65) across all of the four attitude items, indicating that they, in general, regarded waste management behavior as a pleasant practice and believed that the participation in waste management could bring personal benefits. There is no direct evidence to show the sample in Wan et al. (2017) work had uniformly high levels of attitudes toward recycling. However, an earlier study on recycling (Chan, 1998) as well as a recent study on environmental concern in Hong Kong (Cheung et al., 2015) suggest that the residents in this area would have positive attitudes toward recycling. Jointly, the inconsistent results in association with the relationship between attitudes and waste management may suggest that the role of attitude on pro-environmental behavior might be vulnerable to the specific context or population involved in different studies.

It should also be noted that although the effect of attitude in Tang et al. (2011) study was significant, its effect was weaker than those of subjective norm and self-efficacy. Hence, the finding concerning the superior role of subjective norms in predicting waste management behavior in comparison with attitudes in the present study collaborates those in previous studies in supporting a cultural explanation of social behaviors. That is, subjective norms play a more important role than attitudes do in personal decision-making in collectivistic cultures than in individualistic cultures (Tang et al., 2011; Morren and Grinstein, 2021). It would be especially the case given the fact that the majority of university students in mainland China live a dormitory life on campus. As both subjective norms and perceived behavioral control are subjective to external circumstances in a more direct way than attitudes, the findings imply that waste management behavior would be understood as context-dependent pro-environmental practice for university students.

Secondly, personal norms represent an altruistic perspective to understand pro-environmental behavior. Previous studies have

added this variable in the TPB in predicting both intention to recycle (Botetzagias et al., 2015; Wan et al., 2017) and recycling behavior (Tang et al., 2011; Onel and Mukherjee, 2017). In accordance with the findings of these studies, a significant effect of personal norms was found on waste management behavior of university students in this study. This suggests that moral concern would be an essential factor driving waste management behavior in general. Moreover, the finding concerning the effect of personal norms on waste management behavior in comparison with those of subjective norms and perceived behavioral control is similar to that reported by Tang et al. (2011), who took the adult population in rural China as the case. Drawing on these findings, it could be inferred that the role of personal norms in predicting waste management behavior within the TPB may be robust to individual differences in age and educational level in the Chinese context.

In addition, the present study found that subjective norms, environmental concern, and environmental knowledge significantly predicted personal norms. This means that if people perceive more intensive social pressure to waste management, hold stronger beliefs in limits of growth and eco-crises, and are more knowledgeable of both environment issues and action strategies to perform waste management practices, they would be more likely to develop a sense of moral obligation to engage in waste management behavior. Comparatively, subjective norms had the strongest effect on personal norms among the three variables. As subjective norms capture expectations from important others such as parents, teachers/tutors, peers who usually play important roles in socialization, informal environmental virtue/moral education during the course of socialization process would have profound influence on the development of pro-environmental norms among Chinese university students. Further studies are needed to examine the relationships of these variables with personal norms in a wider range of university student populations as well as other adult populations in mainland China.

The present study also contributed to the body of environmental literacy literature by probing the role of environmental knowledge in predicting waste management behavior within the expanded TPB model. Consistent with previous studies on environmental knowledge (Seacat and Northrup, 2010; Tang et al., 2011; Izagirre-Olaizola et al., 2015), the present study found that environmental knowledge significantly predicted waste management behavior over and beyond the TPB variables and personal norms. Moreover, the findings revealed that besides direct effect, environmental knowledge also influenced waste management behavior indirectly through the paths of KNOW → EC → PN → WM, KNOW → PN → WM, and KNOW → PBC → WM. Thus, we argue for a theoretical position of environment knowledge as critical antecedents of attitudinal variables within a social-psychological framework of waste management behavior. Noting that the indirect effect accounted only for 20% of the total effect, it is also strongly recommended that future studies examine other psychological mechanisms linking environmental knowledge and waste management behavior.

More importantly, the present study made a novel contribution to test the moderating effect of perceived behavioral control on the relationship between personal norms and waste management behavior. As expected, the results revealed that perceived behavioral control positively moderated the effect of personal norms on waste management. This means that in an inconvenience context in which personal norms play a critical role in driving waste management (Guagnano et al., 1995; Hage et al., 2009; Moore and Boldero, 2017), the stronger one believes he or she has the ability to overcome external barriers, the more likely his or her moral obligation would be translated into waste management behavior.

The present study also had some limitations. First, as this study used university students from China as a case, the findings may not be generalized to general populations (e.g., the residents) or populations in individualistic cultures. University students represent a specific young adult population with similar age and experiences in environmental learning. Hence, they may gain a better understanding of the environmental system and hold stronger environmental attitudes (Dunlap et al., 2000; Schwartz, 2009) in comparison with general populations. This may in turn, lead to different contours concerning the relationships of environmental knowledge and attitudes with waste management behavior between the two populations. Scholars also found that attitudes appeared to be more important in determining pro-environmental behaviors in individualistic cultures than it did in collectivistic cultures (Morren and Grinstein, 2016). Therefore, future research is recommended to examine the expanded TPB model in predicting waste management behavior from a comparative perspective, for example, comparing populations from different cultural settings, or comparing university students with residents within the same cultural setting. Second, because of the cross-sectional research design, this study could not examine the causal relationships between the variables in the model. It is recommended that future research use longitudinal or mixed research design to better identify how the changes in the variables would lead to waste management behavior. Third, noted that environmental knowledge was measured in an indirect way, the validity of the results in the present study might be influenced by the response bias. Future studies are encouraged to develop direct measures of knowledge in their investigations. It is also recommended that future studies involve both direct and indirect measures of knowledge to evaluate how different kinds of measures may influence the relationships between environmental knowledge and waste management behavior. Last but not the least, this study examined students' waste management behavior through self-reported surveys. People are often biased when reporting on their own experiences as they are either consciously or unconsciously influenced by social desirability. Although some strategies (such as the anonymity and voluntariness of the online survey) were used to reduce the influence of social desirability, the social desirability bias could not be eradicated. In this regard, future studies on waste management behaviors are suggested to measure participants' actual behavior using observation. For instance, Geng et al. (2015) employed

a situational simulation experiment to measure participants' spontaneous pro-environmental behavior by observing if they would use plastic bags to pack gifts when they completed the questionnaire. If the participant did not choose to use plastic bags, it was considered as environmentally friendly behavior. We suggest that future research use similar techniques as a supplementary instrument to support the interpretation of self-reported measures.

CONCLUSION AND IMPLICATIONS

The present study responded to a call for increased focus on waste management behavior of young adults by examining an expanded model of the TPB among university student populations in China. The findings suggest that the expanded TPB, with personal norms as the moral basis and environmental knowledge as the cognitive basis, would be a promising framework to understand waste management behavior of university students in China.

Drawing on the findings of this study, several practical implications are proposed. First, since subjective norms appear to be the most influential factor in determining waste management behavior of university student population, campus or social campaigns that target at university students should take the influence of their social networks (such as cohorts, friends, or interest groups) into consideration. This means that waste management initiatives should be promoted not only at the individual level, but also at the collective level through these social networks (especially the intimate network composed of important others) (White and Simpson, 2013). For example, campus recycling programs can encourage students or recruit youth leaders to share their recycling stories or tips or sustainable lifestyle through social networking or media platforms (e.g., WeChat, Twitter, TikTok, or Instagram). Such events can also be promoted offline in the form of workshops so that normative information can be disseminated among cohorts. In addition, programs with the purpose of inspiring information/knowledge sharing via social networks are suggested to be promoted from early stages of life when students start their school life at the primary level. Second, interventions should target students' behavioral control over waste management practice so that they can gain confidence in their ability to overcome external barriers, and hence take actions. For instance, recycling propaganda or educational programs can use virtual reality technology to mimic local recycling scenarios in which students can gain recycling skills by "doing." Since the higher level of environmental knowledge one has, the more likely he or she will perceive control over waste management behavior, information campaigns could be promoted to provide tips of performing waste management on campus in daily life or information concerning local waste management programs. Third, noted that environmental knowledge also offers an essential cognitive basis for developing moral motives for waste management behavior, educational program should highlight both environmental- and action-oriented knowledge to help university students gain thorough understanding of waste management from a critical and systematic perspective. For example, educational initiatives on recycling should not only provide information concerning procedures of recycling, but also help students gain system knowledge such as lifecycle of products from raw materials to waste treatment as well as environmental and social impacts involved in this process. Environmental courses can encourage students to participate in community recycling projects by using service-learning approaches so that they can gain a deeper understanding of interactions between ecological and sociopolitical systems (Hollweg et al., 2011).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee of Nantong University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

LW: research design, data collection and analysis, writing–theoretical framework, materials and methods, results, and discussion of original draft. YZ: questionnaire design and writing–introduction and discussion of original draft. JZ: writing–conclusion and implications of original draft, review, and editing. All authors contributed to the article and approved the submitted version.

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Can Housing Assets Affect the Chinese Residents' Willingness to Pay for Green Housing?

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As the development trend of the future housing field, green housing is an effective way to reduce pollution, save energy, and promote industrial upgrading. At the same time, the green house is of great significance to change the development mode of the construction industry and promote the sustainable development of the social economy. This study proposes a comprehensive research model to examine the influencing mechanism of residents' intention to purchase green buildings. The proposed model is empirically tested using data collected from 1,338 urban residents in China. Based on logit, probit, and ivprobit models, factors such as personal characteristics, housing price, and the number of real estate ownership are selected to conduct empirical analysis and mechanism analysis on willingness that affects consumers' purchase of green houses. The results show that housing assets significantly affect the willingness of householders to pay for green houses. The more houses they own, the higher their willingness to pay for a green house will be. Similarly, if the housing prices are higher, householders are more willing to buy a green house. The amount of housing assets will affect the willingness of householders to pay for green housing through the way of individual happiness. In terms of the characteristics of the householder, if the householder is more educated, unmarried, his willingness to buy a green house will be stronger, and owning housing assets may affect the individual happiness due to the housing wealth effect brought by rising housing prices. People with more housing assets are more likely to have the happiness brought by higher wealth, which may affect the purchase intention of householders.

Keywords: green housing, individual happiness, housing assets, ivprobit model, willingness to pay

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INTRODUCTION

The traditional construction industry is characterized by high energy consumption and low efficiency, and it is in urgent need of transformation and upgrading, so, green housing came into being (CABEE, 2017). As a new type of housing model, green housing emphasizes the importance of saving resources and protecting the environment, conforms to the concept of sustainable development, and is also a new trend in the development of the real estate and construction industry in the future (Darko and Chan, 2016). Green housing contains strong development potential and market opportunities in the Chinese real estate market. The development of green buildings is not

only a policy requirement of China but also a long-term plan based on the future life of the people across the nation.

However, green housing has the characteristics of low popularity and high prices compared with ordinary housing. People's concerns about the high purchase cost of green housing and the later investment income led to great uncertainty in consumers' purchase intention of green housing. However, the purchase intention of consumers is affected by many factors and finally failed to form a green housing consumption market.

Following the increased awareness of its benefits, standards that define green housing began to develop worldwide. Compared with other developed countries, the green building development in China lags behind that of developed countries (Jones and Laquidara-Carr, 2016). More than 95% of buildings in China are high-energy-consuming buildings, and their energy consumption is about three times that of other developed countries. In recent years, under the guidance of relevant national policies, the development of green buildings in China has accelerated (Li, 2016; Ma et al., 2017).

China is a newly emerged green building market (Data, 2016) with only 5% of Chinese enterprises implementing green building projects, accounting for more than 60% of the total construction projects. One major reason for low green building consumption in China is the low residents' demand intentions for green housing.

Especially from the year 2019, the housing sector has suffered numerous difficulties from the coronavirus disease 2019 (COVID-19) pandemic, including the field of green buildings, and this problem will last for a long time. During this special period, it has led to a great deal of uncertainty in many areas of residential life, and home became much more important for living even for working, thus, suitable environments must be enabled. That means COVID-19 is bound to cause new requirements for future housing which involves resource efficiency (Kaklauskas et al., 2021). Future green building assessment will likely focus more on its occupants than the building itself.

Therefore, it is necessary to explore consumers' purchase intention of green housing in China, analyze and determine which factors directly or indirectly affect the purchase intention, and get the deepest influencing factors. Therefore, it is urgent to explore consumers' willingness to buy green housing (Wang et al., 2015). This study will provide a helpful reference for government departments to formulate relevant policies and effective measurements to improve housing comfort, safety, and health; stimulate the green housing market; and achieve sustainable development of the Chinese real estate economy.

On the basis of research, this study further explores how to promote the popularity of green housing in the Chinese real estate market and increase people's awareness of green constructions.

LITERATURE REVIEW

This study conducts empirical research on green housing consumers from a micro perspective. After obtaining a large amount of real and accurate data through field research, we scientifically analyze the purchase intention of green housing consumers, and clarify how the purchase behavior of green housing arises and the influencing factors of purchase intention and the mechanism of multi-housing householders' willingness to pay for green housing. Therefore, this article adopts a micro-quantitative research method to conduct in-depth and systematic research, and analyze effects of the main factors especially housing assets on Chinese residentsŠ willingness to pay for green housing, which can be as a reference for the promotion of green housing.

Green Building Definition

In this article, the definition of green housing connotation refers to the definition of green building. The concept of green building originated from the word "ecological building," which was proposed by The American architect Paolo Soleri in the 1960s. In 1990, the world's first green building standard was released in the United Kingdom. Since then, green building has become the development direction of the industry, and various countries have launched their own green building evaluation standards, up to now, green housing has received increased attention over the past 20 years. In October 2000, the "International Conference on Sustainable Building 2000" was held in the Netherlands, which marked the comprehensive development of the international green building movement (Li et al., 2018). At the 20th UIA congress in Beijing in the year 1999, Architecture and Environment in the 21st Century were one of the important topics. The Beijing Charter published by UIA emphasized: "we must face the ecological dilemma to strengthen ecological awareness, at the same time, call upon architects all over the world to regard environmental and societal sustainable development as the core of their profession and responsibilities (Wu, 2000)."

The green building definition in China includes private and public green housing buildings (Assessment Standard for Green Building, 2016). Therefore, green housing is a subset of green buildings, with all the general characteristics of green buildings and some additional attributes (Li et al., 2018). Green housing emphasizes residence comfort, safety, and health in the context of livable space. It is an architectural concept to meet modern development requirements, but does not require a specific housing type, nor does it distinguish between regions. According to the Green Building Evaluation Standard of China, green housing can save resources (energy, land, water, and materials), protect the environment, and reduce pollution to the maximum extent, provide healthy, applicable, and efficient space for people, and harmoniously co-exist with nature within the whole life cycle of the building.

Since the COVID-19 pandemic arises, lockdowns in China have changed the way people and communities live, interact, and work, it also reminds us about the necessity to make the built environment resilient, including outdoor spaces, but especially indoor spaces, such as offices and entertainment facilities. Lockdowns tested the three main aspects of residential buildings, i.e., comfort, environment, and health and safety, which means new green housings should integrate wellbeing and hygiene (Kaklauskas et al., 2021).

Research on the Influencing Factors of Green Housing Purchase Intention

Regarding the research on the influencing factors of green housing purchase intention, the Eastern and Western scholars have done some research, covering a wide range of angles. The main influencing factors are analyzed in the following categories, and finally combined with the influencing factors of residential purchase intention and green product purchase intention, it is combined to identify the research factors of green housing purchase behaviors.

Socio-Demographic Characteristics

The basic inquiry in examining the factors that affect the purchasing intention of the consumer is the relationship between socio-demographic factors and consumption. According to Jayantha and Ming (2016), the demographic background of the housing buyers, including income level, age, and marital status could influence the decision on property purchase. Zhang and Cai (2015) believed that the characteristics of residents have a significant impact on the purchase of green housing. It is found that the annual income level of the family determines the affordability of the buyers, which has a direct impact on the purchase intention when the price of a green house is higher than that of an ordinary house (Zhao and Chen, 2020). Besides, women may be more likely than men to be actively involved in improving the green environment (Belaid and Garcia, 2016). Furthermore, research reveals that the improvement in education has positive effects on low-carbon consumption behavior (Ding et al., 2017). Attaran and Celik (2015) investigated the environmental responsibility of students and their willingness to pay for studying and living in green buildings at New England University and found that female students are more environmentally responsible than male students.

Psychological Factors

According to Ding et al. (2018), the psychological factors include environmental value, personal norm, sense of responsibility, attitude, perceived behavioral control, subjective norms, intention, habits, and so on. The literature on green housing consumption emphasizes the influences of green attitudes, perceptions, and economic benefits on a consumer's tendency to prefer green products that are on green purchase behavior (Rosner et al., 2021). Li et al. (2019) confirmed that the framing effect can influence the willingness of residents to pay for green housing through the resident environmental values. Egoistic and ecological values showed partial mediation between perceived benefits and willingness to pay for both framing contexts. Zhao and Chen (2021) found that perceived value is a crucial predictor of green housing purchase intention. Huang (2014) used the structural equation model to systematically study the willingness of consumers to pay for green housing, and through questionnaire surveys, it was found that factors such as consumer economy, social status, consumer expectations, consumer perception, external stimuli, and other factors have significant impacts on willingness to pay. Wang et al. (2015) analyzed the supply-demand relationship of China's energy-saving building market and pointed out that factors, such as energy-saving building prices, preferences, future forecasts, energy-saving awareness of consumers, investment payback period, and corporate marketing and publicity have significant effects on the market demand for energy-saving buildings. Besides, personal norms are indirectly (through New Ecological Paradigm, in turn, awareness of consequences and ascription of responsibility) influenced by values, and they significantly have a direct effect on the green consumption behavior of residents (Fornara et al., 2016).

Economic and Political Factors

Policies are one of the most important external factors that affect the green consumption behavior of residents, and the policy instruments include information policy, economic policy, technology policy, and administrative regulation (Lindén et al., 2006).

Information policy mainly means information feedback. The economic policy mainly refers to "tax and subsidy" and "price." The technical policy mainly affects the maturity of technology, and administrative regulations refer to mandatory policies that have a direct effect on residents' green consumption behavior (Ding et al., 2018). Economic policy, as an external incentive, has a positive effect on environmental-friendly behavior and energy-saving behavior (Belaid and Garcia, 2016). Wang et al. (2015) studied the green housing market from a demand-side perspective and pointed out that consumers do not have a sufficient understanding of incremental costs, incremental benefits, and indirect incremental benefits, resulting in low purchase enthusiasm. The article analyzed the composition of green building incremental costs and established a green building market and finally suggested that government incentive subsidies should be considered to make indirect benefits explicit. Yang and Li (2014) studied the demand for the willingness of consumers to pay for green buildings and established a classification index of consumer demand factors for green buildings, starting from the three aspects of resource utilization, indoor environment, and community environment. Finally, they proposed that green building related knowledge affects the willingness of consumers to buy green housing. Zhang (2011) studied the willingness of consumers to pay for green buildings and analyzed factors, such as product feature stimulus, social stimulus, green advertising, and green certification, and found that the above factors have different effects on the willingness of consumers to pay and payment level. Robinson et al. (2016) analyzed the demand for green office building features among office tenants in the United States and determined that public firms and firms in the energy and information technology industries are most likely to pay for green-labeled buildings. Construction practitioners with a potential green housing purchasing intention are characteristic of informed consumers. Government economic incentives for green housing and the formulation of laws and regulations, evaluation standard, and release related to the concept of science popularization and propaganda can increase the perceived benefits of the green house, reduce the green housing's perception of the cost, increase the trust and purchasing power of the consumer, and real estate enterprises in the promotion. The popularization of green housing related concept

TABLE 1 | Variable definition.

Variables	Definition
willingness	Will to pay for green housings takes 1, and not will to pay takes 0
housenumber	Number of housing assets owned by the householder
lnhouseprice	The market price of the house
gender	Male takes 1, female takes 0
education	College level and above is 1, otherwise is 0
marriage	Married or remarried take 1, otherwise take 0
size	Family population
lnincome	Total income in a family
rural	1 for living in rural areas, 0 for urban areas

knowledge by the government can enhance the attention of residents to green housing and promote the formation of the green consumption concept of consumers in housing purchases (Zhao and Chen, 2020).

From the research results of the above scholars, it can be seen that in the research on the maturity of the green housing market, the main factors that affect purchase intentions of consumers are the speed and level of economic development, demographic characteristics, consumer product awareness, sales prices, environmental protection knowledge, social ethics, publicity, economic ability, and green housing product performance.

The Impact of Housing Assets on Residential Consumption (Housing Wealth Effect)

This article aimed to investigate the key factors affecting the willingness of Chinese residents to pay for green housing for the following two reasons. First, basic sociodemographic characteristics, such as age, gender, occupation, income, and educational level are the influential factors identified from the above research. Second, to evaluate the willingness to pay for green housing by different socioeconomic groups in China and to reveal that rich and multi-housing householders prefer to pay more to improve their living comfort.

According to China Family Panel Studies (CFPS) survey, the impacts on urban Chinese consumers' spending associated with housing value, financial assets, and household income are evaluated. Findings suggest that the housing assets play a significant effect on household consumption in China, which is much larger in comparison with developed countries. Scholars reveal that larger impact is related to structural limits on investing in all probability which favors real estate ownership, as well as the dominant position of housing in household wealth (Chen et al., 2021). Besides, Chinese residents who have joint ownership of housing property on average have the highest consumption propensity, while those having sole ownership of housing property consume the most in response to the appreciation in housing wealth (Chen et al., 2020).

Case et al. (2005) analyzed the macro panel data of 14 Western countries and the United States and found that changes in total housing wealth have a significant impact on total consumption, and its impact is much greater than that of financial wealth. A 10% increase in housing wealth will increase household consumption by 1 and 0.4% in Western countries and the United States, respectively. Carroll et al. (2017) distinguished between immediate and final wealth effects. When housing wealth increases, the recent marginal propensity to consume in 3 months is about 2%, and the propensity to spend additional wealth in a few years is about 9%. Overall, the literature supports the active housing wealth effect.

The housing wealth effect varies from family to family. Liao et al. (2014) pointed out that higher house prices mean higher hidden rents, which hinders the housing wealth effect of homeowners who use houses as housing. Their views on the housing wealth effect have several implications. The wealth effect of households with multiple houses should be stronger. This effect should be greater among homeowners with a shorter life expectancy and a weaker inheritance motivation. For owners who want to reduce the size of their families and plan to reduce the size of their houses, the impact will also be greater. In addition, the housing wealth effect may depend on preventive savings motives. Consumption growth may be positively correlated with the predictable part of housing price growth because higher home values reduce the need for precautionary savings (Hu et al., 2014, 2020; Carroll et al., 2017). Finally, Buiter (2008) pointed out that the appreciation of housing prices redistributes wealth from short-term housing families to long-term housing families. Therefore, tenants and owners may experience different housing wealth effects, and these effects may be offset overall.

If there is a wealth effect in the real estate market, what factor will affect it? Whether to own the ownership of the house and the number of houses held is an important factor affecting the wealth effect of the housing market. Buiter (2008) believes that the increase in housing prices will cause the redistribution of wealth from house renters to owners. That is, the wealth effect of house owners is greater than that of house renters. Sinai and Souleles (2005) pointed out that high house prices mean higher implied rents, which in turn results in a smaller wealth effect for single-house holders, while households with multiple houses have a larger wealth effect. Finally, higher the market value of the real estate will weaken the demand for precautionary savings, which will bring about an increase in consumption. That is the wealth effect of real estate and the reverse change of the precautionary savings motives of an individual (Peng et al., 2019). In fact, according to Pratt and Zeckhauser (1987), investors with different risk aversion coefficients will have different expected marginal utility from the same consumption combination. That is, the consumption decision of the family is closely related to the risk aversion coefficient. On the other hand, the real estate market is extremely risky. Therefore, the risk attitude of investors and the wealth effect of real estate must have a certain influence on the relationship.

Through combing the existing literature, there is no research that analyzes the relationship between the purchase intention of green housing and the wealth effect of housing assets from a family perspective. This article will investigate the willingness to pay of multi-housing householders for green housing using a large amount of questionnaire data, which can enrich the scope of sociodemographic characteristic groups in related literature. Additionally, it can offer valuable strategic recommendations

TABLE 2 | Descriptive statistics.

Variable	Obs	Mean	SD	Min	Max
willingness	1338	0.411357	0.49209	0	1
housenumber	1338	1.269564	0.590762	0	27
houseprice	1338	743721.7	1241674	2000	7.00E+06
gender	1338	0.500574	0.500003	0	1
education	1338	0.206829	0.405034	0	1
marriage	1338	0.022728	0.149035	0	1
size	1338	3.586014	1.52072	1	13
income	1338	90049.09	109884.3	−3460	695165
rural	1338	0.346083	0.475723	0	1

TABLE 3 | Empirical results.

	Variables	OLS	Logit	Probit
willingness	housenumber	0.0451***	0.189***	0.117***
		−7.548	−7.31	−7.349
	lnhouseprice	0.0110***	0.0505***	0.0306***
		−4.99	−5.074	−5.068
	gender	−0.005	−0.0221	−0.0134
		(−0.757)	(−0.763)	(−0.755)
	education	0.135***	0.561***	0.350***
		−17.38	−16.9	−16.94
	marriage	−0.0552***	−0.262***	−0.158***
		(−3.588)	(−3.670)	(−3.682)
	size	0.0189***	0.0836***	0.0522***
		−8.556	−8.638	−8.765
	lnincome	0.00296	0.0129	0.00822
		−1.314	−1.308	−1.351
	rural	−0.0536***	−0.244***	−0.148***
		(−5.840)	(−5.913)	(−5.901)
		−1.691	(−10.99)	(−11.12)
	Constant	0.0651*	−1.895***	−1.171***
	Observations	1338	1338	1338

*z-Statistics are in parentheses,***, **, and * indicate the significance levels of 1, 5, and 10%, respectively.*

for the government after the general consumers have gained sufficient knowledge about green housing. Therefore, the current study cannot only provide a theoretical basis for the guiding policies and operational strategies of the development of the green housing market but also provide an effective measure for the government to adjust the regulation and economic incentive policies related to upscaling the next step of green building promotion. So, the contributions of this study are idea innovation and data innovation.

DATA SOURCES AND RESEARCH METHODS

What are the deep reasons and the influencing paths of Chinese residents' willingness to pay for green housing? This is the key question to promote green housing purchase behavior, and it is worth further study. Based on this, this article analyzes the relationship between housing wealth effects and green housing purchase intention, then explores the mechanism of multi-housing householders' willingness to pay for green housing.

The survey sample covers 29 provinces (autonomous regions and municipalities), 1,338 households. The survey was conducted in 2019.

We take the willingness to pay for green housings of the respondents as an explained variable. According to the question in the survey, "Are you willing to pay for green housings?" the answers of "yes, I am willing to pay" are assigned a value of 1, answers of "no, I am not willing to pay" are assigned a value of 0.

The core explanatory variable is the number of house assets owned by the respondents (house number). In addition, the house price is one of the main variables discussed in this article. We choose the question "What is the market price of the house where your family currently lives" from the questionnaire as the data of house price (lnhouseprice).

In addition, considering other factors that may affect the willingness to pay for green housings of the respondents, we add a series of control variables in the empirical model based on previous literature, including demographic characteristics, household assets and income, and regional and urban characteristics. Demographic variables include gender (gender), education level (education), marriage (marriage), and family population (size). In the survey, the level of education is divided into nine categories. In this article, the value of vocational college and above is set as 1, otherwise, it is set as 0. In the category of household assets and income, total household income (lnincome) includes wage income, agricultural operating income, industrial and commercial operating income, transfer income, and investment income.

As for the regional characteristics, the urban households (rural) are assigned a value of "0," and the rural households are assigned a value of "1" (see **Table 1**).

MODEL AND EMPIRICAL RESULTS

Model Specification

Using the above data and variables, the logit and probit models are set to analyze the impact of housing on household risk attitudes. The basic model is as follows.

$$willines s_i = \alpha 1 housenumber_i + \alpha 2 houseprice_i + \beta X_i + \varepsilon_i$$

In the model, willingness$_i$ represents the willingness to pay for green houses of the respondents i, house number represents the number of owner-occupied housing assets, and house price represents the market price of the house. X_i is the respondents or family characteristics, and ε_i is the random error term.

Descriptive Statistics

It can be seen from **Table 2** that the education level of household heads is generally low. The average household size of the respondents was 3.58. The average gender is 0.5005, indicating that the proportion of male and female in the survey tends to be balanced. The average household income is ¥90,049.09.

TABLE 4 | The ivprobit regression results of the first stage.

housenumber	Coefficient	SE	*t*	*P* > *t*	[95% confidence interval]	
fjob	0.09708	0.012337	7.87	0.000	0.072897	0.121263
lnhouseprice	0.042732	0.003332	12.82	0.000	0.0362	0.049264
gender	0.005296	0.009882	0.54	0.592	−0.01407	0.024666
education	1.20E−01	1.14E−02	10.51	0.000	9.73E−02	1.42E−01
marriage	−0.0117	0.026218	−0.45	0.656	−0.06309	0.039694
size	0.024961	0.003627	6.88	0.000	0.017851	0.032072
lnincome	0.007849	0.003335	2.35	0.019	0.001313	0.014386
rural	−0.00855	0.013492	−0.63	0.526	−0.03499	0.017898
_cons	0.468691	0.05834	8.03	0.000	0.354336	0.583047
R-square	0.0447					

*The dependent variable is house number. z-Statistics are in parentheses, ***, **, and * indicate the significance levels of 1, 5, and 10%, respectively.*

TABLE 5 | Regression results of the second stage of ivprobit estimation.

	Coefficient	SE	*z*	*P* > *z*	[95% confidence interval]	
housenumber	1.513887	0.347892	4.35	0.000	0.832031	2.195743
lnhouseprice	−0.00781	0.018158	−0.43	0.667	−0.0434	0.027778
gender	−0.03528	0.027316	−1.29	0.197	−0.08882	0.018258
education	1.84E−01	5.42E−02	3.4	0.001	7.82E−02	0.290523
marriage	−0.03346	0.073127	−0.46	0.647	−0.17679	0.109867
size	−0.04816	0.013206	−3.65	0.000	−0.07404	−0.02228
lnincome	−0.00407	0.009633	−0.42	0.673	−0.02294	0.014815
rural	−0.11323	0.037908	−2.99	0.003	−0.18753	−0.03893
_cons	−1.8436	0.228448	−8.07	0.000	−2.29135	−1.39586
Wald test of exogeneity	$\chi^2(1) = 22.53$	$P = 0.0000$				

*The dependent variable is willingness. z-Statistics are in parentheses, ***, **, and * indicate the significance levels of 1, 5, and 10%, respectively.*

TABLE 6 | Ivprobit test.

	Test	Statistic	*P*-value
Unrecognizable test	Kleibergen-Paap rk LM	47.322	0.0000
Weak tool identification test	CLR	6.99	0.0089
	K	5.75	0.0165
	J	9.46	0.0021
	K-J	n.a.	0.0105
	AR	15.21	0.0005
	Wald	8.72	0.0031

Empirical Results

Table 3 reports the impact of house numbers and housing prices on the wiliness to pay for green houses of householders after using OLS, logit, and probit models. It can be found that after controlling other factors, if a family owns more housing assets, then the respondents will have a higher willingness to pay for green houses. Similarly, and if the housing price is higher, the respondents are more willing to take pay for green houses.

In addition, in the aspect of the characteristics of the household head, if the respondent has a higher education level, then he will have a stronger willingness to buy green houses. The married respondents prefer to buy green housing compared with those who are not married. In addition, compared with urban areas, households in rural areas are more inclined to buy green houses.

Endogenous Solving

Considering that the above estimation results may be biased due to factors, such as reverse causality and missing variables, in this section, we will use the method of instrumental variables to overcome possible endogenous problems. We choose the fathers' job position (fjob) as instrumental variables for the housing number variable. In the survey, the highest positions of parents' jobs are divided into 10 categories. (1) Ordinary employees; (2) Leader in charge of a department; (3) Leader in charge of a unit; (4) (Deputy) Team Leader; (5) (Deputy) Section Director; (6) (Deputy) Director; (7) (Deputy) Director and above; (8) Village cadres; (9) Township cadres; (10) Farmers; (11) No job; (12) Others. We will take the answer of (1), (10), (11), and (12) (no job titles) as 0, and others are taken as 1. On the one hand, the job position of fathers is closely related to the number of housing properties of the respondents. If the father has a higher position, then their children can get more resources and have a higher probability to own more numbers of housing properties. On the other hand, the job positions of fathers do not link to the willingness to pay for green houses of their child, so we believe that these two

TABLE 7 | Mechanism analyzing results.

	Variables	OLS	Logit	Probit
willingness	housenumber	0.0132	0.0522	0.032
		−0.974	−0.907	−0.899
	hh	0.00670**	0.0286**	0.0178**
		−2.165	−2.169	−2.179
	lnhouseprice	0.0143***	0.0636***	0.0384***
		−5.841	−5.879	−5.86
	gender	0.0008	0.00316	0.00183
		−0.111	−0.102	−0.0958
	education	0.127***	0.518***	0.324***
		−15.19	−14.79	−14.83
	marriage	−0.0677**	−0.315**	−0.189**
		(−2.454)	(−2.500)	(−2.500)
	size	0.00780***	0.0342***	0.0217***
		−3.157	−3.225	−3.309
	lnincome	0.00199	0.00842	0.00523
		−0.803	−0.795	−0.798
	rural	−0.0648***	−0.288***	−0.176***
		(−6.493)	(−6.551)	(−6.570)
		−2.382	(−9.173)	(−9.213)
	Constant	0.102**	−1.712***	−1.052***
	R-squared	0.033		

*z-Statistics are in parentheses, ***, **, and * indicate the significance levels of 1, 5, and 10%, respectively.*

TABLE 8 | Robustness test.

	Variables	OLS	Logit	Probit
willingness	housenumber	0.0419***	0.175***	0.108***
		−6.793	−6.652	−6.689
	lnhouseprice2	0.0429***	0.182***	0.112***
		−5.246	−5.221	−5.201
	gender	0.00172	0.00713	0.00423
		−0.248	−0.239	−0.23
	education	0.132***	0.543***	0.339***
		−16.56	−16.21	−16.22
	marriage	−0.0741***	−0.347***	−0.208***
		(−2.840)	(−2.881)	(−2.892)
	size	0.00962***	0.0419***	0.0264***
		−4.108	−4.161	−4.235
	lnincome	0.000929	0.00406	0.00244
		−0.389	−0.396	−0.385
	rural	−0.0855***	−0.381***	−0.232***
		(−9.699)	(−9.746)	(−9.763)
		(−1.372)	(−7.372)	(−7.370)
	Constant	−0.113	−2.581***	−1.599***
	R-squared	0.033		

*z-Statistics are in parentheses, ***, **, and * indicate the significance levels of 1, 5, and 10%, respectively.*

instrumental variables are not related to the willingness of the respondents.

From **Table 4**, we can see that the job position of the father has a significant positive effect on the number of houses owned by the respondents.

Table 5 reports the regression results of the second stage of ivprobit estimation (initial instrumental variable test). From **Table 5**, we can see the Wald test result of the exogenous null hypothesis "H0:ρ = 0," the *P*-value is 0.0000, so house number can be considered as an endogenous explanatory variable at the 1% level. According to the estimation results in **Table 3**, the coefficient of the house number variable is 0.117, which is significant at the 1% level; but the ivprobit estimation result in **Table 5** shows that the coefficient of the house number variable is 1.51, which is also significant at the 1% level. The above results show that if the general probit model is used for estimation, the endogenousness of house number will be ignored, which will underestimate the influence of the number of houses on risk attitudes.

As can be seen from **Table 6** the model setting passed a series of tests. First, regarding the unrecognizable test, the *P*-values of Kleibergen-Paap rk LM statistic is 0.000, rejecting the null hypothesis, indicating that there is a correlation between instrumental variables and endogenous variables. Second, regarding the test of weak instrumental variables, the *P*-values of CLR, KJ, AR, and Wald are all significant at the 1% level, so the null hypothesis "H0: Endogenous variables and instrumental variables are not correlated" should be rejected, and alternative hypotheses "H1: Endogenous variables are related to instrumental variables" should not be rejected. This also shows that the instrumental variables selected in this article are not weak instrumental variables.

MECHANISM ANALYSIS

The above analysis finds that housing assets have indeed significantly affected the willingness of household heads to pay for green house. The greater the number of housing properties owned, the higher the willingness to pay for the green house of the respondents. Next, we will further verify whether the number of housing assets will affect the willingness of respondents to pay for the green house by the way of individual happiness.

From the perspective of the characteristics of the respondents, owning housing assets may affect the happiness of an individual, which in turn affects the willingness of the head to pay for a green house. Due to the housing wealth effect brought about by rising housing prices, people with more housing assets are more likely to have higher happiness brought by wealth, which may cause an influence on the purchase intention of respondents.

In the survey, there is a question that "in general, do you feel happy now?" We set the answer "very unhappy" is 1, "unhappy" is 2, "generally" is 3, "happy" is 4, and "very happy" is 5.

The above empirical results show that after adding the interaction term (hh) of the number of houses (house number) multiplied by happiness (happiness), the number of houses does not significantly affect the willingness of the respondents, but its interaction term significantly positively affects the willingness. That is one of the channels through which housing assets affect the willingness of householders is their happiness (see **Table 7**).

ROBUSTNESS TEST

This part conducts the robustness test by replacing the market house price with the average house price at the provincial level. It turns out that the number of housing assets still affect the willingness to pay for the green house of the respondents (see **Table 8**).

CONCLUSION AND POLICY IMPLICATIONS

If a family has more housing assets, then the householder will have a higher willingness to buy a green house. Similarly, if the housing price is higher, householders are more willing to buy a green house.

In addition, in terms of the characteristics of the householder, the more educated the householder is, the stronger his willingness to buy a green house will be. Compared with unmarried people, married households are more likely to buy green houses. In addition, families in rural areas are more likely to buy green housings than those in urban areas.

Mechanism Analysis Conclusion

The above analysis found that housing assets did significantly affect the willingness of householders to pay for green house. The more houses they own, the higher their willingness to pay for a green house will be. Then, we further verified whether the number of housing assets will affect the willingness of householders to pay for green housing through the way of individual happiness.

From the characteristics of householders, owning housing assets may affect individual happiness and then affect willingness of householders to pay for green houses. Due to the housing wealth effect brought by rising housing prices, people with more housing assets are more likely to have the happiness brought by higher wealth, which may affect the purchase intention of householders.

The above empirical results show that when the "housenumber" is multiplied by "hh" of "happiness," the number of houses has no significant influence on the intention of householders, but the interaction has a significant positive influence on the intention. In other words, one of the channels through which housing assets affect the intentions of households is their happiness.

Countermeasures and Suggestions at the Government Level

China is currently in the initial stage of green housing development. Mandatory policies are important ways to promote the improvement of green housing performance and marketing (Li et al., 2019). As the main body to promote the development of green housing, the government should play the main guiding and promoting role, that is, formulate strategic countermeasures from the macro level to promote the green housing development in a positive and healthy direction, and at the same time put forward some basic policies from the micro level, to stimulate willingness of consumers to buy green houses, and the development of the market demand side (Dong, 2013).

In the conclusion of this study, the higher the income and the more housing assets, the stronger the willingness to pay for consumers. Since the price of green housing is generally higher than that of normal houses, consumers will inevitably be restricted by their own consumption power when purchasing, and high-income groups are more able to afford higher-priced green houses. Therefore, specific incentive measures should be formulated for consumers to buy green houses, and practical preferences should be given to consumers of middle-and-low-income groups, for example, tax incentives, housing purchase subsidies, and property management incentives (Huang, 2014), that means providing consumers with economic stimulus from many aspects, and use the leverage principle of the market economy to motivate consumers to buy green houses.

At the same time, the research in this article found that people with higher education levels are more likely to buy green buildings. Generally, people with higher education have a stronger awareness of energy conservation and environmental protection, and their high willingness to pay for green houses may be more out of their own sense of social responsibility. This is consistent with the research conclusions of Kahn (2002). Kahn pointed out that the proportion of urban residents who went to college is significantly positively correlated with the local support for government environmental protection policies, because people with higher education are more aware of the long-term harm of environmental problems, and thus they pay more attention to environmental protection. Therefore, the government should use advantageous media platforms to strengthen the publicity and promotion of green housing, so as to create a green atmosphere in the whole society, such as introducing environmental friendliness, low lifetime cost, healthy and comfortable living characteristics of green housing from a technical point of view, so as to enhance consumers' awareness of green houses, attract consumers' attention, and arouse consumers' expectation of buying green buildings. In short, it is to activate the demand side of the green housing market (Zhang et al., 2018).

In addition, we found that one of the channels through which the housing assets affect intentions of households is their happiness. Due to the continuous increase in Chinese housing prices in recent years, the wealth effect brought by housing assets has led to a sharp increase in the wealth of people who own more houses. In this way, the happiness index brought by wealth will also increase. Therefore, the government can introduce more policies to improve the happiness index of residents, including housing subsidies, affordable housing, and low-rent housing.

Countermeasures and Suggestions at the Developer Level

As an important part of the residential market, developers play an important role in the promotion and development of green houses. Developers should abide by the rules and regulations of the government, follow the development trend of the residential market, and actively promote the development of green housing.

First, developers should respond to the policy of government, actively develop green housing, fulfill the government's requirements for energy saving, water saving, and material saving for housing with high quality and quantity, seize the opportunity of the government to promote the development of green housing, and launch high-quality housing. Green residential real estate should seize the opportunity of green residential development, and expand their own influences (Li et al., 2019).

Second, the developer should cooperate with the government to actively create a green atmosphere for the whole society, vigorously promote environmental protection, and economic advantages of green housing. They can carry out special green housing real estate promotion activities, which can expand the brand influence of the developer, can improve its own visibility, and more importantly, can popularize the knowledge of green housing. Therefore, more consumers can understand green housing and the advantages of green housing, which will stimulate consumer expectations, strengthen consumer awareness, and increase consumer willingness to pay for green housing (Denni et al., 2018).

More importantly, many real estate brokers have noticed that modern buyers are becoming more and more selective, so before the implementation of advertising for green housing, the real estate company should not only consider individual differences of potential buyers, the desired features of the property, and how the location impacts on the property, but also pay more attention to the arousal and valence, affective behavior, emotional, and physiological states of possible buyers of green housing (AVABEPS) while they review the advertising. In other words, real estate advertising cannot ignore considering the physiological, emotional, and affective responses of clients, it is better to employ a neuro decision matrix, make multivariant planning performed on customized, video neuro-advertising green-housing variants, and multiple criteria analysis (Kaklauskas et al., 2020).

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

QW and ZZ: doing empirical analysis and writing the original draft together. WL: conceptualization and validation. All authors contributed to the article and approved the submitted version.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX

Appendix (part of the questionnaire).

1. What is your gender?

1. Male 2. Female

2. What is your birth year? _____
3. Which province are you from? _____
4. What is your educational level?

1. No schooling at all 2. Primary school 3. Junior high 4. High school
5. Technical high school 6. College/vocational school 7. Bachelor's degree
8. Master's degree 9. Doctorate degree

5. What is your marital status at present?

1. Unmarried 2. Married 3. Divorced 4. Remarried

6. Apart from yourself, how many family members live with you? _____
7. Are you living in rural or urban area?

1. Rural 2. Urban

8. What is the type of your working role?

1. An employee 2. An employer 3. An individual worker 4. A household worker

9. What was the highest position of your father?

1. Ordinary staff/worker 2. Division leader of the work unit, e.g., manager
3. Top leader of the work unit, e.g., general manager 4. (sub) Team Leader
5. (deputy) Section chief 6. (deputy) Director of a division
7. (deputy) Director-general of a bureau and above 8. Village cadre
9. Township cadre 10. Peasant
A. Others (please specify) B. He/she had no jobs before

10. What is the total income of your family last year? _____

Or Which range below is the total income of your family last year approximately?
1. Less than 10,000 2. 10,000–20,000 3. 20,000–50,000 4. 50,000–100,000
5. 100,000–200,000 6. 200,000–300,000 7. 300,000–500,000 8. 500,000–1,000,000
9. 1,000,000–2,000,000 10. 2,000,000–5,000,000 11. More than 5,000,000

11. How many houses do you own with rental houses excluded? (number of houses owned if you are the householder) _____
12. How much is this house worth currently (market price on real estate website)? (Unit: RMB) _____

Or Which range below is the market price of house approximately?
1. Below 10,000 2. 10,000–30,000 3. 30,000–50,000 4. 50,000–70,000 5. 70,000–100,000 6. 100,000–300,000 7. 300,000–500,000 8. 500,000–1,000,000 9. 1,000,000–5,000,000 10. 5,000,000–10,000,000 11. 10,000,000–15,000,000 12. 15,000,000–20,000,000 13. Above 20,000,000

13. Are you willing to pay for green housings? (China Green Building Evaluation Standard: land saving and outdoor environment, energy saving and energy utilization, water saving and water resource utilization, material saving and material resource utilization, indoor environmental quality, operation management, and construction management)

1. Yes 2. No

14. In general, do you feel happy now?

1. Very happy 2. Happy 3. Generally 4. Unhappy 5. Very unhappy

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Environmental Value and Pro-environmental Behavior Among Young Adults: The Mediating Role of Risk Perception and Moral Anger

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This study aims to identify the relationship between students' environmental value (EV) and pro-environmental behavior (PEB) within a values-belief-norm framework. To conduct an empirical study, we used a sample of 558 online surveys and adopted the partial least squares path modeling method to test the relationships between variables in the conceptual model. The results indicate that EV positively predicted PEB among young adults. In addition, we highlight that risk perception (RP) and moral anger (MA) play critical chain mediating roles in the relationship between EV and PEB. This study has meaningful implications for practitioners seeking to encourage the public's ecofriendly behavior by suggesting ways to encourage RP and stimulate individuals' moral emotions about the environment.

Keywords: environmental value, risk perception, moral anger, pro-environmental behavior, structural equation modeling, Chain mediating effect

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INTRODUCTION

Environmental issues are related to the sustainable development of human society. Environmental risk has ranked first on the World Risk List for 5 years in a row, just as the latest Global Risk Report, which was released by the World Economic Forum in 2021, pointed out that in the next decade, extreme weather, biodiversity loss, natural resource crises, and climate action failure will continue to dominate. Clearly, these environmental problems primarily stem from human activities (Dong et al., 2017), such as driving cars, energy use, diet, household waste and other behaviors. Such a severe ecological crisis has not only aroused widespread concern among the public but also prompted researchers to probe deeply into mechanisms of individual pro-environmental behavior (PEB) to provide practical strategies for improving the condition of the environment (Wang and Wu, 2015). College students are the main source of contemporary and future environmental protection and an important group for practicing environmental protection. Recent studies have found that young people are more concerned about the environment than older generations (Royne et al., 2011), and young people are considered to be the promoters of new environmental movements, such as green consumer activities (Bentley et al., 2004). Therefore, we examine Chinese college students' PEB to inspire their understanding of the importance of environmental protection and help them form stable values, stimulate their moral awareness and sense of social responsibility, and engage in more environmentally friendly behaviors.

Pro-environmental behavior refers to the behavior that individuals need to be conscious, voluntary, and active in avoiding harming the environment (Steg and Vlek, 2009; Liu and Wu, 2013). PEB covers many aspects of environmental protection and can be carried out through direct and indirect means to mitigate environmental damage; it promotes harmonious coexistence between humans and nature. Studies have confirmed that PEB is influenced by cognitive factors, including environmental value (EV; Mustonen et al., 2016), environmental identity (Clayton, 2012), environmental concern (Coelho et al., 2017), and awareness of consequences (Chen and Tung, 2014). Among these factors, an individual's EV is the most stable factor and is considered the most potent predictor of PEB (Han et al., 2018; Riper et al., 2020). The basic theory of values (Stern and Dietz, 1994) also holds that PEB is a form of prosocial behavior caused by internal values. It has been found that biospheric values (i.e., concern about the ecosystem's interests) can positively predict pro-environmental intention and behavior (Geiger and Keller, 2018). However, egoistic values (concern only for one's own interests) are negatively related to environmental protection behavior (Hurst et al., 2013). Individuals with low EV are indifferent to the ecosystem's interests, so they are less likely to consciously care about the environment or adopt behaviors that are beneficial to the environment.

Subsequent studies have uncovered that although values are essential to behavior, values do not necessarily directly translate into behavior, and there can be a gap between values and behavior (Yousefpour et al., 2019). For example, individuals can strongly cherish nature and the environment but not think of themselves as people who support environmental protection (Juvan and Dolnicar, 2014). According to the values-belief-norm theory, other factors affect PEB, such as beliefs (Ünal et al., 2018), personal norms (Antonetti and Maklan, 2014), perceptual control (Du et al., 2020) and other cognitive factors. The studies show that only individuals with high EV, certain environmental beliefs, moral norms, and behavioral and perceptual control can promote PEB. Therefore, other intermediary mechanisms may be involved in the relationship between EV and PEB, as mentioned in Ünal et al. (2018).

In early research on the relationship between EV and PEB, researchers paid considerable attention to the role of cognitive factors. However, in many situations, individuals do not act in a completely rational way. Individuals do not fully understand the relationship between their environmental decisions and environmental outcomes and may be influenced by morality or emotion (Onwezen, 2015).

A recent study (Yu and Tian, 2017) found that the role of emotional factors such as guilt (Adams et al., 2020), compassion (Geiger and Keller, 2018), and moral anger (MA) should not be ignored (Reese and Jacob, 2015). Some studies have confirmed that cognitive and emotional factors together play a role in EV and PEB (Lerner et al., 2015; Riper et al., 2020). There is evidence that individuals with high EV have a stronger sense of risk and are more likely to perceive the threat posed by the environment, which makes people aware of the consequences of their own harmfulness and motivates them to engage in more PEB (Schmitt et al., 2017, 2019). Zhang (2013) also found that individuals with higher EV perceive environmental risks significantly more than other people and pay more attention to environmental issues, making them less likely to take risks in environmental decision-making. Therefore, we believe that risk perception (RP) plays a mediating role in the relationship between EV and PEB. In addition, moral emotion also has an influence on PEB (Onwezen et al., 2013; Han et al., 2018). Some studies have shown that in the face of environmental damage, individuals' strong belief in environmental justice will stimulate greater MA and a sense of responsibility and will prompt more pro-environmental intentions (Reese and Jacob, 2015). Atran and Ginges (2012) believed that when some protective values are threatened, an individual will produce a series of negative emotions (such as anger and disgust) to fight (Sheikh et al., 2012) and then trigger the corresponding behavioral response. Therefore, we have reason to believe that MA may also partly explain the relationship between EV and PEB. Therefore, RP and MA may play multiple mediating roles in the relationship between EV and PEB. Our research mainly reveals the intermediary mechanism between EV and PEB.

Because of the focus of these studies, the overall goal of this study is to establish a conceptual framework including cognitive and emotional processes to clearly understand the mechanism of college students' PEB. We studied 568 college students and explored the possible relationship between RP and MA according to the theoretical model and hypothesis proposed in previous studies, and we investigated the mediating role of RP and MA between EV and PEB. Exploring the intermediary mechanism between EV and college students' PEB can provide guidance for the exploration of relevant theoretical mechanisms of environmental psychology and can provide new ideas for the stimulation of young people's PEB. Such work also provides methods and guidance for the treatment of environmental pollution in China.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The Relationship Between Environmental Value and Pro-environmental Behavior

Values refer to a series of important life goals or standards that play a guiding role in people's lives (Schwartz, 1992). EV is one such value, and it is the most stable and lasting guiding principle of individual environmental behavior. According to de Groot and Steg (2008), EV is an ideal condition for dealing with the relationship between human beings and the ecological environment. The term refers to the degree of value individuals ascribe to issues related to the biosphere and the environment.

Environmental value has long been regarded as the driving factor of moral norms and the cognitive factor of decision-making regarding environmental protection. It can guide behavior by promoting the evaluation of situations and can lead to goal setting (Han, 2015; Fornara et al., 2016). Many studies have confirmed that EV is an important predictor of PEB (Pradhananga et al., 2017; Ünal et al., 2018). Individuals

or groups with positive EV will show more PEBs (de Groot and Steg, 2010). Compared to environmental knowledge, environmental awareness, environmental concern, and other variables, EV has more positive predictive power and can more effectively predict support for environmental protection, including pro-environmental policies (Steg et al., 2011; Hurst et al., 2013). Individuals who attach importance to EV often regard environmental protection as an essential pursuit. A person who cares greatly about the environment engages in more environmentally friendly behaviors to protect the environment and carries out more PEBs than others. However, the current research shows that EV cannot fully explain PEB because behavior can also be influenced by other intermediary variables (e.g., cognitive and emotional factors). Thus, it is necessary to fully investigate the relationship between EV and PEB; meanwhile, it is important to identify the contributions of cognitive factors such as RP and emotional factors such as MA to this association.

Thus, we propose the following hypothesis:

H1. Individuals' EV **is related to** PEB.

The Mediating Role of Risk Perception in the Relationship Between Environmental Value and Pro-environmental Behavior

Risk perception, a more authoritative term, was first proposed by Slovic (1999) and refers to people's empirical judgments of and attitudes toward various risks. The concept explains how the public perceives social threats (Wachinger et al., 2013; Slovic, 2016). Many studies have confirmed that RP is a multidimensional cognitive structure. This study refers to the studies of Yu and Xie (2006) and Zhang (2013); environmental RP refers to an individual's perception of the severity, possibility, and persistence of risk, which can reflect an individual's psychological representation of environmental hazards.

Previous studies have found that EV can predict an individual's willingness to drive an ecologically friendly car because it is highly related to perceptive consequences of driving cars, such as exhaust emissions (Ünal et al., 2018). RP plays a mediating role in the relationship between EV and ecofriendly driving. Individuals who attach great importance to EV and consider themselves a part of nature will care about environmental issues, and they are more sensitive to the threats of the environment (Tortosa-Edo et al., 2014). Some studies have shown a strong correlation between EV and RP (Liu et al., 2014; Ojala and Lidskog, 2017). According to the social amplification of the risk framework, EV is an essential factor in perceiving the risks of global warming (Ohe and Ikeda, 2005). When an individual feels threatened by risks to his important values, his risk awareness will increase (Mumpower et al., 2016). If confrontation with environmental risk threatens the important values that people hold, people's perception of risk will decline. For example, individuals who focus on hedonistic values have less concern about environmental problems (Islam et al., 2013).

Recent studies have shown that RP is positively related to individuals' PEB (Pahl et al., 2005; Schmitt et al., 2019). For example, there is a significant positive correlation between the public's RP of marine microplastic pollution and pro-environmental intention (Jeong et al., 2021). There is a positive correlation between the perception of flood risk and the willingness of individuals to take private mitigation measures (Terpstra et al., 2009; Bubeck et al., 2012). According to the theory of protection motivation, people will adopt defensive action to reduce their risk when faced with a risk event. For example, stronger climate RPs may foreshadow more energy-saving behaviors (Linden, 2015; Lacroix and Gifford, 2017). Clearly, when we have stronger RPs of the environment, we will engage in corresponding PEB to reduce our environmental RP. These findings suggest that RP plays a mediating role between EV and PEB.

H2. Environmental value is related to RP.

H3. Risk perception is positively related to PEB.

The Mediating Role of Moral Anger in the Relationship Between Environmental Value and Pro-environmental Behavior

Moral emotion refers to an emotional experience whereby an individual evaluates his or her behavior and thoughts or those of others according to specific moral standards (Haidt, 2003). Emotions aroused by assessing one's behavior and beliefs are called self-conscious emotions and include pride, guilt, shame, and empathy (Onwezen, 2014). Emotions evoked by evaluating the actions and thoughts of others are called emotions related to others, and include anger and disgust. Moral emotions in environmental psychology are emotions based on ecological norms or ecological responsibility.

First, there are few studies on the relationship between EV and MA, and we refer to the related studies on protective values and MA. Protective values refer to the concept of refusing to exchange economic values. He and Xi (2005) found that in Chinese culture, protective values include "protective values about the natural environment and traditional cultural values" (such as destroying forests, polluting rivers and destroying monuments) and "protective values related to human relations, human rights and interpersonal emotions" (such as not caring for the elderly, hurting children, or cloning technology); the former are more valued and universal than the latter (He and Guan, 2005). Recent studies have found that monetary compensation is used to force people to exchange these protective values or make them "pay" for something important (participants were asked how much they can accept the disappearance of some species), which can lead to anger and disgust among individuals in response to this kind of exchange (Atran and Ginges, 2012; Sandel, 2012; Duc et al., 2013). According to the sacred value protection model (SVPM; Tetlock, 2003), because protective values are closely related to the self and moral identity, when individuals are forced to choose between values and monetary interests, they may be regarded as a threat to the self and moral identity. This exchange will aggravate negative emotions (Yue et al., 2021). Environmental economics also holds that "sacrificing natural or rare species for money" is morally wrong. Based on the above studies, we believe that MA will arise when an individual's EV is threatened (such as through the

destruction of the natural environment, the extinction of marine species, and the emission of nuclear wastewater into the ocean).

Second, the importance of moral emotions for ecofriendly decision-making and behavior has been proven (Harth et al., 2013). For example, Melissa and Janet (2020) found that ecoguilt can motivate environmental behavior change. Despite the established relationship between guilt and PEB across diverse domains, other-oriented emotions have been infrequently used as predictors of individual environmental behaviors, and in particular, MA is rare. A qualitative study found students to be very concerned about nature, to express empathy for the harm suffered by nature, and to be angry with humans who destroy the environment (Herman et al., 2018). According to the model of environmental justice, anger over violating ecological norms affects people's willingness to adopt environmentally friendly behaviors. Tapia-Fonllem et al. (2013) measured residents' anger toward other people's bad environmental behaviors (such as felling trees, littering, or wasting water resources) and found that anger has a significant impact on PEB (including green purchases, energy and water savings, recycling of goods, and participation in environmental protection activities). Nerb and Spada (2001) asked participants to report their levels of anger and sadness after reading news that the environment was being damaged by human activities and found that only the emotion of anger had significant predictive power for PEB (for instance, donations for repairing the environment).

Based on previous studies, we propose the following hypotheses:

H4. Individuals' EV **is positively related to** MA.

H5. Individuals' MA **is related to** PEB.

The Relationship Between Risk Perception and Moral Anger

Regarding the emotional reaction to risk perception, Böhm (2003) divides emotions into other- and self-related emotions, both of which are based on the perception of environmental risks and ethics. The former refers to expressing anger toward others and attributing responsibility to others who destroy the environment. The latter refers to personal guilt or shame, meaning that individuals blame themselves rather than others. The analysis results show that an individual's responsibility for environmental risks has a positive impact on self-related moral emotions, including guilt and shame, instead of other-related emotions (Adams et al., 2020; Jeong et al., 2021). However, some scholars present different views. According to the social-cognitive theory model, the cognitive factors of risk (probability of event occurrence, event severity, or efficiency of event processing) trigger emotional reactions (anxiety, panic, anger). When responsibility for risk can be clearly assigned to a third party, this will produce ethical other-oriented emotions (such as anger). For example, discharging nuclear wastewater into the ocean will arouse people's anger. As Ojala (2007) said, when individuals understand global environmental threats, this may trigger unpleasant emotions.

Based on the above, we assume the following:

H6. Individuals' RP **is related to** MA.

Study Hypotheses

In this study, a chain mediation model (**Figure 1**) was applied to test the mediating role of RP and MA in the association between EV and PEB. Specifically, three mediation paths were examined as follows:

Hypothesis 7: Environmental value is indirectly associated with young adults' PEB ***via*** RP.

Hypothesis 8: Environmental value is indirectly associated with young adults' PEB ***via*** MA.

Hypothesis 9: Environmental value is indirectly associated with young adults' PEB **through** RP **and** MA.

MATERIALS AND METHODS

Participants

A total of 600 college students from four universities in Beijing, Inner Mongolia, Yunnan, Fujian Province, China were selected using the convenience sampling method. Survey data were obtained through written network measurement. Voluntary participation and anonymity were emphasized. To ensure the objectivity and reliability of the data obtained, we promised that the data obtained from the questionnaire would only be used for academic research and that the participants could fill out the survey according to their actual situations. There were no right or wrong answers. The survey was conducted in October 2020. Data were cleaned to omit people who completed the survey too quickly ($n = 19$) or provided incomplete responses ($n = 13$).

A total of 568 college students returned completed questionnaires, representing an effective response rate of 94.6%. Of the final sample, 305 (55%) were male, 253 (45%) were female, 94 (16.8%) were urban residents, 464 (83.2%) were rural residents, 477 (86%) were Han of descent, 81 (14%) were ethnic minorities, 350 (59.8%) majored in art, and 235 (40.2%) majored in science. The mean age of the participants was 19.59 years ($SD = 1.28$). The proportions of participants in years 1–4 in university were 53.5, 23.5, 12.9, and 10.1%, respectively.

Measures

Environmental Value Scale

Four items (Steg et al., 2014) were used to measure EV and have been used extensively in previous research on public attitudes toward climate change and PEB (see, e.g., Poortinga et al., 2004; Slimak and Dietz, 2010). Participants rated the importance of the following four items: preventing pollution (protecting natural resources); respecting the earth (harmony with other species); unity with nature (fitting into nature); and protecting the environment (preserving nature). The scale ranged from −1 "not important" to 4 "of supreme importance." The higher the score was, the higher the degree of EV was, and the greater the inclination to protect the environment was. The scale showed good internal consistency (Cronbach's $\alpha = 0.93$), so a single score measuring pro-EV was computed and used

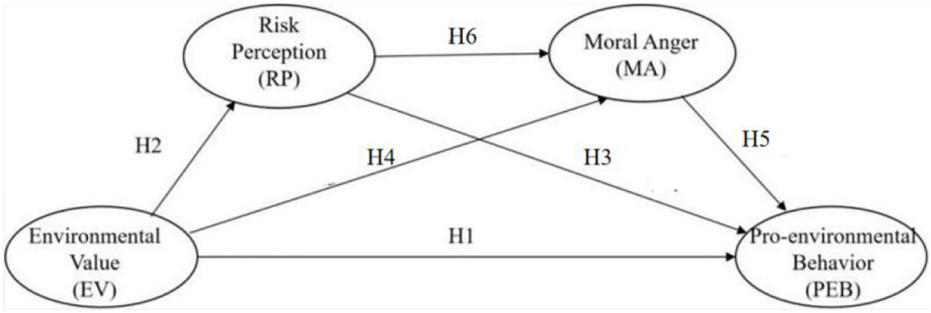

FIGURE 1 | Conceptual model of hypothesis path (H) indicating causal relationships between each variable.

for subsequent analyses. The validity index of the questionnaire reached an acceptable level ($\chi^2/df = 3.75$, CFI = 0.99, TLI = 0.99, RMSEA = 0.07, RMR = 0.007).

Risk Perception Scale

Risk perception was assessed using six items adopted from the environmental RP scale (Zhang, 2013) on a five-point Likert-type scale. This ten-item measure measures three dimensions: (1) perception of severity (e.g., "The destruction of the natural environment will have a serious impact on my life") refers to the perceived seriousness of the impact of environmental hazards on human society; (2) perception of durability (e.g., "Once the natural environment is destroyed, it will last for a long time") refers to the perceived persistence of environmental hazards; and (3) perception of possibility (e.g., "There is a great possibility that the natural environment will deteriorate") refers to the possibility of environmental hazards. The higher a score is, the stronger perceptions of environmental threat are. For the current sample, Cronbach's alpha for the entire questionnaire was measured as 0.85. The validity fitting indexes of the questionnaire were measured as $\chi^2/df = 4.44$, CFI = 0.95, TLI = 0.95, RMSEA = 0.079, and RMR = 0.027.

Moral Anger Scale

To measure the MA of the participants, a 4-item scale was modified from the work of Beugré (2012). Example items include the following: I feel sad, angry, bothered, and concerned when I see others destroying the environment. The items were measured on a 5-point Likert scale ranging from "1-strongly disagree" to "5-strongly agree." For the current sample, Cronbach's alpha for the entire questionnaire was measured as 0.95. The validity fitting indexes of the questionnaire were measured as $\chi^2/df = 4.41$, CFI = 0.99, TLI = 0.99, RMSEA = 0.078, and RMR = 0.011.

Pro-environmental Behavior Scale

Pro-environmental behavior was assessed using five items adapted from the research of Liu and Wu (2013) on a five-point frequency scale ranging from "1-never" to "5-always." The present study only uses items for private domain PEB, which are closely related to the actual lives of university students with strong practicality and high content validity and which are used as the measurement indicators of university students' PEB in this study. For the current sample, internal consistency was measured as 0.82. The validity fitting indexes of the questionnaire were measured as $\chi^2/df = 3.72$, CFI = 0.99, TLI = 0.97, and RMSEA = 0.08.

Demographic Characteristics

Because previous research has indicated that a person's gender, urban or rural residence, college major, and education level may affect human PEB (Zhang et al., 2019), we included these four variables as control variables.

Analytical Strategies

In this analysis, we validated the hypothetical model using a three-step strategy. First, the reliability and consistency of the questionnaire data were tested. Second, the measurement model was validated by confirmatory factor analysis (CFA), and third, the fitting and path coefficients of the hypothetical model were measured by structural equation modeling. We used SPSS 17.0 and Mplus 7.4 for our SEM analysis.

The reliability and consistency of the questionnaire data were tested before conducting the SEM analysis. We used Cronbach's α coefficients to measure reliability. According to the results, all Cronbach's alpha (a) coefficients were between 0.82 and 0.95, exceeding the standard value of 0.7 and indicating that the scale was reliable.

Confirmatory factor analysis is part of the structural equation model. Thompson (2007) proposed that CFA should be completed to test for structural validity before analyzing the structural equation model. Construct validity includes convergence validity and discrimination validity. The results show that the factor loadings ranged between 0.6 and 0.9. The combined reliability (CR) was between 0.96 and 0.97 and exceeded the standard value of 0.7, and all average variance extracted (AVE) values were between 0.70 and 0.98 and exceeded the standard value of 0.5. Therefore, the questionnaire exhibits appropriate convergent and discriminant validity.

RESULTS

Common Method Bias Test

Since multiple variable data used in this study were from the same participant, there may be a common method bias

problem. In this study, single method-factor approaches were used for a common method bias test (Xiong et al., 2012). This method extracts the "general" factor and then incorporates it into the structural equation model. The results indicate that the fitting of the model is unsatisfactory at $\chi^2/df = 5.20$, CFI = 0.80, TLI = 0.80, and RMSEA = 0.09. To a certain extent, this shows that common method **bias** is not extreme for this study.

Descriptive and Pearson Correlation Results

The descriptive statistics and Pearson correlations for the assessed variables are presented in **Table 1**. All variables were found to be significantly correlated.

Model Fit Tests

When a structural equation model is used to validate theoretical models, a satisfactory model fit is a necessary condition (Byrne, 2001). This study adopts the values of χ^2/df, CFI, GFI, TLI, IFI and RMSEA to estimate model fit. All of these indices exceed the standard value ($\chi^2/df = 4.16$, CFI = 0.99, GFI = 0.98, TLI = 0.97, IFI = 0.99, and RMSEA = 0.075). Consequently, we can conclude that the model we propose has a good fit with the data.

Structural Results

The structural results are presented in **Figure 2**. The results support our six hypotheses. The results for the positive and direct effects of EV on PEB (standardized direct effect $\beta = 0.14$, $t = 3.119$, $p < 0.05$) are statistically significant, and the 95% confidence interval is [0.270, 0.420], supporting **Hypothesis 1**. The results for the positive and direct effects of EV on RP (standardized direct effect $\beta = 0.46$, $t = 10.781$, $p < 0.05$) are statistically significant, and the 95% confidence interval is [0.389, 0.560], supporting **Hypothesis 2**. RP has significant positive impacts on PEB (standardized direct effect $\beta = 0.13$, $t = 2.401$, $p < 0.01$), and the confidence interval of the path is [0.163, 0.361], supporting **Hypothesis 3**. The results indicate that EV can positively predict MA (standardized direct effect $\beta = 0.27$, $t = 7.191$, $p < 0.01$), and its 95% confidence interval is [0.436, 0.584], supporting **Hypothesis 4**. MA has significant positive impacts on PEB (standardized direct effect $\beta = 0.30$, $t = 5.770$, $p < 0.05$), and the confidence interval of the path is [0.206, 0.414], supporting **Hypothesis 5.** The results indicate that RP can positively predict MA (standardized direct effect $\beta = 0.51$, $t = 12.114$, $p < 0.01\beta = 0.51$, $p < 0.05$), and its 95% confidence interval is [0.410, 0.572], supporting **Hypothesis 6**.

As shown in **Figure 2**, there are not only direct effects between EV and PEB but also indirect effects between them. Three mediating effects may be at play in the research model. First, RP may act as an intermediary between EV and PEB. Second, MA may act as an intermediary between EV and PEB. Third, RP and MA may play multiple intermediary roles in the relationship between EV and PEB. Therefore, we further analyze these possible mediating effects.

Mediating Effect Analysis

This study controls demographic variables gender, age, birthplace, and academic major and uses a structural equation model to verify the mediating roles of environmental RP and MA in EV and proecological behaviors. We used bootstrapping (Wen and Ye, 2014) to test the mediating variable effects of RP and MA. We performed bootstrapping at a 95% confidence interval with 2,000 samples (Taylor et al., 2008). We calculated the asymptotic critical ratio (t) and confidence interval of the lower and upper bounds (95% BC, 95% percentile) to test whether the indirect effects were significant (Preacher and Hayes, 2008). There is an indirect effect when $t > 0$, and the 95% confidence interval does not contain zero. First, we test whether the total indirect effect is significant.

The confidence interval of the chain mediation effect from EV to PEB is [0.045, 0.107]. This interval does not contain zero, which shows that the chain mediation effect is significant. The three mediation paths in the model are such that EV is indirectly associated with young adults' PEB *via* RP (Hypothesis 7), EV is indirectly associated with young adults' PEB *via* MA (Hypothesis 8), and EV is indirectly associated with young adults' PEB through RP and MA (Hypothesis 9). The results of the significance test of the three mediation paths are shown in **Table 2**. Therefore, the total effects of EV on PEB include 17.03% of the mediating effect through RP, 23.06% of the mediating effect through MA, and 20.04% of the mediating effect through RP and MA.

TABLE 1 | Descriptive statistics and Pearson correlations between the study variables.

	M ± *SD*	1	2	3	4	5	6	7
1. EV	4.27 ± 0.75	1						
2. POS	3.70 ± 0.55	0.349**	1					
3. POD	4.24 ± 0.71	0.426**	0.729**	1				
4. POP	4.21 ± 0.74	0.375**	0.662**	0.734**	1			
5. RP	4.05 ± 0.59	0.430**	0.863**	0.922**	0.904**	1		
6. MA	4.18 ± 0.75	0.499**	0.535**	0.567**	0.487**	0.588**	1	
7. PEB	3.58 ± 0.80	0.347**	0.393**	0.321**	0.268**	0.356**	0.449**	1

***p < 0.01. EV, environmental value; RP, risk perception; POS, perception of severity; POD, perception of durability; POP, perception of possibility; MA, moral anger; PEB, pro-environmental behavior.*

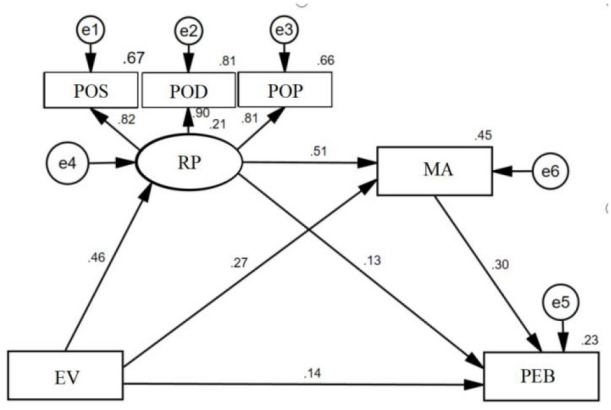

FIGURE 2 | Hypothesis test results.

TABLE 2 | Direct, indirect and total effects†of the SEM components depicted in **Figure 2**.

Effect source	Standardized path effect	Percentage effect	BC 95%	
			Lower	Upper
Indirect effects	0.21118	60.13%	0.160	0.260
EV—RP—PEB	$0.46 \times 0.13 = 0.0598$	17.03%	0.016	0.129
EV—MA—PEB	$0.27 \times 0.30 = 0.081$	23.06%	0.039	0.110
EV—RP—MA—PEB	$0.46 \times 0.51 \times 0.30 = 0.07038$	20.04%	0.045	0.107
Direct effects	0.140	39.87%	0.042	0.228
Total effects	0.35118	100%	0.270	0.420

DISCUSSION

One of the primary findings of this research is that EV is related to PEB. This result is in line with the argument made by Ünal et al. (2018) that people with higher EV are more likely to behave in an environmentally friendly manner.

As most countries face great pressures to improve the environment, this study attempts to better understand ways to transform individual EV into PEB. Many studies on PEB come from Western countries (Casaló and Escario, 2018; Park, 2019). In recent years, research on environmental behavior among Chinese people has begun in China (Wang and Wu, 2015; Zhou et al., 2018; Fang, 2020).

This study explores college students' PEB in the Chinese context. The results confirm the relationships between EV, RP, MA, and PEB found in previous studies. First, the study shows that EV can directly predict PEB. This finding is consistent with other study results (Riper and Kyle, 2014; Pradhananga et al., 2017; Sheng et al., 2020); individuals with high EV are more likely to engage in PEB. Since ancient times, Chinese people have advocated the ecological view of the unity of humans and nature, the equality of all living beings, and conformity to nature. This ecological view also profoundly guides (restricts) the environmental behavior of college students. The results also show that EV is positively correlated with RP and MA, which is consistent with past results (Stoutenborough et al., 2014; Ojala and Lidskog, 2017). This means that college students who believe it is important to protect the environment are better able to perceive environmental threats and are more morally angry with others for violating ecological norms (littering, mistreating small animals, or eating wild animals). Frantz and Mayer (2010) also supports this view and find that altruistic people (i.e., those concerned about the interests of others and of other species) are more attuned to global environmental risks (such as ozone holes and global warming). Second, we found a significant positive correlation between RP and PEB, which is consistent with the existing research results (Joireman et al., 2004; Xie et al., 2019). The stronger the perception of environmental risk is, the more likely an individual is to engage in PEB. For example, when individuals have a strong sense of threat to the environment, they are more willing to change their purchase decisions and behavior for environmental reasons, and they are more likely to buy green products (Wang and Li, 2019). People more attuned to risks of urban smog will realize that smog causes respiratory diseases and are more likely to take actions associated with reducing smog (Zhu et al., 2020). Third, our results show a positive correlation between RP and MA where individuals with greater RP tend to think that human beings do too much harm to the natural environment and show strong levels of MA. In addition, MA will encourage individuals to protect the environment. In a model study of responsible ecological behavior, MA was found to be the most potent predictor of PEB (Montada and Kals, 2000).

Further analysis is needed to determine the role of RP and MA in EV and PEB. The results show that RP plays a mediating role between EV and PEB. Its chain mode is EV—RP—PEB. EV is indirectly associated with young adults' PEB *via* RP, which is consistent with the results of previous studies (Nordlund and Garvill, 2002; Zhang, 2013; Jeong et al., 2021). This means that individuals who attach importance to EV are more likely to perceive threats from the environment and pay more attention to environmental issues, which can easily transform into environmental behaviors to guard against risks. Therefore, environmental RP is more related to whether individual EV can be transformed into natural environmental behaviors, reflecting the human psychological representation of environmental hazards.

Another important finding of our study is another meditating chain between EV and PEB: EV—MA—PEB. EV is indirectly associated with young adults' PEB *via* MA. Individuals with high EV will experience more MA when they see others destroy the environment, and this moral emotion encourages individuals to engage in more PEB. Individuals with high EV will experience more MA when they see others destroy the environment, and this moral emotion will prompt individuals to engage in more PEB. In addition, the results show that the mediating effect of MA is greater than that of the other two paths. This means that emotional factors play an essential role in transforming EV into PEB, and emotional aspects can better explain the relationship between EV and PEB than cognitive factors (Kanchanapibul et al., 2014; Wang and Wu, 2015). Liu et al. (2020) also believed that

the influence of the emotional system on environmental behavior is dominant. In environmental decision-making, individuals do not necessarily act in a rational way but may also be guided by emotional and moral principles (Onwezen, 2015; Han et al., 2018).

The fourth important finding of this study is that RP and MA play a significant chain mediating role between EV and PEB. The path is EV—RP—MA—PEB. In other words, individuals with high EV have a stronger ability to perceive environmental threats and then experience more MA against those who cause environmental risks, prompting them to engage in PEB. Onwezen et al. (2013) and Han et al. (2018) argue cognitive and emotional factors are the core mediating variables between EV and PEB. To some extent, emotion is the result of the cognitive process. This is consistent with existing studies that emphasize the critical role of cognitive-emotional relationships in individual decision-making processes, not only for consumer behavior but also for environmental behavior (Hunter, 2006; Bamberg et al., 2007; Wang and Wu, 2015). Our results support this conclusion and further find that psychological factors, including people's cognition and moral emotion toward environmental problems, are positively related to their environmental behavior intention. RP and MA work together to some extent, motivating us to engage in behavior that is good for the environment.

Although cognitive and emotional factors play an essential role in explaining the formation of individual environmental behavior, few empirical studies combine the two to understand the mechanism of environmental behavior. This study brings cognitive and emotional factors into a comprehensive theoretical framework, which greatly deepens our understanding of PEB. In other words, this present study makes effective use of the driving forces of PEB. It successfully examines the complex relationship between these variables to better understand the mediating effects of EV and young adults' PEB. It provides not only a reference for Chinese environmental psychology but also data support for exploring related theoretical mechanisms such as VBN theory and PEB theory.

The practical significance of this study is as follows. First, societies and schools can cultivate the ecological values of college students and the public through environmental education, raise people's awareness of environmental problems, and motivate people pay more attention to the interests of the ecosystem and the wellbeing of nature. Second, we suggest that the media provide more news about ecological crises and environmental issues (the threats of urban haze and shortages of resources). Such efforts can help raise awareness of environmental risks and encourage people to take action to protect the environment. Third, many public service advertisements use knowledge of EV and RP to promote environmental protection behavior when designing and promoting themes. For example, in global warming advertisements, the earth is portrayed as warming; similar to ice cream, it is constantly melting, and finally, delicate ice cream, like the earth, disappears. Advertisements can emphasize the destruction of the human environment and the threat of environmental damage to our survival. It is crucial for people to support EV. By paying attention to the interests of these biospheres, we can stimulate EV, individual awareness of risks, and MA at violations of ecological norms, which will eventually enhance pro-environmental intentions and behavior.

CONCLUSION

The main objectives of this study were to examine EV, RP, and MA in relation to PEB. Consistent with the literature, our research confirms that EV positively relates to PEB. Furthermore, our research empirically demonstrates that individuals with higher EV have higher levels of RP, more moral emotions, and more PEB. Based on these results, we recommend that societies and families cultivate university students' EV. Practitioners in the field of the environment need to consider providing the public with scientific knowledge of risks related to environmental issues to promote environmental protection. The novel finding of the current study is that RP and MA play a significantly chaining mediating role in the relationship between EV and PEB. These results imply that it is necessary to understand human behavioral psychology at the psychological level and that a scientific approach is needed to activate the PEB of college students to maintain environmental sustainability.

The results of this study show that the mediating effects of RP and MA may contribute to understanding the relationship between EV and PEB in a sample of Chinese individuals. However, this study has the following limitations that need to be addressed in future research. First, we use cross-sectional data, which may have endogeneity issues, which is a common problem in empirical research based on single survey data. Therefore, longitudinal data or causal experiments should be used in future studies to validate the claims of the present study. Second, we studied a sample of Chinese college students, excluding other groups. The results of this study could be verified in other populations in future studies. Third, part of the theoretical model described in this study is based on values-belief-norm theory. However, due to the limitations of the data obtained, we did not consider norms in the model for our analysis. Although our research focuses on the relationships between EV, RP, MA, and PEB, we can integrate environmental knowledge and norms into a complete VBN model for further research in the future.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Inner Mongolia Normal University. The

patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

XL contributed to the experimental design and analysis of the data and drafted the manuscript. ZL helped revise manuscript. TW provided final approval of the manuscript. All authors contributed to the article and approved the submitted version.

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Values, Motives, and Organic Food Consumption in China: A Moderating Role of Perceived Uncertainty

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The present research attempts to understand the importance of altruistic and egoistic values in determining consumers' motives and intention to purchase organic foods. Using the face-to-face survey approach, a total of 1,067 responses were collected from consumers in China. Data analysis was performed using a two-step structural equation modeling (SEM) approach, i.e., measurement and structural models. The findings indicated that both values influence the intention to purchase organic foods through the mediation of motives. Specifically, the altruistic value influences the environmental concern (EC), and the egoistic value influences the health concern (HC). Moreover, the perceived uncertainty negatively moderates a relationship between consumer HC and organic purchase intention while positively moderating a relationship between consumer EC and organic purchase intention. Several implications and suggestions are also discussed.

Keywords: organic food, altruistic value, egoistic value, health concern, environmental concern, uncertainty, purchase intention

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INTRODUCTION

Emerging food safety incidents and environmental problems have increased global consumers' attention to food quality, safety, and environmental friendliness (Central News Agency, 2013; Hsu and Chen, 2014; Teng and Lu, 2016; Molinillo et al., 2020; Rana and Paul, 2020). This phenomenon makes consumers more aware of possible pesticide residues in food, excessive use of environmentally harmful pesticides and chemicals, and the credibility of production methods (Fernqvist and Ekelund, 2014; Alzubaidi et al., 2021), which in turn arises as consumers doubts about modern agricultural cultivation methods and promotes the interest and demand for organic foods (Mondelaers et al., 2009). A gradual, yet, extensive growth has been witnessed worldwide in demand for organic foods (Sultan et al., 2020) with global sales posited to have crossed USD 90 billion in the past 20 years (Willer et al., 2020). Organic food is considered to have both nutritional and environmental benefits (Kushwah et al., 2019), which could be easily integrated with individuals' personal values.

In the past decade, people have noticed the shift in consumers' food preferences. Consumers are beginning to prefer organic food to industrially grown food as it is considered eco-friendly and healthier (Tandon et al., 2020). In the past, organic foods have been more popular with consumers in developed countries, but in the past decade, organic foods have witnessed a great revolution in developing countries such as China. Organic food consumption in emerging markets is growing faster than in Western markets (Nafees et al., 2022). Although the organic food industry in China is still at its nascent stage, the demand for organic food has increased dramatically in recent years. With a continuous improvement of living standards, China is evolving into the fastest growing organic food market in the world. According to the "2020–2025 China Organic Food Industry

Market Panoramic Survey and Investment Value Assessment Advisory Report" issued by China Research Institute, China will become the fourth largest consumer of organic foods, which are expected to account for 1–1.5% of the whole Chinese food market.[1]

Organic food consumption belongs to sustainable consumption and turning to organic foods is believed to help promote the sustainable development of consumption (Reisch et al., 2013; Feil et al., 2020). At the same time, organic food is also classified as ethical consumption because it shows concerns about the ecological environment (organic foods have less harmful effects on the environment) and is also beneficial to individuals (health). Several researchers have highlighted the importance of values in studying pro-environmental behavior or ethical behavior (De Groot and Steg, 2009; Hidalgo-Baz et al., 2017; Ahangarkolaee and Gorton, 2020; Vega-Zamora et al., 2020). Value is defined as "a desirable trans-situational goal varying in importance, which serves as a guiding principle in the life of a person on other social entity" (Schwartz, 1992). The literature shows that the altruistic value (concerning others) and the egoistic value (pro-self) are the two key driving forces for people to make moral behavior decisions. However, a direct prediction effect of values on individual behavior is weak (Homer and Kahle, 1988) and there is no consensus on the effect of consumer values on organic food consumption in the existing literature (Van Doorn and Verhoef, 2015; Yadav, 2016). In China, the studies related to organic food consumption are far from enough (Thøgersen et al., 2015; Teng and Lu, 2016; Lin et al., 2021; Liu et al., 2021). Most studies have focused on the consumer motivation to buy organic products and their values. Due to the vague boundary of the two concepts, most studies are separated (Kareklas et al., 2014; Teng and Lu, 2016) or mixed together (Yadav, 2016) when examining the effect of values or motivation on organic purchase. Jolibert and Baumgartner (1997) pointed out that the inherent values of society will form a definite behavioral motivation, and there was a hierarchical relationship between them. However, a few scholars in the field of organic consumption explore how consumer values drive consumption motivation, thereby affecting the purchase intention of organic foods. Although a few studies have adopted the causal chain perspective of "Values-Motivation-Behavior" (VMB) (Zhang, 2008; Gao et al., 2014), it is still a lack of application in the field of organic food consumption. Therefore, this study aims to investigate the mechanism of "VMB" in the context of Chinese organic consumption.

Further, there may be some obstacles in the influence of values and motivation on consumer behavior. Even if the main effect of values and motivation on organic food purchase behavior is clear, it is not enough to understand consumers' final behavior. Therefore, another task of this study is to explore the moderation effect of perceived uncertainty on this influence process. In reality, consumers may lack the knowledge of organic foods, and the credibility of organic food-related certification is low, which will lead to consumers' feeling of uncertainty. At present, due to various certification systems and food labels, the information credibility and standards of organic products are in a state of confusion, especially in China, which increased the difficulty to distinguish the information. In 2018, a survey of 2,006 respondents was conducted by the social survey center of China Youth Daily showed that 86.0% of the respondents had bought organic foods, and 50.5% of the respondents could not distinguish the foods which were organic. Around 69.9% of the respondents felt that "organic food" is more in name than in reality.[2] In view of the current situation of an organic food market in China, it is necessary to study and understand the moderating role of perceived uncertainty when investigating the impact of consumer motivation on organic food purchase intention.

In sum, the multi-purpose of this study are as follows: (1) to explore the influence of values and consumption motives on organic purchase intention in the context of Chinese consumers; (2) to examine the mediating effect of consumption motives on the relationship between values and organic purchase intention; and (3) to examine the moderating effect of perceived uncertainty on the relationship between consumption motives and the purchase intention of organic foods.

LITERATURE REVIEW AND HYPOTHESIS

Consumer Values

Schwartz Value Theory is often used to study the relationship between values and consumer behavior (Schwartz, 1992). A few studies have proven the influence of values on pro-environment behavior such as the reduction of household carbon dioxide emissions (Steg et al., 2005), waste recycling, and resource utilization (Milfont et al., 2010), and green consumption behavior. For example, Homer and Kahle (1988) point out that the value dimensions will affect the natural food purchase. Kim and Kim (2010) propose that Korean consumer values affect the choice of green products through their attitude toward the environment.

The theory of Value-Belief-Norm (VBN) puts forward the egoistic value, altruistic value, and biosphere value, which are the main values related to environmental problems and can predict specific environmental behavior (Stern et al., 1999; Stern, 2000; Prakash et al., 2019). Altruistic values describe the situation under which peoples act on behalf of others while expecting no personal benefits (Schwartz, 1968). Instead, egoistic values mean acting on behalf of oneself or expecting personal benefits such as eliminating the suffering and harm of oneself (Kollmuss and Agyeman, 2002). For organic consumption, egoistic values mean that consumers want food to be beneficial to their health, while altruistic values mean consumers concerning no pollution to the environment. The research has considered both values as individuals' consumption of organic food shows their concern toward the self-benefits as well as toward the environmental benefits (Kareklas et al., 2014). Yadav (2016) takes health concern (HC) and environmental concern (EC) as proxy variables of egoistic and altruistic values to investigate their impact on organic

[1] https://www.360kuai.com/pc/92f35c2eb952fd0b4?cota=4&kuai_so=1&tj_url=so_rec&sign=360_57c3bbd1&refer_scene=so_1

[2] http://www.xinhuanet.com/fortune/2018-08/21/c_1123299476.htm

food purchase intention. ECs and HCs have always been the two most common motivations for organic food purchases (Wandel and Bugge, 1997). This study believes that values, as an abstract cognition existing in one's heart, will have a positive impact on consumers' motivation as well as purchase behavior intentions.

Values are the abstract expression of the subconscious, while motivation is a relatively concrete concept, which reflects an individual's corresponding behavior or response stimulated by some factors. Motivation builds a bridge between values and behavioral intention, transforming abstract conceptual values into specific behaviors (Shen, 1994; Zhang, 2008). Accordingly, the hypotheses are proposed as follows:

H1a. Egoistic value positively influences an individual's HC.

H1b. Altruistic value positively influences an individual's EC.

H2a. Egoistic values among the individuals positively influence their intention to purchase organic foods.

H2b. Altruistic values among individuals positively influence their intention to purchase organic foods.

Health Concerns and Environmental Concerns

Food safety, taste and freshness, environmental protection, and animal welfare are the common motivations of organic food consumption (Hemmerling et al., 2015; Rana and Paul, 2020). Among them, the health aspect is proved to be one of the two most prominent motivations for consumers to buy organic foods in Europe, Australia, Asia, and the United States (Schleenbecker and Hamm, 2013; Rizzo et al., 2020; Nafees et al., 2022). The importance of environmental preservation and food security is also found to be the main reason for buying organic foods in the Asian developing organic market (Sirieix et al., 2011; Teng and Lu, 2016; Ahangarkolaee and Gorton, 2020; Lin et al., 2021). Based on the review findings, the present study considers HC and EC as the dominant motives related to the decision of organic food consumption in a Chinese context.

The HC among individuals shows concern for self or to their family, so in nature, it is egoistic (Magnusson et al., 2003). HCs reflect the influence of egoistic values, that is, they want to keep themselves and their families healthy (Massey et al., 2018). Egoistic values drive consumers to pay more attention to health-related issues and then affect individual consumption decisions. Organic foods are considered to be healthier and more nutritious (Grankvist and Biel, 2001; Lea and Worsley, 2005) because they are produced without any harmful chemical fertilizers (Pino et al., 2012). When purchasing organic foods, health-related problems and safety concerns are considered as the main motivating factors (Goetzke and Spiller, 2014; Le-Anh and Nguyen-To, 2020). More specifically, the desire for body health and wellbeing drives the demand in food markets. Extensive empirical studies show that HCs are among the important drivers for developing a positive intention toward organic food consumption (Schifferstein and Ophuis, 1998; Kareklas et al., 2014; Yadav, 2016).

On the other hand, EC can be regarded as altruistic in nature because individuals are aware of the consequences of environmental problems and are willing to make efforts to protect the environment with little thought of benefits for themselves (Dunlap and Jones, 2002; Thøgersen, 2011; Wang et al., 2020). Personal concerns for the environment are related to consumers' altruistic value or altruistic purchase considerations as consumers often choose organic food products due to consumers' thinking that the production mode of organic foods does not harm the environment and has the attribute of ecological friendliness (Lee and Hwang, 2016). It has been suggested that the choice of organic foods over traditional food indicates consumers' concern for others and the common interests (Thøgersen, 2011; Kareklas et al., 2014). EC shows the degree to which consumers are aware of environmental problems and support efforts to solve them or express their willingness to contribute personally to solve the problems (Dunlap and Jones, 2002). A growing body of literature on organic food consumption suggests that environmental concern plays a crucial role in influencing the consumption intention of organic foods as buying organic foods, which is considered to be a behavior beneficial to the environment (Kareklas et al., 2014; Hansmann et al., 2020; Liu et al., 2021). Accordingly, the hypotheses are proposed as follows:

H3a. HC positively influences the individual's intention to purchase organic foods.

H3b. EC positively influences the individual's intention to purchase organic foods.

H4a. HC mediates a relationship between egoistic value and organic purchase intention.

H4b. EC mediates a relationship between altruistic value and organic purchase intention.

The Perceived Uncertainty

In the consumption scenario, uncertainty refers to the fact that due to information asymmetry, consumers face difficulty obtaining the complete product information or have doubts about the information obtained (Vieira, 2008), which will reduce the consumer's purchase intention (Shiu et al., 2011). Some studies show that consumers tend to be skeptical about organic foods (Vermeir and Verbeke, 2006; Janssen and Hamm, 2011) as lacking the relevant knowledge or an insufficient understanding of organic labeling will produce perceived uncertainty (Janssen and Hamm, 2011). Additionally, consumers may be confused by the existence of multiple organic certification bodies because it is difficult to accurately evaluate the authenticity of organic certification, which also decreases consumer trust and further hinders organic consumption (Wang and He, 2016). Sometimes, eco-labels may send irrelevant, confusing, or even detrimental messages to consumers (Delmas and Lessem, 2017).

Prior research has indicated that perceived uncertainty negatively affects trust and the intention of purchasing organic foods (e.g., Yiridoe et al., 2005; Shiu et al., 2011). Especially, Vermeir and Verbeke (2006) emphasize the importance of mental processing uncertainty in organic food consumption. When consumers perceive a higher uncertainty, the more uncertain they are about the knowledge of organic foods, and the more difficult

is to judge whether the organic food consumption decision is correct (Yiridoe et al., 2005). As Thøgersen (2009) suggests uncertainty may prevent people from purchasing organic foods even though they have favorable attitudes. Accordingly, even though consumers have strong motivations to buy organic foods, a higher level of perceived uncertainty may reduce the willingness to buy organic foods. In contrast, if the information about organic foods is credible, sufficient, and easy to obtain, the level of uncertainty may be reduced and a higher motivation will further strengthen consumers' organic consumption behavior (De Magistris and Gracia, 2008; Teng and Lu, 2016). Therefore, it is speculated that perceived uncertainty will moderate a relationship between motives and organic purchase intention. Therefore, we proposed the hypothesis H5:

H5a. Perceived uncertainty positively moderates the relationship between HC and organic purchase intention. That is, when perceived uncertainty is higher, the relationship between HC and organic purchase intention is weaker and *vice versa*.

H5b. Perceived uncertainty positively moderates a relationship between environmental concern and organic purchase intention. That is, when perceived uncertainty is higher, the relationship between environmental concern and organic purchase intention is weaker and *vice versa*.

Conceptual Model

It is important content in the field of consumer behavior to study the antecedents of consumer behavior intention from the perspective of values and motivation. However, in view of the vague boundary between the two concepts of values and motivation, existing studies usually only consider some factors and pay less attention to the complete causality from values to motivation to behavior. Zhang (2008) constructed the VMB model and then verified that values affect college students' motivation to buy overseas study service products, and this motivation affects further purchase behavior. Drawing on the VMB model, Gao et al. (2014) explored the relationship among Confucian values, motivation, and TV purchase behavior of Chinese farmers. Recent studies have verified the driving effect of values on motivations, attitudes, and subsequent behaviors from different contexts (Hidalgo-Baz et al., 2017; Tarabashkina et al., 2020; Liu et al., 2021; Teah et al., 2021). Therefore, this study follows the same theoretical model, combined with the above literature discussion and hypothesis deduction, and constructs the following conceptual model (**Figure 1**) in the context of organic food consumption.

TABLE 1 | Demographic profiles of the sample (n = 1,067).

	N	%		*n*	%
1. Gender			**5. Occupation**		
Female	601	56.3	Student	205	19.2
Male	466	43.7	Civil servant	48	4.5
2. Education			Teachers, doctors and researchers	155	14.5
High school or below	202	18.9			
College or university	696	65.2	Business operators	95	8.9
Postgraduate	146	13.7	Company employee	278	26.1
Missing	23	2.2	Worker	116	10.9
3. Marriage			Unemployed	14	1.3
Married	530	49.7	Housewives	17	1.6
Unmarried	487	45.6	Other	132	12.4
Divorce	36	3.4	Missing	7	0.7
Widowed	14	1.3	**6. Age**		
4. Monthly household income (RMB)			Below 19	105	9.8
Below 3,000	378	35.4	20–29	374	35.1
3,001–5,000	326	30.6	30–39	309	29.0
5,001–7,000	237	22.2	40–49	192	18.0
7,001–9,000	76	7.1	50–59	67	6.3
Above 9,000	37	3.5	Above 60	19	1.8
Missing	13	1.2	Missing	1	0.1

MATERIALS AND METHODS

Measures

We designed a structured questionnaire to take a survey. The questionnaire includes two sections. In the first section, we measured the constructs. In the second section, we collected demographic information including gender, age, marriage, occupation, education, average monthly income, and the experience of organic food purchase.

In this study, multi-item scales are used to measure the constructs. To ensure the validity of the scale used in the survey, the items were adapted from the relevant research and existing literature. These scales are adopted from previous studies and modified to fit the theme and context of this study. The measurement items are backtranslated by native speakers to confirm that the contents and meanings are consistent with the original wordings. All items are assessed with the five-point Likert scales, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Values

The scales of Steg et al. (2005) are used to measure respondents' altruistic and egoistic values.

Health Concern

The items of HC are from Yadav (2016). Example items include: "I chose food carefully to ensure the good health."

Environment Concern

The construct of EC is measured by the four items borrowed from Yadav (2016). Example items include: "The balance of nature is very delicate and can be easily upset."

Perceived Uncertainty About Organic Foods

A six-item scale deriving from the scale of Shiu et al. (2011) is used to measure perceived uncertainty about organic food knowledge, choice, and evaluation. Example items include: "organic food labels lead me to be unsure of the best choice for me," and "I'm not confident of my personal view on organic food."

TABLE 2 | Results of confirmatory factor analysis (CFA).

Construct	Items	Loading	CR	Cronbach's α
Egoistic values	Authority: the right to lead or command	0.505***	0.682	0.738
	Social power: control over others, dominance	0.622***		
	Wealth: material possessions, money	0.661***		
	Influential: having an impact on people and events	0.572***		
Altruistic values	Social justice: correcting injustice, care for the weak	0.455***	0.685	0.708
	Helpful: working for the welfare of others	0.634***		
	Equality: equal opportunity for all	0.731***		
	A world at peace: free of war and conflict	0.541***		
Health Concern	I chose food carefully to ensure the good health	0.722***	0.688	0.704
	I didn't consider myself as health conscious Consumer	0.701***		
	I think often about health related issues	0.523***		
Environmental Concern	The balance of nature is very delicate and can be easily upset	0.792***	0.741	0.741
	Human beings are severely abusing the environment	0.786***		
	Humans must maintain the balance with nature in order to survive	0.565***		
	Human interferences with nature often produce disastrous consequences	0.407***		
Purchase Intention	I am glad to buy organic foods	0.752***	0.794	0.822
	I expect to consume organic foods	0.791***		
	I would buy organic food products	0.710***		
	I plan to consume organic foods	0.534***		
	I intend to purchase organic foods produce within the next 2 weeks	NA		
Perceived uncertainty	1. I'm not sure of my knowledge about organic foods	0.735***	0.799	0.831
	2. I'm not confident of my personal view on organic foods	0.765***		
	3. Organic food labels lead me to be unsure of the best choice for me	0.660***		
	4. There is too much organic product information for me to make the right choice	NA		
	5. I have no confidence in evaluating between organic foods and conventional foods	0.609***		
	6. I'm not confident of those organic foods in the current market	0.546***		

***$p < 0.001$.

Purchase Intention of Organic Food

Adopted from Steg et al. (2005), a five-item scale is used to measure the intention to buy organic food. Example items include: "I expect to consume organic food," and "I would buy organic food products."

Data Collection and the Sample

In this study, a professional market research consulting company in China was entrusted to collect the data from January to March 2020. As the questionnaires were obtained by intercepting interviews at the entrance of the supermarkets located in Nangang District, Daoli District, Daowai District, Xiangfang District, and Songbei District of Harbin, convenience sampling methods were adopted. A total of 2,000 questionnaires were collected. After excluding 933 questionnaires with missing data, invalid answers, and subjects without organic food purchase experience, 1,067 valid questionnaires were retained. The demographic profiles of the sample are shown in **Table 1**.

RESULTS

We used AMOS 24.0 to analyze the data as AMOS is the most commonly used software for estimating covariance-based structural models. We have a large enough sample and the variables are normally distributed, so AMOS is suitable for our data. A two-stage procedure was applied to analyze the data. In the first stage, the measurement model was assessed in terms of its reliability and validity. In the second stage, the structural model was examined. The significance of the model estimates was based on a bootstrapping procedure with 5,000 samples.

Reliability and Validity Test

The confirmatory factor analysis (CFA) was used to measure the reliability and validity of the data. The initial CFA results show that the CFA fit indices represented an appropriate model fit (x^2 = 928.575, df = 224, x^2/df = 4.145, CFI = 0.922, AGFI = 0.903, IFI = 0.923, GFI = 0.928, RMSEA = 0.054). Further, we measured the convergent and discriminant validity to ensure data validity. The value of Cronbach's α ranges from 0.704 to 0.831 which is well above the acceptable limit of 0.7, suggesting good internal reliability among the items of each construct. Factor loading and average variance extracted (AVE) were used to test the convergent validity. After deleting "I plan to buy organic food in the next two weeks" and "there is too much organic food information for me to make a reasonable choice" with low factor loading, the factor loading of all items is above 0.5, which meets the criterion. The value of AVE was above or close to 0.5. The composite reliability (CR) values of each construct exceeded the threshold of 0.60 (from 0.682 to 0.831), showing an ideal internal consistency

among the construct items. Please refer to **Table 2** for the detailed results of reliability and convergent validity.

Finally, the discriminant validity was evaluated. The square root of the AVE of each construct was higher than its correlation value. In addition, Brown (2006) suggested that to ensure the validity of discrimination, the correlation value between all constructs should be less than 0.8. Please refer to **Table 3** for the detailed results of discriminant validity.

Hypotheses Testing

Structural Equation Model

Table 4 shows the results based on Structural equation model (SEM). The value of β represents the association between the independent variable and dependent variable. It can be seen that the altruistic value significantly influences the EC (β = 0.401, $t = 7.823$, $p < 0.001$) and organic purchase intention (β = 0.277, $t = 5.782$, $p < 0.001$). Therefore, the hypotheses H1b and H2b were supported. The egoistic value significantly influences the HC (β = 0.198, $t = 4.654$, $p < 0.001$) and purchase intention (β = 0.145, $t = 3.446$, $p < 0.01$). Therefore, the hypotheses H1a and H2a were supported. Finally, HC has a significant influence on the purchase intention (β = 0.283, $t = 7.559$, $p < 0.001$) and EC has a significant influence on the purchase intention (β = 0.163, $t = 4.170$, $p < 0.001$), which supported the Hypotheses H3a and H3b.

TABLE 3 | Correlations of variables.

	EV	AV	HC	EC	PI	PU
EV	***0.593***					
AV	0.362***	***0.599***				
HC	0.192***	0.380***	***0.655***			
EC	0.651***	0.288***	0.243***	***0.658***		
PI	0.396***	0.501***	0.465***	0.378***	***0.704***	
PU	0.337***	–0.087*	0.070	0.397***	–0.091*	***0.668***

EV, egoistic value; AV, altruistic value; HC, health concern; EC, environmental concern; PI, purchase intention; PU, perceived uncertainty.
The square roots of AVE for discriminant validity are italicized along the diagonal.
**p < 0.05; ***p < 0.001 (two-tailed).*

TABLE 4 | Path analysis of structural equation model (SEM).

Path	β	t-Statistics	Sig.	Hypothesis
Egoistic value→Health concern	0.198	4.654	***	H1a supported
Altruistic value→Environmental concern	0.401	7.823	***	H1b supported
Health concern→Purchase intention	0.283	7.559	***	H3a supported
Environmental concern→Purchase intention	0.163	4.170	***	H3b supported
Egoistic value→Purchase intention	0.145	3.446	***	H2a supported
Altruistic value→Purchase intention	0.277	5.782	***	H2b supported

****p < 0.001 (two-tailed).*

TABLE 5 | The results of the mediating effect analysis.

	Direct effect				Indirect effect		
Path	**Effect**	**LLCI**	**ULCI**	***P* value**	**Effect**	**LLCI**	**ULCI**
EV→HC→PI	0.278	0.220	0.337	0.000	0.044	0.021	0.071
AV→EC→PI	0.334	0.280	0.398	0.000	0.077	0.053	0.104

EV, egoistic value; AV, altruistic value; HC, health concern; EC, environmental concern; PI, purchase intention.

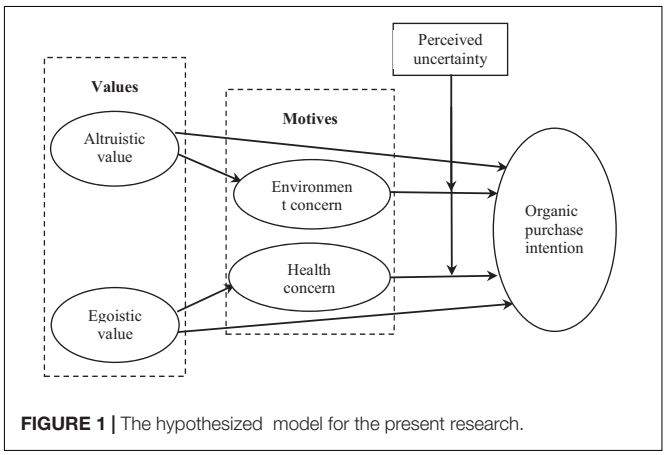

FIGURE 1 | The hypothesized model for the present research.

Test of Mediation Effect

The PROCESS program for SPSS (model 4) is used to test the role of HC and EC as mediators between the egoistic value, altruistic value, and purchase intention, respectively (Preacher and Hayes, 2008). Bootstrapping was performed at a 95% CI with 5,000 bootstrap samples to investigate the indirect effects of the independent variable through a mediator. The CI of the lower and upper bounds was calculated to test whether the indirect effects were significant. As seen in **Table 5**, in both the cases, HC and EC show a partial mediation effect. HC partially mediates the relationship between the egoistic value and purchase intention (an indirect effect = 0.044), and EC partially mediates the relationship between the altruistic value and purchase intention (an indirect effect = 0.077) of organic foods. Thus, both H4a and H4b are supported.

Test of the Moderation Effect

We used hierarchical multiple regression to test the moderating role of perceived uncertainty. When using HC as an independent variable, the interaction of HC and uncertainty is significantly negative ($B = -0.102$, $p < 0.001$), implying that perceived uncertainty plays a negative moderating role in the relationship between HC and organic purchase intention, which supports H5a. The finding indicates that the consumer perceived uncertainty will weaken a positive relationship between HC motivation and organic purchase intention. That is, the stronger the perceived uncertainty of consumers for organic food, the weaker the promotion effect of HC motivation on the organic food purchase intention. The two-way interaction effects are shown in **Figure 2**.

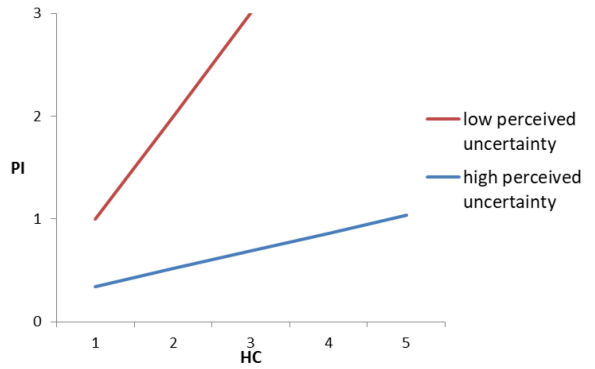

FIGURE 2 | Two-way interaction of perceived uncertainty and health concern (HC).

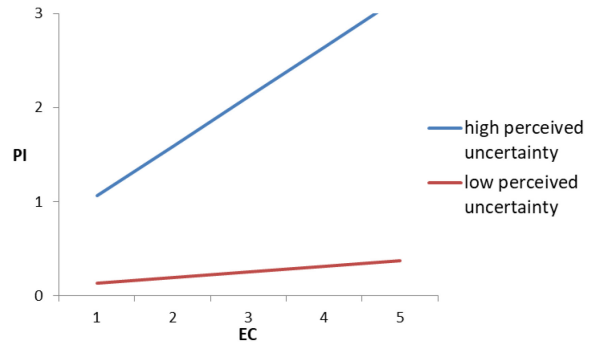

FIGURE 3 | Two-way interaction of perceived uncertainty and environmental concern (EC).

When using EC as an independent variable, the interaction of EC and uncertainty is significantly positive ($B = 0.134$, $p < 0.001$), implying that perceived uncertainty plays a positive moderating role in the relationship between EC and organic purchase intention, which is contrary to the hypothesis H5b. That is, perceived uncertainty will strengthen the influence of EC motivation on the purchase intention of organic foods. The stronger the perceived uncertainty of consumers for organic food, the stronger the promotion effect of EC motivation on the purchase intention of organic foods. The two-way interaction effects are shown in **Figure 3**.

DISCUSSION

Theoretical Implications

This study aims to investigate and understand the significance of altruistic and egoistic values in determining consumers' willingness to buy organic foods in the context of China, which is the largest developing nation in the world. The findings report that both altruistic and egoistic values play a significant role in determining the motives and intention toward purchasing organic foods, which verifies the significance of stable value orientations in explaining people's consumption intention of organic foods (Chen, 2020). Specifically, the altruistic value is found to influence the consumer's EC, and the egoistic value is found to influence the consumer's HC. The finding is consistent with Yadav (2016) as they report that both EC and egoistic HC significantly influence the attitude and intention toward purchasing organic foods among Indian youth. In addition, it is found that, compared to EC, the HC has a stronger impact on the consumer's intention of buying organic foods. The findings support the study of Magnusson et al. (2003) and Yadav (2016) that when consumers decide to buy organic foods, the egoistic motive is more influential compared to an altruistic motive.

The results of this empirical study in the context of China confirm the previous findings (e.g., Yiridoe et al., 2005; Vermeir and Verbeke, 2006; Schleenbecker and Hamm, 2013; Hemmerling et al., 2015; Teng and Lu, 2016; Ahangarkolaee and Gorton, 2020; Nafees et al., 2022) that the consumer's health consciousness, food safety concerns, and ecological motives, which are the subdimensions of organic consumption motives and are all positively related to involvement with organic foods. Specifically, a consumer with HC is more likely to take health-related behavior and consume organic foods, which are related to their internal needs for health and safety (Hill and Lynchehaun, 2002; Bezençon and Blili, 2010; Michaelidou and Hassan, 2010).

Furthermore, those who are conscious of environmental protection and animal welfare are more involved in organic food consumption, which is consistent with some previous results (e.g., Chen, 2007; Hjelmar, 2011; Teng and Lu, 2016) but is also inconsistent with other findings (e.g., Zakowska-Biemans, 2011; Zagata, 2012). Zakowska-Biemans (2011) also mention that although people widely recognize the importance of environmental protection and animal welfare, it is not relevant to the organic purchase decision. Nevertheless, researchers claim that the consumers with ecological motives are more involved in an ethical product decision (Bezençon and Blili, 2010), which further has a positive impact on consumers' intention of purchasing organic foods. In this research, the finding of a positive effect of ecological motives reconfirms the results of Chen (2007), Teng and Lu (2016), and Zhu (2018), indicating that consumers in China pay attention to environmental protection in their daily food intake, so they are more likely to consume organic foods related to environmental values.

In addition to the effects of consumption motives on consumers' willingness to buy organic foods, this study also confirms the mediating effect of consumption motives on the relationship between altruistic values, egoistic values, and organic purchase intention. The results show that consumption value and consumption motivation are two different concepts. Mixing consumption motivation with values (such as Yadav, 2016) prevented us from understanding the complete mechanism of value-motivation-behavior. In fact, our research has proven that the values rooted in an individual's heart affect the purchase behavior of organic foods through driving consumption motivation. Whether in the relationship between egoistic values or altruistic values and organic food purchase intention, the mediating effect of EC is stronger than that of HC. In the past, many studies have concluded that the effect of HC motivation

is greater than that of EC motivation (Magnusson et al., 2003). The possible reason for this result is that with a continuous deterioration of the environment, people increasingly feel that their survival and development are under a direct threat. Therefore, the awareness and willingness of environmental protection of Chinese consumers are gradually increasing, which makes the EC motivation play an increasingly important role.

This study also found that perceived uncertainty significantly weakens the positive impact of HC on the purchase intention of organic foods. Such a result shows that even though buying organic food is normally considered better for health than conventional foods, feeling a strong uncertainty would hinder the influence of HC on the purchase decision of organic foods. This is because the perceived risk caused by incomplete information and uncertainty may have a negative effect on consumer purchase intention (Hassan et al., 2013). When consumers feel uncertain about the consequences of eating organic foods, they are unlikely to make a decision to buy organic foods because they do not possess the relevant knowledge and information to accurately predict the outcome of organic food consumption (Thøgersen, 2009; Chen and Huang, 2013).

Surprisingly, this study found that perceived uncertainty significantly weakens the influence of EC on the intention of organic purchasing, which shows that a strong sense of uncertainty would promote the influence of EC on the purchase decision of organic foods. The higher the perceived uncertainty, the stronger the impact of EC on the intention of purchasing organic foods. In other words, the lower the perceived uncertainty, the weaker the influence of EC on the intention of purchasing organic food. In terms of the main effect, the motivation to care about environmental protection urges consumers to think about the benefits of organic foods to the environment. When they confirm that organic food planting is beneficial to environmental protection (such as less use of pesticides and fertilizers), they are more willing to buy organic foods. However, the lower the feelings of uncertainty about organic foods, that is, the higher the feelings of certainty, the weaker their willingness to consume organic foods. This may be that the more consumers think that they have related knowledge about organic foods (note that this knowledge may include not only the health benefits of organic foods, but also the negative effects of organic foods on the environment), the more they doubt the benefits of organic food planting on environmental protection, so it weakens the influence of environmental motivation on the willingness to purchase organic foods. Chinese consumers' cognition of organic foods mainly focuses on health and taste because in most Chinese people's understanding, organic cultivation is actually the traditional agricultural cultivation method (such as using human and animal excrement as a fertilizer), and the traditional planting method also has a certain negative impact on the environment. In fact, whether organic agriculture is good or bad for the ecological environment is still a controversial topic in the scientific community. Therefore, when consumers' perception of organic foods is uncertain, they usually follow the mainstream cognition of society, that is, organic agriculture does not use chemically synthesized pesticides and fertilizers, which are conducive to an ecological balance. However, when consumers learn more about the process of organic food cultivation, they may find the disadvantages of organic agriculture, such as the need for more arable land due to low yield, thus reducing the forest area.[3]

Practical Implications

The findings of this study are conducive to guiding the development of the organic food industry. Some management implications and suggestions from the results of this research are as follows.

According to this study, two kinds of consumption motives have positive influences on consumers' willingness to buy organic foods. Moreover, the two values have positive influences on the related consumption motives, and then have a positive impact on the intention of organic food consumption. The empirical results show that marketers in the organic food section should understand the needs, values, and benefits of organic foods perceived by consumers with each consumption motive in terms of health and environmental aspects with the aim to make effective marketing communication strategies. Specifically, marketers should use the most authoritative scientific evidence to emphasize the health and safety of organic foods. If consumers feel more that organic foods can provide health and safety benefits to meet their health needs, they will become more willing to consume organic foods. Similarly, marketers should let consumers with an environmental motivation understand that the production and packaging of organic foods are carried out in a way that protects the environment (Lockie et al., 2002). In this way, consumers can be confident that organic food production strictly abides by environmental principles, which will strengthen their organic purchasing behavior. Marketing personnel should aim to improve consumers' awareness and knowledge of organic products to promote consumption (Marreiros et al., 2021).

Besides, the results show that perceived uncertainty has a negative moderating effect on the relationship between the consumer's health motives and the purchase intention of organic products. As the perceived uncertainty comes from consumers' incomplete information and risk perception in the process of transaction, marketers should convince consumers by providing reliable information, so as to enhance consumers' confidence in the health benefits of organic foods. The literature shows that to improve the ability of consumers to verify the attributes and values of organic foods publicized by organic food suppliers, it is necessary to establish public trust in the organic food certification system and organic food traceability system (Janssen and Hamm, 2011). Although the food traceability system is widely used in the organic food industry to reduce the information asymmetry between consumers and suppliers (Chen and Huang, 2013), the traditional food traceability system is difficult to ensure its objectivity and fairness, so the latest blockchain technology should be introduced. Blockchain food traceability system has the characteristics of full transparency, traceability tracking, and tamper proof, which can ensure the authenticity of the information. As China's organic market is still in the development

[3]Impact of organic agriculture on climate change. http://news.sciencenet.cn/sbhtmlnews/2019/1/342478.shtm?id=342478

stage, it is very important to establish a reliable organic food system and provide reliable and comprehensive information for improving consumers' confidence in organic foods.

Besides, the results indicate that perceived uncertainty has a positive moderating effect on the relationship between consumer environmental motives and the intention of organic purchase. This means that a strong sense of uncertainty toward organic foods positively moderates the influence of EC on consumers' willingness to buy organic foods. Based on the aforementioned discussion, we believe that the agricultural sector needs to improve the environmental attributes of organic agriculture. In the process of developing from traditional organic agriculture to industrialized organic agriculture, practitioners should not only use scientific and technological means to ensure and strengthen the health and environmentally friendly attributes of organic foods but also reduce and eliminate the adverse factors on the environment in the process of organic agriculture planting, so that organic agriculture can truly evolve into green organic agriculture.

Limitations

This study inevitably has some limitations. First, this study does not consider other values such as biosphere value and Confucian value, which were found to influence pro-environmental behavior (Shin et al., 2017; Zhang et al., 2020). Second, this study did not conduct random sampling during the survey, which makes the representativeness of the sample insufficient. In the future, if we want to reveal Chinese consumers' willingness to buy organic foods, it is necessary to carry out a large-scale random sampling survey. Finally, the self-report method used in this survey has its inherent defects. In the future, laboratory research methods can be considered to reveal and verify the impact mechanism of organic food consumption.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SW: conceptualization, data curation, project administration, and supervision. FL: formal analysis and methodology. SS: investigation. SS and FL: Writing—original draft. SS and RW: writing—review and editing. All authors contributed to the article and approved the submitted version.

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ORIGINAL RESEARCH
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The Effect of Nudging in Promoting the Consumption of Organic Fruits and Vegetables

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A field study collecting behavioral data was conducted to investigate effects of behavioral interventions, commonly known as nudges, in promoting the consumption of organic fruits and vegetables. Consumption, both organically and conventionally produced fruits and vegetables, was measured in a grocery store during 4 days (1 day every other week) where consumers were exposed to informational messages in combination with either emotional images or social norm messages. Measurements of daily consumption without exposure to nudges were carried out during four other days (1 day every other week, alternated with the nudging days). The results showed no effect of the nudging strategy; instead, it pointed to the importance of the price as a determinant of buying decisions. Buying ecological alternatives was associated with lower price differences between the ecological and non-ecological alternatives. We conclude that combined nudges and collected psychological data from participants may contribute to more successful nudging interventions. Some political measures in balancing the price difference between organically and conventionally produced products might also be interesting strategies in order to promote the consumption of organic fruits and vegetables.

Keywords: organically and conventionally produced fruits and vegetables, nudging, consumer choices, field study, ecological food

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INTRODUCTION

The consumption of organic food products is growing rapidly worldwide, which may be due to the fact that production, handling, processing, and marketing of organic food have to meet certified organic standards where the use of synthetic fertilizers, pesticides, and genetic modification is not allowed (Brantsæter et al., 2017). More strict standards for products to be labeled as organic may offer a guarantee to consumers that the chosen products are truly organic and may have contributed to the increasing consumption. The overall aim of the organic agriculture is to sustain or improve the health of the soil and the ecosystem from the smallest organisms in the soil to human beings. According to the review of Brantsæter et al. (2017), pesticide residues exposure is clearly lower with organic foods as compared with conventional foods, but the potential specific impact of this difference on human health is still unclear. This positive impact on health of the soil and the ecosystem, influenced by organic food, highlights the need of behavior change toward an increased consumption of organic food products. In fact, the focus on the climate impact of food consumption is increasing, and the recent

pandemic situation has contributed to a raised focus on health concerns and risk perception related to food consumption (Yin et al., 2021). In a recent study, Yin et al. (2021) could show an increase on organic agricultural products purchase intention as a consequence of the health awareness post-COVID-19.

In general, an increasing number of studies are pointing to the benefits of organically produced food in terms of reducing climate change. Strategies of incentivizing the consumption of organic food products have thus also become highly necessary in order to diminish climate change and to promote environmental sustainability (Koger and Winter, 2010; Gifford et al., 2011; Intergovernmental Panel on Climate Change, 2014; Clayton et al., 2015). The present study examines how the nudging framework can contribute to the desirable increase in consumption of organically produced food products.

Modifying choice situations to make climate-friendly consumption easier originates in applied behavioral analysis. The behavioral analytic approach emphasizes observable actions and contextual variables that can be manipulated to promote behavior changes (Geller, 2002; Lehman and Geller, 2004; Schultz and Kaiser, 2012) and is based on the principles of operant conditioning with origins in the work of Skinner (1953, 1971).

Mainstream economics, e.g., neoclassical economics, assume that individual behavior is based on the rational nature of human beings, following the logic that important incentives people react to are influenced by price and choice. Behavioral sciences, drawing on insights from cognitive- and social psychology, stress that besides price and availability of options, behavioral biases, and the decision context also influence choices that people make, often routinely. Behavioral economics relate the decision context, the environment in which individuals make choices, to economic questions (Kahneman, 2013) and the decision context is what Thaler and Sunstein (2008) refer to as "choice architecture."

Altering the social and physical environment or changing the way options are presented to people may increase attractiveness of a particular option, a preferred or even default choice. Thaler and Sunstein (2008) refer to an example of a cafeteria, where different types of foods are placed in different order have implications for the customer's choice of food. This means, by changing the layout of the store or the order of the placement of food in a cafeteria, "choice architects" may influence peoples' behavior. These perspectives of the environment or elements of behavior architecture have been named "nudges" and are designed based on insights from cognitive and social psychology and lately behavioral economics. Nudges rely on the idea of choice architecture that may include changes in infrastructure or the environment that guide and enable individuals to make choices almost automatically. Accordingly, nudges do not try to change one's value system or increase information provision. Instead nudges focus on *enabling behaviors* and individual decisions for the benefit of private and often public interests (Kahneman, 2011).

Originally, the term nudge was used in the context of behavior change as defined by Thaler and Sunstein (2008, p. 6) "… any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting the fruit at eye level counts as a nudge. Banning junk food does not."

Defining nudge in this way is being discussed in existing literature, among other things to be too general and unspecific. According to Sunstein (2014), nudge tools include defaults, working with warnings of various kinds, changing layouts and features of different environments, reminding people about their choices, drawing attention to social norms, and using framing in order to change behavior. Coercive policy instruments such as laws, bans, jail sentences or economic, and fiscal measures, e.g., taxes or subsidies, are not nudges according to Sunstein (2014).

Over the last 10 year nudges have been used in a wide variety of domains with the aim of influencing the choices of individuals and society as a whole, including personal finance, healthy- and sustainable lifestyles, businesses in their marketing, and governments as policy instrument (Szaszi et al., 2018). However, as the implementation of nudges as a public policy instrument has increased, so has the critical voices. Present multidisciplinary perspectives on the ongoing nudging debate are dominated by three assumptions: nudges are a simple and effective means for steering individual choices; they are easily implemented in public policy; and but they represent a possible threat to autonomous decision making (de Ridder et al., 2020). Based on research examining nudging from the perspectives of behavioral-, philosophical-, and political science, de Ridder et al. (2020) argue that none of these assumptions have strong support. Rather, they suggest that nudges are more legitimated than expected, nudges may increase autonomous decision making and that the implementation of nudges are far from easy.

To illustrate the underlying cognitive processes of nudging, Kahneman (2011) describes two systems of thinking: (1) a fast system (automatic and intuitive) and (2) a slow system (deliberate and conscious). While the fast system is guiding large parts of our daily behaviors, which we do routinely, almost automatically, e.g., taking a walk, driving the car, and buying our daily food, the slow system relies on a much greater deliberate mental effort when we need to make decisions about important choices in life. That means that the fast system relies on heuristics (rules of thumb), mental shortcuts, and biases, while the slow system is governed by reflective and conscious processes and uses detailed multi-criteria cognitive evaluations, e.g., when people buy a house or choose a new job. According to Kahneman (2011) and Thaler and Sunstein (2008), an application of nudging is based on automatic, intuitive, and unconscious processes. This automatic way of making decisions may be described as cognitive and/or affective task-relevant processes that take place outside conscious awareness and guide large parts of our daily behaviors, that is, those things which we do routinely, almost automatically.

Previously established policy tools and strategies for changing behavior are mostly focused on the slow system, which is based on some degree of information together with cognitive processes to make rational choices. For that reason, the intention

to promote people's rational choices are often combined with providing information and incentives, even if studies demonstrate that providing information does not necessarily lead to changes in behavior (Abrahamse et al., 2005; Steg and Vlek, 2009; Grunert and Aachmann, 2016).

According to Kahneman's terminology (2011) relying on the fast system of thinking, behavior change does not always mean that we need to change minds. Instead, nudge means carefully guiding people's behavior in desirable direction and arranges the choice situation in a way that makes the desirable behavior to the easiest or most attractive option. Nudges may be appropriate when choices have delayed effects, when they are complex or infrequent and thus, learning is not possible, when feedback is not available, or when the relation between choice and outcome is ambiguous, as suggested by Thaler and Sunstein (2008). Many situations in everyday life do not require active decision-making choices; instead, it is more appropriate to speak of routine or habitual behaviors. As about 45% of our everyday actions are behaviors that are not actively reflected upon (Verplanken and Wood, 2006), nudges may likely be appropriate for both routine behaviors and complex decisions that require more of people's cognitive capacity than is manageable in daily life (Lehner et al., 2016).

However, recent studies have shown that individual goals and plans are important moderators of nudge effectiveness. These findings do not support the belief that nudge interventions have straightforward effects on behavior, especially as growing evidence is revealing that such effectiveness does not rely on a fast system of thinking. Rather, nudges can also be effective when recipients are aware of their presence and have the opportunity to reflect on their choices (de Ridder et al., 2020).

Concerning the effectiveness of nudging as a way to influence food choice, the empirical evidence remains contradictory (Nornberg et al., 2016; Broers et al., 2017). In their meta-analysis, Broers et al. (2017) found it reasonable to conclude that nudging does have an effect on fruit and vegetable choice, sales, or servings, and that among the different nudges, altering the placement and combined nudges seem to be the most effective ones.

Tools that count as nudging and have been applied in the food domain to influence food consumption include (1) simplification and framing of information, (2) changing layouts and features of different environments, (3) changes to the default policy, and (4) drawing attention to social norms in order to change behavior (Naturvårdsverket, 2014; Sunstein, 2015). Based on the insight that the amount, accessibility, and complexity of information provided to people affect the outcomes of decisions, nudging builds on presenting a more simple and straightforward information in order to promote a desirable behavior. Simplification in combination with framing, a conscious phrasing of the information, may also encourage decision making by activating people's values and attitudes (Lehner et al., 2016). Simplified information tailored to specific choice situations increases the likelihood of influencing individual consumers in making certain information more salient. A recent study showed that grocery shoppers base their choices in supermarkets on a small number of salient factors. The more important were price (for 46% of respondents) and health (36%), but they can be modified depending on the choice context (Kalnikaitė et al., 2013). An example of information simplification and framing is food labeling. Focusing on health and environmental aspects of food, a design of a "traffic light system" of information provision can be a successful strategy to frame the consumer decision in line with learned-in reactions to traffic lights (i.e., red is bad; green is good; Sacks et al., 2009). However, the efficacy of the traffic lights strategy depends on the degree of self-control of the consumers. Koenigstorfer et al. (2014) showed that traffic lights labeling only helped consumers with low self-control to reduce their food purchasing behavior.

Individuals' consumer choices are also affected by the physical environment. Changed accessibility, presentation, proximity, and visibility of food have significant impact on the type and amount of food consumed (Lehner et al., 2016; van Gestel et al., 2020). One way to nudge people into buying certain products is to place these products on shelves at the eye level. Also, products that are situated closest to cashier are the ones that are often sold (Goldberg and Gunasti, 2007). Another nudging tool, to do changes in the default policy, is based on the fact that most people prefer not to act, unless they have to, and that most people tend to postpone their actions, to procrastinate. For that reason, they are easily influenced by defaults, standard choices, which determine the result in case people take no action. For example, a single-sided print option is a default which contributes to much higher volumes of paper than if default would have been double-sided copy. Egebark and Ekström (2016) demonstrated in a Swedish study that 30% of paper consumption is determined by the default and that by switching the default options paper consumption could be reduced by 15%. Defaults have also been used in food research; a study by Loeb et al. (2017) shows that parents select healthier breakfast options for their children when they are readily available (v. only available on request).

Finally, human behaviors are strongly influenced by social norms, which according to Cialdini et al. (1990) affect the individual in two ways, as injunctive norms, and as descriptive norms. The injunctive norms affect the individual to act based on moral guidelines, i.e., what ought to be done in certain ways. The descriptive norms, on the other hand, point to how most people behave (the "normal" way), thus giving the individual a benchmark on how to best act in a particular situation. The norm must be salient, visible, to the individual in order to exert influence on behavior (Cialdini and Goldstein, 2004). In a well-known study, Goldstein et al. (2008) use the power of descriptive norms to change the reuse rates of towels among hotel guests. They placed the text "the majority of guests reuse their towels" in bathrooms and this produced significantly better reuse results than information solely focused on environmental protection.

The guiding question beyond the present research is whether nudging can promote behavior change in the food consumption domains with largest environmental impacts. Nudging might be a promising tool for advancing sustainable consumption because nudge tools do not restrict consumer choice and does

not entail coercion and thus reduces potential resistance (Sunstein, 2015). The aim of the present study is to investigate the effect of nudges on the consumption of fruits and vegetables. Lehner et al. (2016) and Sunstein (2014, 2015) suggest that simplified information tailored to specific choice situations increases the likelihood of influencing individual consumers in making the certain information more salient. In addition, the application of social norms to reinforce behavior has been supported by Cialdini and Goldstein (2004), emphasizing that the norms must be visible to the individual. Thus, the present study will examine if such simplified information tailored to a specific organic product, in combination with descriptive and injunctive norms, in fact are effective nudges in promoting the consumption of organic products.

MATERIALS AND METHODS

Design and Procedure

A field study was conducted in cooperation with a grocery store in a small town in Sweden. The store is daily visited by a mean of 1,400 consumers and offers the consumers an extensive assortment of food and groceries. The town is located in a sparsely populated area with a population of middle income. The supermarket in the study is one of only two supermarkets in the town, located close to each other in the center of the town. During winter-, spring-, and summertime, the area is visited by a large number of tourists, among which a part is assumed to belong to a population of higher income. The time of the study was such a tourist period. The consumption of nine different fruits and vegetables, available as both organically and conventionally produced products, was measured during the opening hours, 8 a.m. to 9 p.m., eight consecutive Fridays. Organic and conventional products were placed next to each other on the same shelf. Nudging instruments, simplified information in combination with descriptive and injunctive norms, as described more in detail in "Materials," were applied directly to the selected organic products and were visible to the consumers four Fridays every other week (the nudge days, weeks 2, 4, 6, and 8). No nudging instruments were applied on the other four Fridays (the baseline days, weeks 1, 3, 5, and 7).

Participants

Considering the intention to measure consumption over many hours, 8 days with 13 h each, we decided to avoid collecting data from participants who visited the store. Involving consumers in surveys or interviews could have negatively affected the store's daily routines and would have required large time resources from researchers. In addition, by answering questionnaires or participating in interviews, a learning effect could have arisen as many customers returned daily to the store and would then, over the days, have become aware of the aspects of choosing between organic- and conventional produced products which could have interfered with the intended effects of nudging. The focus was instead on the buying behavior itself and this method only allowed to collect data on the quantity of sold products, for each week and each product. Furthermore, we did not interfere with other aspects of the selling process, e.g., the price of a given product could vary from week to week. Therefore, data on the selling prices were also collected.

Materials

Signs were made specifically for nine different products, two fruits and seven vegetables. The fruits, lemon and apple, and the vegetables, cherry tomato, carrot, pepper (paprika), iceberg lettuce, rucola, broccoli, and baby spinach, were selected because they were available both as organically and conventionally produced products in similar quantities (e.g., same weight). Paper signs, coated in plastic, had an A5 size (6×8, 4 inches) and a color photo of the product at the top. Below the photo, all signs had a short text presenting a simple and straightforward information in order to promote the desirable behavior of choosing that specific organic product, e.g., *Organic carrots are grown in a way that improve the health of the soil.* At the bottom of the signs of lemon, carrot, iceberg lettuce, broccoli, and baby spinach, there were either a descriptive norm referring to the behavior of others, e.g., *Increasingly more people buy organic lemons in recent years,* or an injunctive norm referring to what ought to be bought, e.g., *If you choose organic baby spinach, you will spare the environment.* Instead of social norms, signs for apple, cherry tomato, pepper, and rucola contained an emotional image of a happy face at the bottom. The package of the organic and control products was identical. Regarding the positioning of the different products in the shelves, although we did not interfere with the routines of the supermarket, could be considered equivalent.

Measures

The consumption data of the targeted products were selected and delivered from the general digital registration of consumption in the grocery store, i.e., each week, we received a list containing the quantity of each product sold and the price per unity.

Analysis

Given the method used to collect data, we could not have access to the individual choices done, i.e., we could not analyze data at the participant level. Instead, we had the list of products sold, with the quantity and the total amount of money payed, so we could calculate the price/unit of each product. Therefore, in order to test, if the choices done (ecological alternative or not) could be predicted from the experimental conditions (control or nudging weeks), we run logistic regressions for each product. As there was a great variability in the prices, namely, comparing each week the ecological and the classical alternative, unit price for each product sold (ecological alternative or not) was also used as a predictor variable. Three of the products (broccoli, apple, and iceberg lettuce) were not sold in organic alternatives during the data collection period; therefore, the analyses were only run for the remaining six products.

RESULTS

The descriptive data, with the quantity of products sold, are presented in **Table 1**, and the prices of each product are represented in **Table 2**.

In order to compare the buying behavior in the weeks with and without the exposure to nudges, logistic regression was computed for the different products. The number of sold products (eco/no-eco) was the dependent variable, and condition (control vs. nudge), unit price for each product, and period (first 4 weeks or last 4 weeks) were the predictors. Separate analyses were performed for the six products. Regarding spinach, lemon, rucola, and carrot, no significant results were obtained.

Regarding tomatoes, the logistic regression model was statistically significant, $\chi^2(3) = 117.67$, $p < 0.001$, explaining 24.9% (Nagelkerke R^2) of the variance in the choice of ecological products. Both nudging and period could significantly contribute to this prediction ($p < 0.01$). There were more choices of ecological tomatoes in the second period, and contrary to our hypothesis, more in the control weeks than during the nudging weeks.

The logistic regression model of pepper was also statistically significant, $\chi^2(3) = 189.39$, $p < 0.001$. The model explained 90.4% (Nagelkerke R^2) of the variance in the choice of ecological or no-ecological products. Control condition (compared to nudging, $p < 0.001$), lower price ($p < 0.001$), and second period (compared to the first one, $p < 0.05$) could predict more sold ecological products (see **Table 1**).

In **Table 3**, we can see the relationship between the percentage of ecological sold products and the relative price, for the two products with significant results in the logistic regression—tomatoes and pepper.

TABLE 1 | Quantity of sold products (ecological or non-ecological), for each condition (control and nudging), in the first or the second period of the experiment.

Product	Moment 1		Moment 2	
	Control	Nudging	Control	Nudging
Spinach				
Eco	7	10	10	8
Non-eco	30	23	12	18
Lemon				
Eco	50	31	28	43
Non-eco	145	191	185	184
Tomato				
Eco	76	24	142	12
Non-eco	86	71	56	104
Pepper				
Eco	20	16	8	9
Non-eco	28	51	31	30
Rucula				
Eco	9	14	11	7
Non-eco	23	32	32	17
Carrot				
Eco	no data		19	15
Non-eco	no data		63	61

DISCUSSION

The current study represents a field experiment in order to investigate effects of a behavioral intervention among supermarket shoppers where the strategy of nudging is used to promote pro-environmental consumer behaviors. In general, the results did not support our hypothesis that nudging could contribute to enhance the consumption of organically produced fruits and vegetables. In fact, apparently, it was the other way around. Except the missing results for spinach, lemon, rucola, and carrot, sales of ecological tomatoes and pepper decreased comparatively in the nudging weeks. However, this is an illusory result. As it can be seen in **Table 2**, the unit price of ecological pepper was almost twice the price of the non-ecological alternative in weeks of both control- and nudging condition during the first 4 weeks (Moment 1). Therefore, it is not so strange that in the nudging weeks of Moment 1, the selling of (less expensive) non-ecological pepper

TABLE 2 | Mean price of sold products (ecological or non-ecological, in swedish crowns), for each condition (control and nudging), in the first or the second period of the experiment.

Product	Moment 1		Moment 2	
	Control	Nudging	Control	Nudging
Spinach				
Eco	21.3	21.3	21.3	21.3
Non-eco	19.1	19.2	18.7	19.0
Lemon				
Eco	9.3	9.3	9.2	9.3
Non-eco	9.5	9.4	8.6	9.5
Tomato				
Eco	14.2	19.5	14.2	19.6
Non-eco	12.4	12.5	14.2	10.1
Pepper				
Eco	40.0	39.9	35.2	22.1
Non-eco	22.6	22.6	20.8	20.1
Rucula				
Eco	21.3	21.3	21.3	21.3
Non-eco	18.9	18.7	18.7	19.2
Carrot				
Eco	no data		24.0	22.3
Non-eco	no data		13.3	13.3

TABLE 3 | Percentage of eco products sold (tomatoes and pepper) and the relative price (non-eco alternative = 1), for each condition (control and nudging), in the first or the second period of the experiment.

Product	Moment 1		Moment 2	
	Control	Nudging	Control	Nudging
Tomato				
Percentage eco	46.9%	25.2%	71.7%	10.3%
Relative price	1.15	1.56	1	1.94
Pepper				
Percentage eco	41.7%	23.9%	20.5%	23.1%
Relative price	1.77	1.77	1.69	1.10

was more than three times higher than the number of ecological pepper. The same phenomenon was observed during the last 4 weeks of the study (Moment 2) with a higher unit price of the ecological pepper, especially during weeks of control condition, resulting in more than three times higher selling of non-ecological pepper.

Regarding tomatoes, the selling of ecological tomatoes is lower during weeks of nudging condition in both Moment 1 and Moment 2 with a higher unit price compared to non-ecological tomatoes. Only in the control condition during Moment 2, where no price difference between the ecological and the non-ecological products exists, almost three times higher sales of ecological tomatoes can be found.

In general, it seems that the price was a determinant factor for buying choices. In fact, the buying of ecological alternatives was related to the price index. When the ecological products were much more expensive than the conventional correspondent products, people bought less of the organic ones. In addition, the pricing of the fresh products caused difficulties as they varied regularly depending on factors as the quantity of products received or their freshness.

Regarding tomatoes, it is clear that when the price of the ecological and the conventional alternatives were similar (i.e., in both control moments), the percentage of ecological choices was higher. For example, in moment 2, when the price was the same, more than two-thirds of the sold products were ecological. Therefore, it is reasonable to conclude that the price difference was crucial to decide which alternative to buy.

Regarding pepper, the relationship between the price difference and the ecological choices was not so clear, but we can see that the price of the ecological alternative compared to the conventional one was almost the double. With such big price differences, it is more difficult to influence the choice of more ecological alternatives.

This importance of the price is well in line with earlier research where Kalnikaitė et al. (2013) found that consumers in grocery stores base their choice of products on very few factors among which price was the dominating factor. Aschemann-Witzel and Zielke (2017) also concluded that price is the major perceived barrier to purchase of organic food, a result that calls for some kind of action. One may consider that consumers with limited budgets are more likely to be hindered from consuming organic food and for this reason organic food may be offered in schools and housing for elderly as a green public policy. Such type of government subsidies should cause only limited social consequences as pupils in schools and elderly in public housing in Sweden anyway receive most of their food for free. However, there is a need of further research to examine whether different public subsidies will have the desired impact in terms of consumption, environment, and social inequality. The public could also provide more consumer information about price gaps, costs of organic production, and benefits of organic food in order to promote organic consumption (Aschemann-Witzel and Zielke, 2017).

Again, trying to explain the fact that the prices could vary so much, one may consider other financial consequences, as mentioned by Benartzi et al. (2017). They describe that product quality varies across time and seasons, e.g., it was observed that some days the organic tomatoes were slightly overripe, which may have reduced the effect of nudging. Furthermore, recent research on consumer behavior (e.g., D'Acunto et al., 2021) has shown the importance of daily confrontation with grocery prices to shape expectations about future inflation, and therefore future economic decisions. More specifically, more than the absolute price, it is the frequency of purchasing and price increases that affect expectancies (D'Acunto et al., 2020).

The current study has targeted two of the nudging tools commonly applied in the food domain to influence food consumption and mentioned above (Sunstein, 2014, 2015; Lehner et al., 2016). These tools, simplification, and framing of information and drawing attention to social norms were used together on six of the nudging signs, whereas attention to social norms was replaced by an emotional image of a happy face on four of the nudging signs. As mentioned earlier, combined nudges have been pointed out by Broers et al. (2017) to have an effect on consumption of fruit and vegetable. In this way, we tried to maximize possible effects of nudging, as the effect of each tool separately was not possible to analyze in our data.

To get a better understanding of nudging in the area of food consumption, additional nudging tools could have been applied, for example, changes in the physical environment and changes to the default policy. Despite earlier confirmed impact of changes in the physical environment on the desired consumption, as changed accessibility, presentation, and visibility of food products (Goldberg and Gunasti, 2007; Lehner et al., 2016; van Gestel et al., 2018), in the present study, it would have been difficult to apply a repositioning of the organic products without disturbing the daily business routine of the grocery store too much. A consequence of this method was that sometimes there were significant price differences between the organic product and the correspondent non-organic one. This difference, which was almost always in the direction of organic products being more expensive, could be as high as 2.5 times. Therefore, when analyzing the results, we had to take price differences in consideration. In future studies, it would be of interest to seek appropriate agreements in advance with food store owners in order to apply all relevant tools for nudging in interventions, and, if possible manipulate the price of some products in order to do comparisons with similar prices.

Considering recent research efforts within the two major areas of nudges, food and climate change, although the results are not very encouraging, some hope exists that nudging can be an interesting strategy in applied research contexts. In general, a considerable potential of nudging in food consumption has been found in laboratory experiments, whereas nudging experiments in real life are less controllable and have so far shown more limited success. This may be due to the opposing power of marketing together with the varying reactions of individuals as discussed by

Lehner et al. (2016). The advantages of a field study, however, can be attributed to a high external validity with the associated possibility to generalize the result to other situations in real life. Another advantage is the objectivity of the outcome measure in this study as measuring behavior is always very accurate and exact.

As empirical evidence regarding the effectiveness of nudging has thus far remained contradictory, according to Broers et al. (2017), continued extensive research is required. This also applies to the fact that widely accepted classification of nudging tools or techniques is still missing (de Ridder et al., 2020).

Thus, making nudging successful, a possibility would be to apply it in environments with high level of control over the behavior of consumers and with little or no interference by other actors, e.g., in school canteens. Because so many competing factors affect the individual through marketing in the retail store, nudging has difficulties to be very impactful. However, it is important to challenge the environment where most daily choices of food products are taken, namely, in the food stores, in order to achieve more sustainable food consumption.

The intention was to carry through the study totally anonymous, without the possibility of analyzing individual behaviors, which resulted in no information that might have contributed to a better understanding of individual consumer choices. It may be considered a limitation that no participants were identified in the current study but the ambition was to carry through the study without disturbing the everyday trade in the store and to be close to the normal reality and increase ecological validity of the study. This strategy finds support in the review of Broers et al. (2017) where they report difficulties in keeping track of participants in field studies. Nudging interventions usually last for several days where it is often unclear how to collect data from a varying number of participants and observations. It is only possible to measure the actual behavior when participants are tracked (anonymously) which could make them more aware of the intervention and block the automatic and intuitive way of reacting to the nudge (Broers et al., 2017). Nevertheless, in order to achieve a better insight in the desired and sustainable behavior, future nudging studies should include a sample size of identified participants (Broers et al., 2017). Also, Vandenbroele et al. (2020) are pointing out that recent studies have not been able to obtain significantly beneficial results from only changing the choice architecture and therefore refer to personal predispositions toward sustainable consumption in designing nudging interventions. Another interesting approach would be the use of robot-advising tools. The use of smartphones is very widespread in many countries, and the possibility of nudging through automatic messages directed to the consumers (and based on their usual consummation) is a promising new strategy. For example, D'Acunto and collaborators (D'Acunto et al., 2020) have used robot-advising nudges to change social norms about peer's consumption behavior. It is an encouraging way to reduce the efficacy of the automatic heuristic decision strategies by the application of algorithmic solutions (e. g. D'Acunto et al., 2019).

Being aware of the target audience and which nudges work for different persons should considerably increase the impact that can be achieved with a nudge. Where individuals carry a positive attitude or desire for a particular behavior but fail to behave in accordance with their attitudes, nudges appear to be more effective than in situations where the individual is consciously opposed to certain behavior (Kalnikaitė et al., 2013).

CONCLUSION

The aim of the current study was to investigate the effect of nudging in promoting the consumption of organic fruits and vegetables. The intervention in a grocery store revealed no effects of nudging, indicating that consumers tended to buy more organic products in case these products were less expensive or only slightly more expensive than conventional products. The price as a well-known barrier to purchase of organic food is discussed together with some measures that can be taken to compensate for the prevailing differences in price between organic and conventional products. Applying a combination of all available nudging tools to strengthen its effects and collecting psychological data from the participants to be aware of their attitudes toward choices of organic products were suggested. These actions should be taken in order to compensate for the grocery stores as environments with low levels of control due to many competing marketing factors, and in future studies, achieve more strong effects of nudging in promoting the consumption of organic fruits and vegetables.

AUTHOR'S NOTE

The content of this manuscript was also presented as an oral paper in the International Conference on Environmental Psychology, Plymouth, September 2019, and the abstract was published in the Conference handbook. Available at: https://www.plymouth.ac.uk/uploads/production/document/path/15/15210/Conference_handbook_FINAL.pdf.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

KW, RA, and FE designed the study and contributed to the manuscript, being KW the main author. KW was responsible for the data collection. KW and FE did the data analysis. All authors contributed to the article and approved the submitted version.

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How and When Daily Abusive Supervision Affects Daily Organizational Citizenship Behavior for the Environment

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Organizational environmental sustainability depends primarily on employees' organizational citizenship behavior for the environment (OCBE), and leadership plays an important role in improving and inhibiting employees' OCBE. The purpose of the present study is to examine the mediation process by which abusive supervision affects employees' OCBE through a daily diary study and to explore the boundary conditions of the relationship between daily moral disengagement and daily OCBE. We collected data from 112 Chinese employees for 10 consecutive days. The results show that daily abusive supervision has a significant negative effect on daily OCBE and that daily moral disengagement plays a significant mediating role in this relationship. In addition, the negative effect of daily moral disengagement on daily OCBE could be attenuated by a psychological green climate. Our findings support our hypotheses and offer useful theoretical and practical implications for promoting OCBE.

Keywords: abusive supervision, organizational citizenship behavior for the environment, moral disengagement, psychological green climate, daily diary study

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INTRODUCTION

In the context of today's growing local and global concerns about significant environmental issues, employee environmental actions are regarded as one of the main ways in which organizational environmental performance and environmental sustainability development can be improved; these sustainability behaviors are broadly referred to as employee pro-environmental or green behaviors and defined as "behaviors that employees engage in that are linked with and contribute to environmental sustainability" (Ones and Dilchert, 2012, p. 87; Wang et al., 2018; Sabbir and Taufique, 2021). Employee pro-environmental behavior can be divided into task-related (required) and proactive (voluntary) behaviors, and these behaviors differ in whether they are included in a formal role or a part of an organization's requirements (Lülfs and Hahn, 2013; Norton et al., 2015; Wu et al., 2021). The success of an organization's important environmental projects depends on voluntary pro-environmental behavior, which is not required by formal management systems (Boiral and Paillé, 2012). Boiral (2009) defines these voluntary behaviors as organizational citizenship behavior for the environment (OCBE), which is defined as "individual and discretionary social behaviors that are not explicitly recognized by the formal reward system and that contribute to a more effective environmental management by organizations" (p. 223); such behaviors include recycling, turning off electric appliances when not in use, preferring to use stairs instead of elevators,

using public transportation, and drinking from reusable cups and bottles (Bissing-Olson et al., 2013; Dumont et al., 2017; Wang et al., 2017; Yuriev et al., 2018; Mi et al., 2019; Anser et al., 2021; Chen et al., 2021). OCBE makes significant contributions to organizational environmental performance and competitive advantage (Del Brio et al., 2007; Jackson et al., 2012; Boiral et al., 2015); thus, scholars have become increasingly interested in predicting employees' level of OCBE (Bissing-Olson et al., 2013). Leadership has been highlighted as a key antecedent affecting employees' OCBE (Robertson and Carleton, 2018; Khan et al., 2021; Wang et al., 2021).

Scholars have explored the effects of different positive leadership styles, such as servant leadership, transformational leadership, empowering leadership, responsible leadership, ethical leadership, and spiritual leadership, on employees' OCBE (Afsar et al., 2016; Mi et al., 2019; Afsar et al., 2020; Raza, 2020; Cheng et al., 2021; Khan et al., 2021). However, the influence of leadership on employees' behavior is not always positive (Choi et al., 2019); a growing body of evidence indicates that leaders may engage in destructive leadership, "which is a broad construct that captures styles of leadership comprised of behaviors embedded within leadership influence processes that harm followers and/or organizations" (Mackey et al., 2021, p. 705), such as abusive supervision, exploitative leadership, toxic leadership, and evil leadership (Aasland et al., 2010; Zhang and Liao, 2015; Milosevic et al., 2020). Studies have shown that there is a great difference in how individuals process positive and negative information (Schmid et al., 2018); specifically, negative information or behavior often has a stronger and more enduring impact than positive information (Baumeister et al., 2001). Although we know much about the impact of positive leadership on OCBE, less is known about the effect of destructive leadership on OCBE. As a typical form of destructive leadership, abusive supervision has attracted the greatest amount of attention in the organizational behavior research field (Zhang and Liu, 2018; Zappalà et al., 2022); therefore, we will focus on the effect of abusive supervision on OCBE.

As a form of immoral behavior, abusive supervision violates moral standards and seriously affects employees' ethical behavior within an organization (Park et al., 2018). Moral disengagement theory provides an explanation mechanism for their relationship; employees' negative experiences of contextual factors may activate individuals' moral disengagement, which in turn guides good and bad behavior (Detert et al., 2008; Khan et al., 2019). Moral disengagement refers to an individual's ability to deactivate moral self-regulation and self-censure, which allows individuals to engage in behavior that is inconsistent with moral standards without the associated self-sanction and guilt (Samnani et al., 2014). As a cognitive defense and justification mechanism (Zhao et al., 2021), moral disengagement is activated when individuals are in stressful job situations (Fida et al., 2015). Previous studies have found that moral disengagement is an important cognitive mechanism that is used to explain an individual's behavioral decisions when he or she encounters negative treatment (Rice et al., 2020; Zhao et al., 2021). Therefore, moral disengagement may provide a compelling theoretical foundation for understanding the inhibiting mechanism of OCBE in abusive supervision situations.

Moral disengagement theory emphasizes the role of situational factors in the expression of moral thoughts and actions; to be more specific, people should not only regulate their behaviors to align with their internal moral standards but also ensure that their behaviors conform to the moral expectations of their situation (Bandura et al., 1996; Huang et al., 2019). This is in line with the person–situation interaction perspective that OCBE is likely to be affected by personal and situational factors (Inoue and Alfaro-Barrantes, 2015). As a much-drawn organizational contextual factor, psychological climate plays a critical role in driving individual behavior (Rubel et al., 2021; Biswas et al., 2022). A specific psychological climate has a close effect on specific behaviors, such as the relationship between an ethical climate and ethical behavior (Wang and Xiao, 2021), and the relationship between an innovation climate and innovative behavior (Newman et al., 2020). Thus, it is necessary to consider the psychological green climate as a contextual factor when studying the formative mechanism of OCBE, which refers to employees' perceptions and interpretations of organizational policies, procedures, and practices regarding environmental sustainability (Dumont et al., 2017). As stated above, we examine whether a psychological green climate could attenuate the negative effect of daily moral disengagement on employees' daily OCBE.

Previous studies that investigated predictors of OCBE have largely focused on stable differences between individuals; however, there is accumulating evidence not only that employees differ from each other in their average or typical levels of OCBE but also that individual employees' level of engagement in OCBE can vary substantially over time, for instance, across workdays (Bissing-Olson et al., 2013). Therefore, studies that focus solely on between-person factors may neglect an important source of variability in behavior, as within-person factors can explain a significant amount of variance in such behavior (Ohly et al., 2010). Therefore, there have been increasing calls for researchers to place greater emphasis on within-person variations in behavior, which can illuminate the factors associated with the emergence of behavior as it occurs (Norton et al., 2015). Furthermore, recent studies have found that the levels of abusive supervision and moral disengagement vary from day to day (Huang et al., 2017; Vogel and Mitchell, 2017). By integrating the within-and between-person approaches, the present study investigates the dynamic mechanism of daily abusive supervision affecting daily OCBE *via* daily moral disengagement and the role of psychological green climate as a between-person level boundary condition in the relationship between daily moral disengagement and daily OCBE.

The present research contributes to the environmental literature in the following ways. First, previous studies have demonstrated that positive leadership, such as spiritual leadership, responsible leadership, inclusive leadership, authentic leadership, and supportive leadership, has a significant effect on OCBE (Anser et al., 2021; Wu et al., 2021). While the destructive leadership associated with OCBE has not been studied in-depth, understanding the nature of these obstacles might shed more

light on the success of environmental behaviors (Yuriev et al., 2018). This study examines the negative effect of abusive supervision on OCBE and reveals the leadership obstacles that impede employees from engaging in OCBE, which could help organizations overcome these obstacles. Second, this study used the daily diary method to examine the mechanism of abusive supervision on OCBE. Compared to the static approach, this approach could reduce retrospective bias and social desirability (Vogel and Mitchell, 2017). More importantly, it could explain the short-term variation in daily OCBE.

CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

Daily Abusive Supervision and Daily Organizational Citizenship Behavior for the Environment

Abusive supervision refers to any display of hostile verbal or non-verbal behavior (excluding physical contact), and these behaviors are likely to vary on a day-to-day basis (Barnes et al., 2015). Employees attach importance to how they are treated by their leader; when individuals are criticized and ridiculed by abusive supervisors, they may feel that they have been treated unjustly or improperly and are not being treated with dignity or respect (Dedahanov et al., 2021; He et al., 2021). In response to this affront, subordinates are prone to punish an abusive boss by purposefully withholding additional efforts that would benefit the organization (Lyu et al., 2016; Johnson et al., 2020). One such response could logically be the withholding of volitional behaviors, such as organizational citizenship behavior, which are not a requirement of the job and could run counter to the goal of retaliation by making the supervisor's job easier (Harris et al., 2011; Zhang and Liao, 2015). In the environmental literature, scholars have also confirmed that as a form of organizational citizenship behavior (Zientara and Zamojska, 2018), OCBE is also affected by the treatment experienced from supervisors (Paillé et al., 2020). Extant studies have found that employees are more prone to behaving responsibly toward the environment on the job if they perceive that their supervisors are supportive (Paillé et al., 2019; Paillé and Meija-Morelos, 2019). In contrast, when subordinates perceive their supervisors' attitudes and behaviors as being unfavorable or unsupportive, they tend to withhold OCBE (Chen et al., 2021). In brief, supervisors' style of support is crucial in influencing subordinates' proactive involvement in environmental management; thus, OCBE can be considered a form of repayment in exchange for support (Paillé et al., 2013), while a lack of managerial support is a major impediment to employees' environmental behaviors at work (Paillé and Mejia-Morelos, 2014). In this vein, as a non-supportive leader behavior (Usman et al., 2021), abusive supervision is expected to undermine employees' motivation to be involved in OCBE because, in addition to offering less support, abusive supervision includes supervisors engaging in hostile and injustice behaviors toward employees.

Hypothesis 1: Daily abusive supervision has a negative effect on daily OCBE.

Mediating Role of Daily Moral Disengagement

According to moral disengagement theory, moral disengagement includes three broad and eight specific interrelated mechanisms, namely, cognitively reconstructing unethical behaviors (moral justification, euphemistic labeling, and advantageous comparison), obscuring or distorting consequences (displacement of responsibility, diffusion of responsibility, and distorting consequences), and devaluing the target (dehumanization and attribution of blame) (Bandura et al., 1996; Samnani et al., 2014). Employees use a moral lens to process supervisors' behavior (Low et al., 2019); thus, leaders have a key influence on the extent to which their subordinates habitually enact morally disengaged cognitions in the workplace (Moore et al., 2019). Repeated observations or experiences of unethical behaviors likely increase individuals' moral leniency and forgetting of moral norms, which can result in the observer's gradual moral disengagement, even without taking notice of this change, the situation may eventually reach a level where moral disengagement becomes the observer's thoughtless routine behavior (Arain et al., 2021). Previous research has found that perceived victimization resulting from negative and unethical supervisory behavior, such as abusive supervision, might lead subordinates to feel dissatisfied with their supervisors or organizations, which in turn decreases their levels of moral self-regulation and increases their levels of moral violations, thereby ultimately triggering a moral disengagement process (He et al., 2019; Rice et al., 2020).

Moral disengagement may be an effective protection strategy for coping with abusive supervision (Fida et al., 2015) because it allows individuals to retaliate against their leaders and organizations without feeling guilty and distressed by reframing the related actions such that they no longer seem immoral (Huang et al., 2017). As such, moral disengagement may inhibit abused employees' prosocial behaviors at work (Newman et al., 2019), such as their OCBE. For example, abused people could resort to distorting the consequences of their actions to sanitize the harm they cause, thus reducing their feelings of distress. In the context of OCBE, people argue that their personal environmental behavior is negligible in terms of causing significant harm to the environment (Wu et al., 2020). As stated above, on a given day, employees who report having been subjected to more abusive supervisory behavior tend to also report having relatively high levels of moral disengagement, which in turn makes employees less likely to engage in OCBE.

Hypothesis 2: Daily moral disengagement mediates the negative relationship between daily abusive supervision and daily OCBE.

Moderating Role of Psychological Green Climate

As mentioned above, moral disengagement is a major internal impediment to employees' pro-environmental behaviors; in

addition, according to moral disengagement theory, individual behavior is regulated not only by internalized moral factors but also by special situational factors (Inoue and Alfaro-Barrantes, 2015). That is, individuals should not only pay attention to weigh, calculate, and integrate morally related information to ensure that their behaviors do not cause guilt and distress but also perceive and interpret their work environment as operating in accordance with their perceptions of the organization's policies, procedures, and practices (Zheng et al., 2019). A psychological green climate provides employees with cues that, in addition to pursuing economic benefits, organizations also pay attention to green-related decisions and behaviors (Dumont et al., 2017). A strong psychological green climate means that their organization values and advocates employees' environmental behaviors, i.e., that it is valuable, appropriate, and desired to engage in OCBE in their organization (Norton et al., 2014). Thus, in this context, although employees are able to withhold OCBE without suffering from guilt and distress, they are also less inclined to make this choice because in such an organization, employees commonly share the value of environmental behaviors; thus, engaging in OCBE can not only make a good impression on the organization but also relieve stress caused by cognitive dissonance (Norton et al., 2017; Huang et al., 2019).In a low-level psychological green climate, organizations express less concern about employees' pro-environmental behaviors, and the psychological green climate is no longer the major consideration factor of employees' OCBE decisions. Thus, their behavior decisions are more dependent on individual moral disengagement. Therefore, the psychological green climate is higher, and the negative effect of moral disengagement on OCBE is weaker.

> *Hypothesis* 3: A psychological green climate moderates the negative relationship between daily moral disengagement and daily OCBE.

MATERIALS AND METHODS

Participants and Procedure

In this study, the daily diary method was used to collect data; that is, respondents were required to complete the same questionnaire once a day for 10 consecutive weekdays. Because respondents answer the same questionnaire every day in such an approach, it is easy for them to feel burnout and boredom, which reduces participants' willingness to participate in the survey. Therefore, the daily diary survey approach usually employs abbreviated scales; that is, each variable in the questionnaire has no more than five items, and the item with the highest factor load and the best representation of the original construct is usually selected. Additionally, the selected item should have dynamic fluctuation (Ohly et al., 2010).

The utilized survey included two questionnaires, namely, questionnaires A and B. Questionnaire A mainly included between-individual variables, such as demographic characteristics and psychological green climate, while questionnaire B mainly included within-individual variables, such as abusive supervision, moral disengagement, and OCBE. Surveys were collected mainly through on-site distribution and collection, and participants were full-time employees in China. The respondents were drawn from four food service companies, three finance companies, and two production companies. According to the statistics, 209 people participated in the survey. Due to the long duration of the survey, some people dropped out during the process, and the effective number of questionnaires included in the study was 112 between-individual questionnaires. We used our sample size to conduct power analysis using G-power 3.1, and the results showed that by assuming a medium effect size = 0.25, and alpha = 0.05, the power could achieve 0.99.

Measures

Participants indicated how they felt at that moment using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Within-individual variables were measured using an abbreviated scale, while daily abusive supervision was measured with a short form of a three-item scale developed by Tepper (2000); a sample item is "Today, my supervisor put me down in front of others." The Cronbach's alpha for this scale, which was averaged across the study period, was 0.78. Three items from Moore et al.' (2012) moral disengagement scale were used to measure daily moral disengagement. A sample item is "People can't be blamed for doing things that are technically wrong when all their friends are doing it too." The Cronbach's alpha for this scale, which was averaged across the study period, was 0.89. Daily OCBE was measured using a shortened scale with three items derived from Boiral and Paillé's (2012) scale; a sample question is "Today, I spontaneously gave my time to remind colleagues to pay attention to environmental protection at work." The Cronbach's alpha value for this scale, which was averaged across the study period was 0.80. The between-individual variable psychological green climate was measured with a four-item scale proposed by Norton et al. (2014): "Our company is worried about its environmental impact," and the scale provided an acceptable reliability ($\alpha = 0.81$).

Analysis

Data collected in daily diary studies contained a hierarchical structure in which daily assessments were nested within participants. We used hierarchical linear modeling (HLM) to test our hypotheses. All between-person level variables were centered at the grand mean and all within-person level variables were centered at the group mean. SPSS and MPLUS statistical software were used for the preliminary analyses; we also used MPLUS to estimate the 95% confidence intervals of the indirect effect.

RESULTS

Descriptive Statistics

Means, standard deviations, correlations, and intraclass correlation (1) for all variables are presented in **Table 1**. The

TABLE 1 | Means, standard deviations, and correlations of the between-and within-level variables.

Variables	Mean	SD	1	2	3	4
Day-level variables						ICC(1)
1. Abusive supervision	2.63	1.13				0.68
2. Moral disengagement	3.00	1.57	0.49**			0.67
3. OCBE	5.21	1.09	−0.37**	−0.38**		0.64
Person-level variables						
4. Psychological green climate	4.58	1.02	−0.19**	−0.28**	0.23**	

***p < 0.01. ICC(1) represents intraclass correlation (1).*

results show that daily abusive supervision has a significant positive correlation with daily moral disengagement ($r = 0.49$, $p < 0.01$); furthermore, there is a significant negative correlation between daily abusive supervision and daily OCBE ($r = -0.37$, $p < 0.01$), and the correlation between daily moral disengagement and daily OCBE is significant ($r = -0.38$, $p < 0.01$). At the between-person level, psychological green climate is positively related to OCBE ($r = 0.23$, $p < 0.01$), and OCBE is aggregated by daily OCBE. The null model results show that approximately 30% of the variance in abusive supervision, moral disengagement, and OCBE could be explained by the within-individual variances and that approximately 70% of the variance could be explained by the between-individual variances. Thus, it is appropriate to use hierarchical linear modeling to analyze our data.

Confirmatory Factor Analysis

Multilevel confirmatory factor analysis results show that the four-factor model fit the data satisfactorily [χ^2 (103) = 340.13, $p < 0.001$, CFI = 0.92, TLI = 0.90, RMSEA = 0.05, $SRMR_{within} = 0.06$, and $SRMR_{between} = 0.07$]. Additionally, the four-factor model fit the data better than the three-factor model [χ^2 (108) = 588.75, $p < 0.001$, CFI = 0.84, TLI = 0.80, RMSEA = 0.06, $SRMR_{within} = 0.07$, and $SRMR_{between} = 0.10$], the two-factor model [χ^2 (111) = 1282.91, $p < 0.001$, CFI = 0.61, TLI = 0.52, RMSEA = 0.10, $SRMR_{within} = 0.12$, and $SRMR_{between} = 0.12$], and the one-factor model [χ^2 (112) = 1387.56, $p < 0.001$, CFI = 0.57, TLI = 0.48, RMSEA = 0.10, $SRMR_{within} = 0.12$, and $SRMR_{between} = 0.15$]. The results indicate that the variables included in this study can be empirically discriminated from each other. In addition, we used two methods to check for possible common variance. First, the results of a one-factor test show that the fit indicators of the one-factor model do not reach the statistical requirements. Second, the unmeasured latent methods factor test was used to construct an unmeasured method variable, namely, common method variance, by loading all indicators of the within-person and between-person levels and then developed a five-factor model that included the four-factor model and common method variance (Podsakoff et al., 2012). The results show that the five-factor model [χ^2 (85) = 301.05, $p < 0.001$, CFI = 0.93, TLI = 0.88, RMSEA = 0.05, $SRMR_{within} = 0.06$, and $SRMR_{between} = 0.05$] does not substantially improve the goodness of fit of the four-factor model. Thus, there is no serious common variance problem in the study.

Hypothesis Testing

The results of multilevel modeling analyses are shown in **Table 2**. Model 1 shows that daily abusive supervision has a significant negative effect on daily OCBE ($\beta = -0.19$, $p < 0.01$); thus, Hypothesis 1 is supported. Model 2 shows that daily abusive supervision is positively related to daily moral disengagement ($\beta = 0.36$, $p < 0.01$); when we include daily moral disengagement in the model, while the result of Model 3 shows that daily moral disengagement is significantly associated with daily OCBE ($\beta = -0.15$, $p < 0.01$), the effect of daily abusive supervision on daily OCBE changes from significant ($\beta = -0.19$, $p < 0.01$) to non-significant ($\beta = -0.10$, $p > 0.05$). In addition, the indirect effect of daily abusive supervision on daily OCBE through daily moral disengagement is also significant [95% CI = (−0.10, −0.02)]; thus, Hypothesis 2 is supported. Model 4 shows that daily moral disengagement and a psychological green climate have significant interactive effects on daily OCBE ($\beta = 0.10$, $p < 0.01$). In detail, the results of a simple slope analysis show that the effect of daily moral disengagement on daily OCBE is significant ($\beta = -0.23$, $p < 0.001$) when the level of psychological green climate is low, and the effect of daily moral disengagement on daily OCBE is non-significant ($\beta = 0.02$, $p > 0.05$) when the level of psychological green climate is high. The difference between these effects is also significant ($\beta = 0.25$, $p < 0.01$); thus, Hypothesis 3 is supported.

TABLE 2 | HLM results of analyses predicting daily OCBE.

Variables	OCBE	Moral disengagement	OCBE	OCBE
	M1	M2	M3	M4
Intercept	5.14***	3.02***	5.21***	5.22***
Day-level variables				
Abusive supervision	−0.19**	0.36**	−0.10	−0.08
Moral disengagement			−0.15**	−0.14**
Person-level variables				
Psychological green climate				0.13
Moral disengagement* psychological green climate				0.10**
Variance				
σ^2	0.35	0.51	0.29	0.29
τ_{00}	0.67***	1.76***	0.58***	0.59***
τ_{11}	0.29***	0.85***	0.19***	0.18***
τ_{22}			0.12***	0.10***

****p < 0.001; **p < 0.01; *p < 0.05.*

DISCUSSION

The purpose of this study was to examine the within-person inhibition effect of abusive supervision, the mechanism through which it operates to influence employees' OCBE, and which organizational condition can attenuate this inhibition effect. The results show that it is necessary to use a cross-level design to study the predictors of OCBE because the variance in OCBE could be explained by both within-person (36%) and between-person variance (64%). We found that at the within-person level, daily abusive supervision has a significant negative effect on daily OCBE; that is, leader behavior may be an obstacle to impeding employees' OCBE. Moreover, we reveal the dynamic mediation mechanism of daily abusive supervision affecting daily OCBE through daily moral disengagement. As a moral model for organizations, leader behavior influences employees' moral standards; thus, leaders' unfair treatment behavior may deactivate employees' moral self-regulatory processes (Lian et al., 2020; Zhao et al., 2021) and discourage them from engaging in OCBE without feeling distress or guilt. Although daily moral disengagement could enable employees to withhold OCBE to prevent discomfort and self-condemnation, as reasonable individuals, employees should make their behaviors consistent with not only their internal moral standards but also their perceptions of their organization's policies, procedures, and practices. This view is supported by our study that a psychological green climate can significantly attenuate the negative effect of daily moral disengagement on daily OCBE; that is, compared to employees with a stronger psychological green climate, employees who perceive a weaker psychological green climate are more likely to withhold OCBE due to moral disengagement.

Theoretical Implications

First, given the important role of leadership in influencing employees' OCBE, previous researchers have highlighted the role of leadership in motivating employees' engagement in OCBE (Khan et al., 2021) and intensively investigated how positive leaders' behaviors increase these prosocial behaviors. However, the extant research overlooks the negative effects of leadership behaviors on OCBE, even though it is also important to understand what kind of leadership (e.g., abusive supervision) might hinder these behaviors (Vogel and Mitchell, 2017) because abusive supervision is very common in organizations worldwide. As an immoral behavior, a previous study found that abusive supervision is a critical inhibition factor for employees' voluntary behavior (Liu and Wang, 2013; Choi et al., 2019; Zhang et al., 2019). To better understand the formation mechanism of OCBE, scholars have called for examining the effect of abusive supervision on OCBE (Wu et al., 2021). Unfortunately, little is known about the effect and mechanisms of abusive supervision on employees' OCBE. This study examines the impeding effect of daily abusive supervision on daily OCBE from the negative leadership perspective and simultaneously reveals the underlying mechanisms of daily abusive supervision on daily OCBE from a moral perspective. The present research enriches the research perspective on OCBE, which addresses the limitation that the relationship between leadership obstacles (abusive supervision) and OCBE has not been studied in depth. The findings of this study also enrich the existing knowledge regarding the mechanism of leadership behavior on employees' OCBE.

Second, researchers have typically operationalized OCBE as a between-person variable (varies from person to person) and focused on temporally stable predictors (Norton et al., 2017); however, studies that focus solely on between-person factors may neglect short-term variability in behavior (Ohly et al., 2010). Recent research has found that within-person factors (vary within a given employee across time and situations) can explain a significant amount of variance in OCBE; however, employees' daily OCBE and its predictors are not well understood (Bissing-Olson et al., 2013; Carfora et al., 2017). The present research examines the within-person effect of abusive supervision on OCBE through the mediating role of moral disengagement and discerns the cross-level moderating effect of the between-person factor (psychological green climate) on the relationship between daily moral disengagement and daily OCBE. The results show that approximately one-third of the total variance in abusive supervision, moral disengagement, and OCBE can be explained by within-person variance, whereas two-thirds of the variance can be explained by between-person variance. This study illustrates that it is necessary to use a multilevel approach to simultaneously explore the within-person and between-person predictors of OCBE.

Third, this study examines under which conditions the negative effect of daily moral disengagement on daily OCBE can be attenuated. The results demonstrate that the higher the level of perceived psychological green climate is, the weaker the within-person negative effect of moral disengagement on OCBE becomes. Our finding is consistent with previous studies that show that employees' conduct is determined by not only individual factors but also work context factors, such as a psychological green climate, because such a climate can create a normative context, which then impacts the way workers behave (Roeck and Farooq, 2018; Zientara and Zamojska, 2018). Our findings respond to recent calls to understand whether the strength of employees' perceptions of different organizational climates accentuates or attenuates the dynamic influence of moral disengagement on employees' prosocial behavior (Newman et al., 2019) and to use a multilevel approach that considers both within-person and between-person factors to examine the formation mechanism of OCBE (Bissing-Olson et al., 2013).

Fourth, our study demonstrates that abusive supervision has a significant impediment effect on employees' OCBE. Our research was conducted using a sample drawn from the Chinese cultural context; thus, the current research lacks the benefit of a cross-cultural sample. However, abusive supervision is prevalent in organizations worldwide; although employees' perceptions and reactions to abusive management may be influenced by cultural context, previous research has found that the consequences of abusive supervision are similar across cultures (Liu and Wang, 2013; Xu et al., 2015). A recent meta-analytic review found

no significant moderation effect in the relationship between abusive supervision and organizational citizenship behavior (OCB) (Zhang et al., 2019). Thus, as a special OCB, researchers in other countries could explore the inhibitive factor of OCBE from the abusive supervision perspective.

Managerial Implications

First, this study finds that the more abusive behavior an employee experiences on a given day, the weaker his or her tendency to implement OCBE on that day is. Therefore, to effectively improve OCBE, organizations must take steps to reduce leaders' abusive behavior. Because there are both within-individual and between-individual variances in abusive behavior, organizations can take the following steps. First, in the recruitment and selection process, organizations can use individual trait assessments to predict leaders' abusive tendencies, such as authoritarian and hostile attribution styles, and then reduce abusive behavior at the source. Second, organizations can provide diversified leadership training to improve leaders' comprehensive quality and management skills, improve leaders' humanistic management thinking, and make leaders realize that they are employees' servicers and that they should respect and care for employees. Third, organizations can establish safe complaint and punishment mechanisms so that employees can report their abusive experiences in a timely manner and management can then reduce abusive supervision behavior by increasing the cost of abusive supervision. Fourth, given the pervasiveness and inevitability of abusive supervision, organizations can resort to stress training to improve employees' ability to copy with abusive behavior and prevent employees' negative response to abusive behavior based on a tit-for-tat strategy.

Second, the results show that moral disengagement is an important dynamic mediating process through which daily abusive supervision affects daily OCBE; therefore, organizations should highlight the role of employee moral disengagement in predicting employee behaviors. Because moral disengagement can be explained by both within-person and between-person variance, organizations can take the following steps. First, as a state variable, employees' moral disengagement may change over time because of supervisors' abuse behavior; thus, organizations could mitigate subordinates' propensity to morally disengage by encouraging managers to treat their subordinates ethically (Arain et al., 2021). As a trait variable, employees' moral disengagement is relatively stable. Organizations can recruit, select, and retain job candidates with strong tendencies for trait-based moral self-regulation by conducting scenario simulation, moral trait tests, and other methods during the recruitment and selection processes (He et al., 2019). In addition, organizations can reinforce employees' moral sensitivities and self-controlling capabilities and reduce the negative effect of unethical behavior on employees' moral disengagement by conducting moral training and lectures, moral psychological counseling and guidance, and other ethics-focused education and training initiatives (Qin et al., 2020).

Third, this study signifies that psychological green climates can significantly weaken the inhibitory effect of daily moral disengagement on daily OCBE; thus, organizations should pay particular attention to establishing a psychological green climate. Organizations could dampen the cognitive and behavioral manifestations of high moral disengagement by developing more ethical climates characterized by policies, practices, and procedures that emphasize OCBE (Arain et al., 2021). For instance, organizations could repeatedly highlight positive examples of employee green behavior in company newsletters (Norton et al., 2017) or provide reputation incentives to employees who engage in environmental behaviors, such as awarding stars for environmental behavior every year. Organizations can take such measures to make employees realize that although OCBE is not a job responsibility, organizations both value and reward this behavior.

Limitations and Future Research

This research has limitations. First, the variables used in this study were all self-reported by employees, which may increase the risk of common method variance and social desirability bias. Furthermore, while self-report measures are more appropriate for daily diary studies because this methodology involves brief and practical measures that must be administered over several days, the approach is are costly in terms of time and other resources and increases both the burden placed on participants and dropout rates (Ohly et al., 2010). Previous studies have confirmed that self-report measures are justified when examining abusive supervision and organizational citizenship behavior for the environment because individuals are most knowledgeable about their own behaviors and experiences (Vogel and Mitchell, 2017; Kirrane et al., 2018; Wang and Xiao, 2021; Xiao et al., 2021). The one-factor test, the unmeasured latent methods factor test, and the significant interaction effects found that common method variance is unlikely to be a serious concern in our study. In terms of social desirability bias, voluntary participation and anonymity can counter socially desirable response tendencies, and the extant empirical research reveals that social desirability has a low or nil effect on the way in which people report their organizational citizenship behavior for the environment and prosocial behaviors on anonymous questionnaires (Podsakoff et al., 2003; Norton et al., 2017; Lanz et al., 2021; Xiao et al., 2021). Nevertheless, to minimize the threat of common variance and social desirability bias, future studies could replicate our model by collecting data from different sources, such as supervisor ratings, peer ratings, and objective data.

Second, our respondents are all Chinese employees, although the theoretical logics and arguments were not culturally specific (Zheng et al., 2019). A previous review found that national cultures have a non-significant effect on the relationship between abusive supervision and OCB (Zhang et al., 2019). While we must be cautious in determining whether our findings are applicable to other cultural contexts, in order to improve the generalizability of our research conclusions, future research should reexamine our research model in different cultural contexts. In addition, the dropout rate (near 50%) was quite high, because we used paper questionnaires to collect the data, we entered only the data of the fully completed questionnaires into the computer, after

which we did not save the paper questionnaires. As a result, we know very little about the differences between the original participants and the dropouts. Even though this may not pose a significant threat to the use of the diary research approach (Ohly et al., 2010), it is would be both important and interesting to understand more information regarding those participants who dropped out, for example, whether they quit because they did not want to waste paper. Therefore, future studies could repeat this study using both electronic and paper questionnaires, and analyze the characteristics of the dropouts.

Third, the diary method requires respondents to complete the same questionnaire for several consecutive days. To reduce employee burnout, increase employee participation and improve the quality of the questionnaire results, we constrained the questionnaire length by using abbreviated scales. Even though we chose items that measured the full set of behaviors, which is in line with prior daily research, and an extremely high correlation between shortened measures and the corresponding full scales has been previously confirmed, this use of this approach may nonetheless be viewed as a limitation (Harris et al., 2011; Qin et al., 2020). Therefore, future studies could appropriately extend the time interval of the questionnaire survey, for example, once a week for several weeks. Such an approach may not only weaken the respondents' memory of the questionnaire but also alleviate respondents' level of burnout. In addition, the full versions of the scales can be adopted in future studies to prevent the reliability and validity problems caused by using reduced scales.

CONCLUSION

The purpose of this study was to explore the dynamic mechanism and boundary conditions of negative leadership behavior affecting employee environmental behavior by daily diary research, that is, at the within-person level, this study aimed to explore whether and how daily abusive supervision affects daily OCBE, while at the between-person level, the current study aimed to examine which conditions could attenuate the negative effect of daily abusive supervision on daily OCBE. The results indicate that daily abusive supervision has a significant negative effect on daily OCBE; i.e., on a given day, the more abusive behavior an employee experiences, the less likely he or she is to engage in OCBE. While previous studies have mainly emphasized the promoting effect of positive leadership behavior on OCBE, little is known about the relationship between abusive supervision and OCBE. Thus, our findings extend existing the knowledge on the relationship between leadership and OCBE. The current study reveals the dynamic processes through which daily abusive supervision influences daily OCBE and that leaders' abusive behavior can trigger abused employees' moral disengagement, which in turn can inhibit employees' OCBE. In addition to individual factors, employee behavior is guided by the organizational climate. Our study confirms that psychological green climates can significantly attenuate the impeding effect of daily moral disengagement on daily OCBE. The higher the psychological green climate is, the weaker the inhibitory effect of daily moral disengagement on daily OCBE is. The results of this study offer implications for organizations that leadership behavior can also negatively impact employees' OCBE, while a strong psychological green climate can help organizations motivate employees' OCBE.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Business School at Nanjing Audit University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

HW wrote the original draft of the manuscript and analyzed the data. JX contributed to data collection. Both authors contributed to the design and conceptualization of the manuscript and reviewed and edited the manuscript.

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The Impact of Positive Emotional Appeals on the Green Purchase Behavior

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The practice of green consumption has become a common initiative of the international community. Existing studies have shown that emotional factors have an important impact on consumer behavior, but few scholars in the field of green consumption behavior have explored the relationship between positive emotions and green purchase behavior in specific dimensions. This study creatively put forward two dimensions and four kinds of positive emotional appeals which include the cherishing appeal, the yearning appeal, the proud appeal, and the admiring appeal. Through the conceptual model analysis based on the data, the effects of different four positive emotional appeals on consumers' perceived green value, perceived green responsibility, and green purchase behaviors were confirmed. The results indicated that the four kinds of positive emotional appeals, perceived green value, perceived green responsibility, and green purchase behavior were positively correlated. Perceived green responsibility and perceived green value have significant mediating effect on the relationship between positive emotional appeals and green purchase behaviors. Middle doctrine significantly moderates the relationship between positive emotional appeals (Cherishing VS. Yearning) and perceived green value.

Keywords: positive emotional appeal, field experiment, green purchase behavior, emotional arousal, middle doctrine

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INTRODUCTION

Nowadays, the global natural ecological environment is deteriorating day by day, and a series of pollution problems emerge one after another. Therefore, it is imperative to attach importance to and actively advocate green consumption behavior. The 19th national congress of the communist party of China (CPC) once again stressed the necessity to establish and practice the concept that clear waters and green mountains are valuable assets. However, in general, residents' green purchase intention and behaviors are not popular, and people are not willing to pay a premium for the green properties of products. The government and society have made great efforts to promote environmental protection and green consumption, but the effect is not satisfactory. The report of the International Institute of Green Finance of the Central University of Finance and Economics pointed out that the green penetration rate of consumers of different age groups in China is

quite different and the environmental protection concept is quite different among different age groups. Consumers of some age groups do not yet have a good awareness of green consumption.[1] The reason is that propaganda is mostly spread in the form of preaching, and the content is dull and unappealing. So, it is difficult to arouse consumers' green purchase desire and change their original purchase concept. Kollmuss and Agyeman (2002) and Tanner and Kast (2003) found that rational cognition had a limited effect on the factors influencing green purchase behavior. Emotional factors had a significantly higher effect on green consumption than cognitive factors (Kanchanapibul et al., 2014). Therefore, more and more scholars gradually realized emotion plays an important role in green purchase behavior. More research breakthroughs were transferred to a relatively irrational variable-emotion (Peattie, 2010). Past research proved the relationship between emotion and green purchasing behavior to some extent (Meneses 2010; Onwezen et al., 2013, 2014; Antonetti and Maklan, 2014; Wang, 2015; Wang et al., 2017). However, a series of practical problems remains, such as how emotional factors influence in consumers' green purchase behavior, which factors can mediate or moderate on this path, and which kind of emotions can significantly promote green purchase behavior, scholars have not come with sufficient conclusions. Wang et al. (2017) pointed out that from the perspective of emotional objects, positive emotions include not only the emotion toward a good objective environment (such as love for the environment), but also the emotion toward proper human behaviors (such as pride or admiring for the proper behaviors). In our view, the positive emotional dimension for a better objective environment, "yearning" is people's expectation of better things in the future, which makes people full of hope and makes continuous efforts for them. There is no doubt that people yearn for more comfortable living conditions, a more beautiful environment, and a better life. According to the report to the 19th national congress of CPC, we should "always take the people's aspiration for a better life as our goal." Therefore, it is of great practical value to deeply explore the positive emotion of "yearning." "Cherishing" is a kind of emotion opposite to "yearning," which is the satisfaction and cherishing of the beautiful things we have at present. Both of these two emotions belong to the positive emotional dimension aiming at the beautiful objective environment. In order to solve the above problems more effectively, this study creatively put forward two specific dimensions of four kinds of positive emotional appeals and make in-depth exploration. One of the dimensions is the emotion toward a better environment, including the cherishing appeal and the yearning appeal. The other dimension is the emotion toward the appropriate individual environmental behavior, including the proud appeal and the admiring appeal. According to different dimensions, this study conducted a thorough research by group on the influence path and effect of positive emotional appeals on green purchase behavior, providing theoretical support for effectively promoting consumers to practice green purchase behavior.

[1]International Institute of Green Finance: Analysis of the current situation of green consumption in the field of e-commerce 2021-12-17. Available at: http://iigf.cufe.edu.cn/info/1012/4475.htm

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Emotional Appeal

Rajesh et al. (2001) believe that advertising appeal is a strategic way to display prominent features of products. In the existing research, many scholars have done a lot of research on the marketing effects of different green appeal advertisements or consumers' reactions to different green appeal advertisements from different perspectives (Schuhwerk and Lefkoff-Hagius, 1995). The analysis dimension includes green and non-green appeals (Ku et al., 2012), environmental interests and economic interests appeals (Xu et al., 2015), self-interest and others' interests appeals (Zhi et al., 2017), long-term interests and short-term interests appeals (Xu et al., 2015), abstract and specific appeals (Yang et al., 2015), mandatory and suggested appeals (Kronrod et al., 2012), strong appeals and non-strong appeals (Chen and Deng, 2017), real environmental demands and false environmental demands (Lei and Kunhao, 2016), etc. However, researchers have paid less attention to emotional appeals. Existing research on emotional appeal mainly focuses on the difference in the impact of rational appeal and emotional appeal (Matthes et al., 2014) and there is a relatively lack of research specifically on emotional advertising appeal. Compared with rational appeal, emotional appeal has more strong emotional elements, which can stimulate consumers' purchase desire and generate psychological identification. Chan (1996) and other scholars argued that compared with emotional appeals, rational appeals advertisements lack vividness and the content is boring, which is difficult to capture people's interest. Therefore, it is very important and necessary to pay attention to the research on emotional appeal.

Environmental Positive Emotion

According to the research results of scholars, the influence of different emotions on consumers' purchase behavior is quite different. Scholars often use the emotion dichotomy, which divides emotion into negative and positive dimensions according to the experience structure (Watson and Tellegen, 1985; Watson et al., 1999). Positive emotions are a series of positive feelings, including enthusiasm, gratitude, excitement, happiness, and pride (Qiu et al., 2008). Meneses (2010) conducted a special study on emotion, and the results showed that positive emotion could increase consumers' intrinsic motivation to purchase products, and the driving effect of positive emotional factors is significantly greater than negative emotional factors. For consumers, positive emotions are very important. However, current research lacks a discussion of the differences in the effects of different types of positive emotion. In the field of green marketing research, the difference in the impact of different types of positive emotions on consumers and the formation mechanism of this difference should be paid attention to by researchers.

Wang (2015) adopted grounded theory approach and sorted out the raw materials of the in-depth interviews. He found environmental emotion has dual factors (both positive and negative) and six dimensions, in which positive environmental

emotions including the feeling of loving the environment, admiring, and being proud of the green behavior. The category of the feeling of loving the environment contained a series of initial concept and the two most typical and important initial concepts in this category are cherishing and yearning. Based on the qualitative result of Wang (2015), we derive that positive environmental emotion contained four dimensions, namely, cherishing, yearning, proud, and admiring.

Cherishing

Cherish refers to the psychological activity of consciously cherishing the objective things, others, and themselves. The awareness of cherishing is relatively stable after it is formed in an individual and will not fade or even disappear due to changes in the environment. It will not go away, but it will change. Once the cherishing consciousness is formed, it will continue to strengthen under the influence of positive conditions; on the contrary, it will gradually weaken under the influence of negative conditions. Shen et al. (2011) constructed the quality scale of college students' gratitude from the three dimensions of cognition, emotion, and behavior, in which the emotional dimension included three sub-dimensions such as sense of cherishing.

Yearning

Yearning refers to the desire to get or to achieve because of love or envy of a certain thing or state, and it is the "expected prospect" of people. Yearning is accompanied by people's good wishes and positive goals, which can inspire people to be full of motivation to move forward and can make people focus on the goals they want to achieve and focus on those goals. Yearning can motivate people to develop in a good direction. It will form a beautiful picture in people's imagination, and it will keep appearing in their minds. People can form the hint of continuous self-motivation by imagining the achievement of goals, motivating individuals to make continuous efforts toward the vision of their dreams. That is, yearning helps arouse people's imaginations and expectations, which motivate individuals to take action to achieve their goals. When yearning enters the expectation into the subconscious, this kind of vision for the future will become the unswerving "belief" of the individual. Under the guidance of the belief, the individual will work hard toward the desired prospect. People who are full of yearning focus on the future and hope to achieve the desired state through present and future efforts.

Proud

Proud is a positive emotion that includes a sense of accomplishment and self-satisfaction (Antonetti and Maklan, 2014) and is also a self-conscious emotion (Feng and Zhang, 2007). Williams and DeSteno (2009) pointed out that the emotion of proud is an individual's self-satisfaction through his own efforts. In real life and existing research, proud is often associated with positive words such as "sense of achievement" and "confidence," which reflect an individual's social emotions and achievement orientation. Many studies have confirmed that pride has a positive impact on green purchasing behavior (Onwezen et al., 2013, 2014; Antonetti and Maklan, 2014). Harth et al. (2013) found that proud is the strongest predictor of environmental protection behaviors. Wang and Wu (2015) used an experimental method to explore the impact of four green buying emotions of proud, appreciation, guilt, and contempt on green buying behavior. They believed that proud is the best factor for cultivating consumers' awareness of green consumption.

Admiring

Admiring means approval and appreciation, which refers to an individual's positive emotional attitude toward others and this emotion also promotes oneself (Keltner and Haidt, 1999; Algoe Sara and Jonathan, 2009). It is a positive emotion (Sarapin et al., 2015) that has lesser degree than "awe" (Zagzebski, 2015). Social cognitive theory holds that people tend to be more inclined to learn from people they admire (Matsueda and Akers, 1999; Bandura, 2001; Wareham et al., 2009). Therefore, admiring is usually paid attention to by researchers because individuals can learn a certain ability through this emotional stimulation. In an empirical study, Algoe Sara and Jonathan (2009) pointed out that an individual's admiring of others leads to better performance in related aspects. Helen et al. (2010) pointed out that individual learning can be improved through admiring. However, in the field of green purchasing, scholars have paid little attention to the role of admiring in shaping individual behavior.

Summary

In the field of green marketing research, there are two gaps in current research: (i) lack of research specifically on emotional appeal; (ii) lack of research on the impact of different dimensions of positive emotional appeal on consumers' green consumption behavior. Investigating the role of positive emotions in different dimensions can help companies conduct green marketing more effectively. Therefore, this paper focuses on the differences and effects of the four representative dimensions of positive emotional appeals on consumers' green purchasing behavior (These four dimensions can be divided into two groups: emotion for better environment and emotion for appropriate personal environmental behavior). The former includes the cherishing and yearning appeal, which, respectively, represent the appreciation of the present beautiful environment and the expectation of the future beautiful environment. The latter includes the proud and admiring appeal, which, respectively, represent the pride in one's own appropriate environmental behavior and the appreciation of others' appropriate environmental behaviors.

Theoretical Background

The Broaden-and-Build Theory of Positive Emotions

Fredrickson (1998) proposed broaden-and-build model of positive emotion theory and demonstrated the specific functions of positive emotion, which believes that positive emotion can affect individual's psychological state, triggering individual's

pleasure, and then changing his thought. Positive emotion produces an action activation—a tendency to avoidance or proximity. Fredrickson (1998) believed that positive affect is not only associated with a general tendency to activate activities but also associated with a specific tendency to act. Positive affect can promote the continuity of behavior development. Under the influence of positive emotions, individual will issue more positive instructions and the cognitive level will be accordingly improved, thus remarkably enhancing the possibility of the corresponding behavioral tendency. Stimulated by positive emotional appeals, the brains will naturally make more positive reactions. In addition, positive emotions have a positive effect on an individual's thoughts and actions. Based on this theory, it is not only consumers' positive emotion which has an expansive influence on their thinking and specific behavioral tendency—green purchase behavior, but also has a positive and long-term impact on their future cognition and behavior. The Broaden-and-Build Theory of Positive Emotions is the basis of this study, which shows that the appeal of positive emotion can indeed promote green consumption behavior.

Prospect Theory

Tversky (1979) put forward prospect theory from the perspective of cognitive psychology on the basis of the deficiencies of expected utility theory in explaining individual behavioral decision making. The theory points out that when decision makers make future risk choices, they use the value function to evaluate the value. The measurement of the value function is mainly based on the degree of deviation from the reference point as shown in **Figure 1**. The gains and losses perceived by individuals are relative to the reference point. The valuation of these gains and losses varies systematically based on the slope of Prospect Theory's value function, which is steeper closer to the reference point (i.e., diminishing sensitivity) and steeper on the loss side than on the gain side of the reference point (i.e., loss aversion, Tversky, 1979). Differences between outcomes along a steeper part of the value function have a greater influence on subsequent decisions (Larrick et al., 2009; Ren, 2015; Wallace and Jordan, 2017).

We believe that consumers will choose different reference points when stimulated by different types of emotional appeals. Yearning appeals make consumers focus on the future and therefore use the future situation as a reference point. The cherishing appeal emphasizes the protection of the existing environment, so the current state is set as a reference point. Admiring appeal will make consumers pay more attention to the green consumption behavior of others, that is, they will set the green consumption behavior of others as the reference point. On the contrary, proud appeal will make consumers pay more attention to themselves, so they tend to set their own behavior as a reference point. Due to the difference in the selection of reference points, it will further affect the perception of consumers. Therefore, based on the above discussion, this article will use prospect theory to explain consumer perception differences.

The Direct Effects and Mediating Effects

This paper will first discuss the difference in the effects of cherishing appeal and yearning appeal on consumers' green purchasing behavior and the mechanism, both of which belong to the dimension of emotions toward a better environment. We suggest that yearning appeal has a greater positive impact on consumers' green consumption behavior than cherishing appeal and the relationship between the effects is mediated by perceived green value. There are several reasons as follows:

Firstly, under different positive emotional appeals, consumers make different responses. According to the broaden-and-build theory of positive emotions, positive emotions have the role in expanding people's thoughts and actions, having a relatively lasting influence on individuals (Liu, 2015). The expansion role is positively correlated with the intensity of positive emotions, that is, the stronger the positive emotions are, the corresponding greater expansion role on the individual's thought and actions. For instance, the empirical research of Chan and Lau (2000) shows that ecological consumption sentiment has a significant positive impact on ecological consumption behavior. The stronger the individual's emotion toward ecology and resources, the stronger the tendency to implement green consumption behavior. The sense of cherishing is a positive emotion toward the present beautiful environment, while the sense of yearning is a positive emotion toward the future better environment. It is common sense that yearning appeals bring more expectations and motivation than cherishing, resulting in a stronger motivation to engage in green consumption.

Secondly, both the cherishing appeal and the yearning appeal reflect the concern for the environment. This will lead consumers to associate the purchase of green products with protecting the environment. Consumers will consider the value of purchasing green products to the environment, that is, pay attention to the green value of products. This paper will use reference points to explain the difference in the impact of cherishing appeal and yearning appeals on consumers. Yearning appeal will make consumers pay more attention to the beautiful ecological environment in the future, which will set the beautiful ecological environment in the future as a reference point. After purchasing green products or conducting green consumption, will bring the existing environmental conditions closer to the desired environmental conditions. According to prospect theory, a "reference point" divides the space of outcomes into regions of gain and loss (Tversky, 1979). Outcomes above the reference point are evaluated as gains and outcomes below the reference point are evaluated as losses. In the value function, consumers set the future beautiful ecological environment as a reference point. The current ecological environment status is on the left side of the reference point, which means "losses." If consumers do not engage in green consumption, the gap between the current situation and the future situation cannot be narrowed, which means consumers cannot reduce their losses. According to the loss aversion effect, individuals are more reluctant to accept "losses" than "gains" when faced with the same size loss and gain. In order to avoid losses, individuals will increase the motivation to engage in a certain behavior. Every time a consumer buys a

unit of a green product, it means approaching the reference point, that is, reducing losses. At this time, the green value brought by the green product is positive. On the contrary, the cherishing appeal will make consumers pay more attention to the existing ecological environment and consumers will take the current ecological environment as a reference point. At this time, purchasing products that are harmful to the environment means destroying the existing ecological environment and moving the environmental conditions away from the reference point (i.e., existing ecological environment). However, buying green products is only seen as a means to maintain the current state. Therefore, compared with yearning appeal, cherishing appeal leads to less green value of products perceived by consumers.

In addition, it is worth noting that the previous behavior of consumers determines the current ecological environment. Under the condition of cherishing appeal, no matter whether consumers are satisfied or dissatisfied with the current ecological environment, green purchasing behavior can only maintain the status quo. Therefore, cherishing appeals brings less perceived green value.

Thirdly, perceived green value refers to individual's subjective evaluation for the effectiveness of green products or green consumption. Liu et al. (2020) found that perceived green value plays an intermediary role between the target framework and green consumption intention. Scholars pointed out that consumers' perceived green value is significantly correlated with individuals' ecological attitudes and green consumption behaviors (Berger and Corbin, 1992). For example, consumers believe that their green purchase behavior has a positive effect on the improvement of the ecological environment, which represents the perceived green value is strong. At that time, consumers attempt to practice more green purchase behaviors conducive to environmental protection, which plays a further strengthening role on the perceived green value. Besides, Hines et al. (1987) argued that the level of consumers' perceived green value would affect the degree to which they adopted pro-environmental behaviors. In addition, the results of Maloney et al. (2014) indicated that consumers' perceived value was positively correlated with green purchase behavior.

In summary, compared with cherishing appeals, yearning appeals have a more positive effects on consumers' green purchasing behavior. This is mediated by perceived green values. Yearning appeals can lead to higher perceived green values, due to the choice of reference points and the intensity of emotion. Perceived green value can have a significant effect on green purchase behavior. Cherishing appeals and yearning appeals may also make consumers consider their own green responsibilities. Cherish the appeal makes consumers pay attention to their responsibility to maintain the existing environment and yearning for the appeal makes consumers pay attention to their responsibility to improve the environment. Although the two are different, we believe that the difference in intensity is not significant. Therefore, we suggest the relationship between emotions toward a better environment appeals (i.e., cherishing appeal and yearning appeal) and green purchase behavior is not mediated by consumers' perceived green responsibility.

Hence, we propose the following:

> *H1:* Compared with the cherishing appeal, yearning appeal has more positive effects on the consumers' green purchase behavior.
> *H2:* The relationship between emotions toward a better environment appeals (i.e., cherishing appeal and yearning appeal) green purchase behavior is significantly mediated by consumers' perceived green value.

Next, this paper will discuss the differences in the effects of proud appeal and admiring appeal on consumers' green purchasing behaviors and their mechanisms, both of which belong to the dimension of emotion toward the appropriate individual environmental behavior. We suggest that compared with proud appeal, admiring appeal has a greater positive effect on consumers' green consumption behavior, and the relationship between them is mediated by perceived green responsibility. The reasons are as follows:

Firstly, as far as the positive emotions for the individual's environmentally appropriate behavior are concerned, compared with self-recognition or self-satisfaction, recognition, and appreciation from others are more effective in motivating individuals to practice proper behaviors. The view of social cognitive theory is that people tend to be more inclined to learn from people or their behaviors they admire (Matsueda and Akers, 1999; Bandura, 2001; Wareham et al., 2009; Han et al., 2017). People will feel affirmation and appreciation for the actions of others to protect the environment. Furthermore, individuals can learn certain abilities and perform better through this emotional stimulation. People often voluntarily learn from people or behaviors they admire sincerely. Compared with the recognition of their own environmental protection behaviors, the individual's appreciation of others' contribution to the improvement of the environment has more stimulus for them to follow their example and practice the same green purchase behavior and consumers will be aware of the good green purchasing behaviors of others in society. Therefore, compared with the proud appeal, the admiring appeal has a stronger positive impact on consumers' green product purchase behavior. Furthermore, both proud appeal and admiring appeal are related to individuals, so consumers will consider aspects related to their own responsibilities when stimulated by one of these two appeals. Although both proud and admiring appeal bring positive psychological experience to consumers, it is admitted that comparing with the proud appeal, the admiring appeal will cause consumers to compare themselves with other individuals and further improve their perception of their own green responsibility. Therefore, we suggest that admiring appeal generates stronger perceived green responsibility than proud appeal.

Secondly, we also use reference points to explain the differences in the impact of proud appeal and admiring appeal on consumers' green buying behavior. Admiring appeal will make consumers pay more attention to the green consumption behavior of others, that is, they will set the green consumption behavior of others as the reference point and compare their own purchasing behavior

with the green purchasing behavior of others. According to prospect theory, outcomes above the reference point are evaluated as gains and outcomes below the reference point are evaluated as losses. When the behavior of others is set as the reference point, the individual's own behavior is on the left side of the reference point and purchasing green products means reducing "losses." In other words, close the gap with others by purchasing green products. On the contrary, proud appeal will make consumers pay more attention to themselves, that is, set their own behavior as a reference point, and the result of further green purchasing behavior at this time means "gains." In other words, buying green products means improving oneself and gaining more sense of achievement. According to the loss aversion effect, individuals are more reluctant to accept "losses" than "gains." Therefore, compared with the proud appeal, the admiring appeal has a stronger positive impact on consumers' green product purchase behavior. Besides, for the same reason as the first point, under the stimulation of admiring appeals, consumers will be aware of the good green purchasing behaviors of others in society, which further enhances consumers' perceived green responsibility.

Thirdly, Lao (2013) defined green consumption as a responsible and sustainable consumption behavior that individuals make efforts to protect the natural environment so as to minimize the negative impact on the environment in the consumption process. As a crucial internal driving factor, environmental responsibility somehow determines the way people purchase behaves. In face of green products, for example, consumers with a higher sense of environmental responsibility tend to have a higher purchase intention and be more actively in implementing green purchasing behaviors. Hines et al. (1987) proposed responsible environmental behavior model, which demonstrates a strong correlation between the individual's sense of responsibility and the environmental behavior. Compared with the individuals without the sense of environmental responsibility, the individuals with the sense of environmental responsibility usually showed more environmentally responsible behaviors, because it indirectly affected the individual's environmental behavior. Responsibility not only affects consumers' green purchase behavior, but also mediates the relationship between consumers' psychological factors and purchase behavior. Wang and Zheng (2011), in the process of exploring the path of psychological awareness factors to consumers' ecological civilization behavior, found that sense of responsibility can be used as an mediating variable between psychological factors and ecological civilization behavior. The result showed that resource and environment emotions influence consumers' sense of green responsibility, thus affecting individuals' ecological civilization behavior.

In summary, compared with the proud appeal, the admiring appeal has a more positive impact on the green purchasing behavior of consumers. This is mediated by perceived green responsibility. Admiring appeals can lead to higher perceived green responsibility and perceived green responsibility can have a significant impact on green purchasing behavior. Moreover, stimulated by proud appeals or admiring appeals, consumers pay more attention to the sense of achievement brought by purchasing green products or narrowing the gap with others rather than the green value of green products. Therefore, we suggest that the relationship between emotions toward the appropriate individual environmental behavior appeals (i.e., proud appeal and admiring appeal) and green purchase behavior is not mediated by consumers' perceived green value. Hence, we propose the following:

> *H3:* Compared with the proud appeal, admiring appeal has more positive effects on the consumers' green purchase behavior.
> *H4:* The relationship between emotions toward the appropriate individual environmental behavior appeals (i.e., proud appeal and admiring appeal) and green purchase behavior is significantly mediated by consumers' perceived green responsibility.

Moderating Effects

Consumers' psychological factors and situational factors exert a great impact on the green purchase behavior. Among multiple situational factors, individual values occupy an important position. Thøgersen and Ölander (2002), for example, found that values are the distal determinants of behavior, and they need to function through adjacent variables, such as perceived behavioral effectiveness. It is common sense that China has a long history of traditional culture. Values such as Taoism, Buddhism, and Confucianism have a subtle influence on individuals' behaviors, shaping their unique ways of thinking and decision making. Confucianism, the most representative of values in China, has the most profound and extensive influence (Pan et al., 2009). The middle doctrine is the core of Confucianism, embodying all Confucian values and virtues. It is not only a principle of dealing with affairs, but also a dialectical way of thinking that rejects extreme and advocates timely adaptation (Yang, 2009). The middle doctrine is an important manifestation of Chinese traditional cultural values and a crucial component of our national social psychology (Du et al., 2014), which make a far-reaching consequence on individual cognition and behavior. For individuals who have a higher level of middle doctrine, different emotional appeals have little effect on their psychology and behavior. The reason is the individuals who have a higher level of middle doctrine are likely to pay more attention to the harmony between man and nature, and viewing problems as a whole so as to pursue the balance of personal interests and social interests. Therefore, they are less affected by emotional appeals. On the contrary, individuals with a lower level of middle doctrine tend to pay more attention to specific and short-term impacts, so the impact of different emotional appeals on them is more pronounced. In other words, middle doctrine negatively moderates the impact of emotional appeals. Individuals with higher middle doctrine values are less susceptible to emotional appeals. Hence, we propose the following:

> *H5a:* The middle doctrine negatively moderates the influence of positive emotional appeals (cherishing vs. yearning) on perceived green value.

H5b: The middle doctrine negatively moderates the influence of positive emotional appeals (cherishing vs. yearning) on green purchase behavior.
H5c: The middle doctrine negatively moderates the influence of positive emotional appeals (proud vs. admiring) on perceived green responsibility.
H5d: The middle doctrine negatively moderates the influence of positive emotional appeals (proud vs. admiring) on green purchase behavior.

Based on the broaden-and-build model of positive emotion theory and prospect theory, this study deeply explores the relationship and mechanism between the positive emotional appeals and green purchase behavior, focusing on comparing differences in stimuli effects of different types of positive emotions, at the same time investigating the moderating role of middle doctrine.

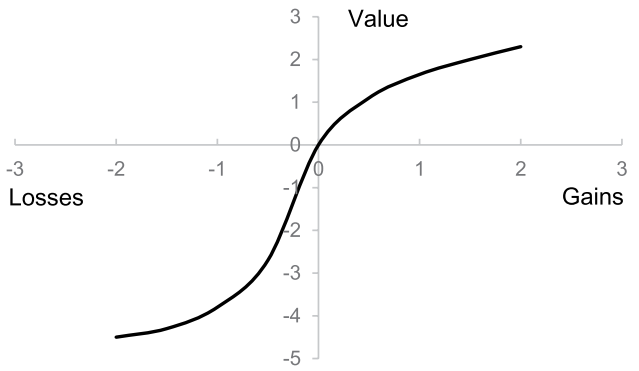

FIGURE 1 | Value function of prospect theory.

The conceptual model of this study is shown in **Figures 2, 3**. Since emotional appeals of different dimensions are mediated by different mediating variables, there are two model diagrams in this study, in which the solid line represents the influence effect and the dotted line represents the moderating effect. Positive emotional appeal is the explanatory variable, perceived green value and perceived green responsibility are mediating variables, middle doctrine is the moderating variable, and green purchase behavior is outcome variable.

MATERIALS AND METHODS

The Experiment Design

Energy-saving refrigerators and air conditioners are often used as products in previous green consumption experiment because of their green environmental properties. After searching in various ways, this study chose a relatively novel green product—green power certificate, which can fully reflect the consumer's sense of responsibility, as the experimental product. The green certificate is an electronic certificate for the green electricity produced by power generation enterprises with a unique code identification. Governments, enterprises, and individuals all can subscribe for green certificate on the information platform. On the one hand, the green certificate trading system can guide and regulate the priority consumption of renewable energy power, effectively improve the consumption of green power, reduce the speed of thermal power generation, and promote the efficient use of renewable energy, which is of great significance to the governance of environmental pollution. On the other hand, China's renewable energy subsidy cumulative gap is large and unsustainable, so the introduction of green certificate

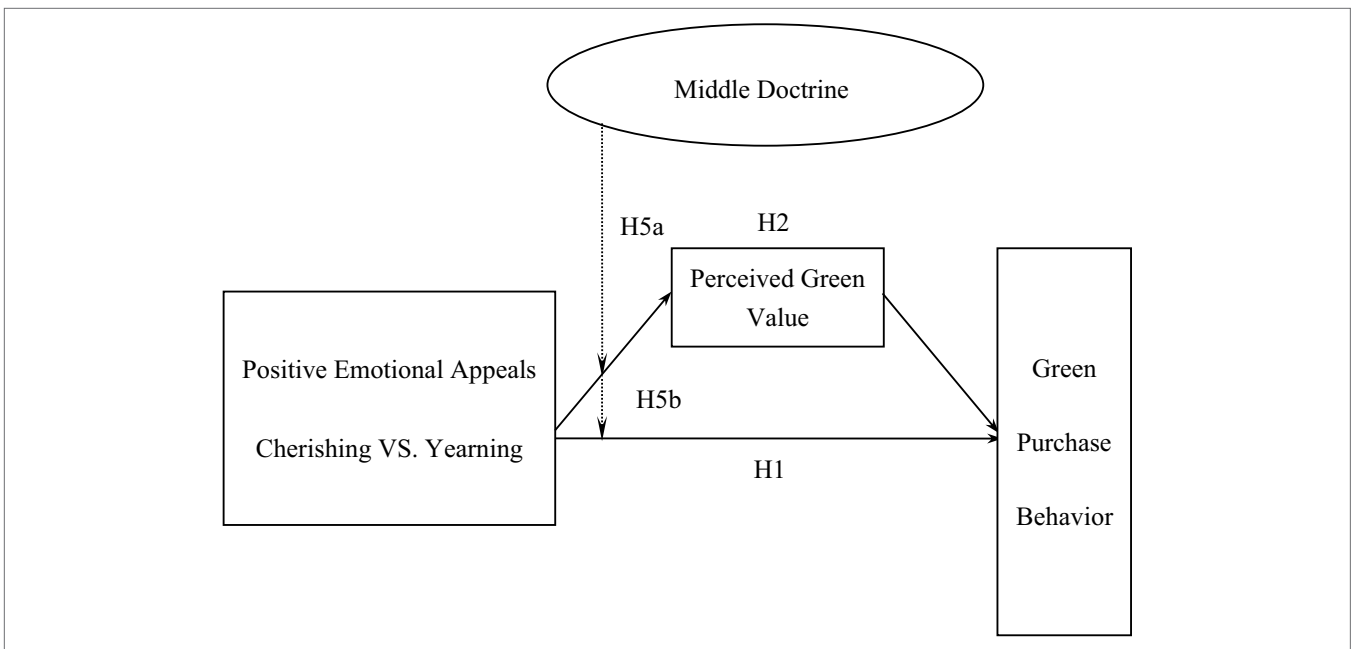

FIGURE 2 | Conceptual model of this study (dimensions of emotions toward a better environment appeals).

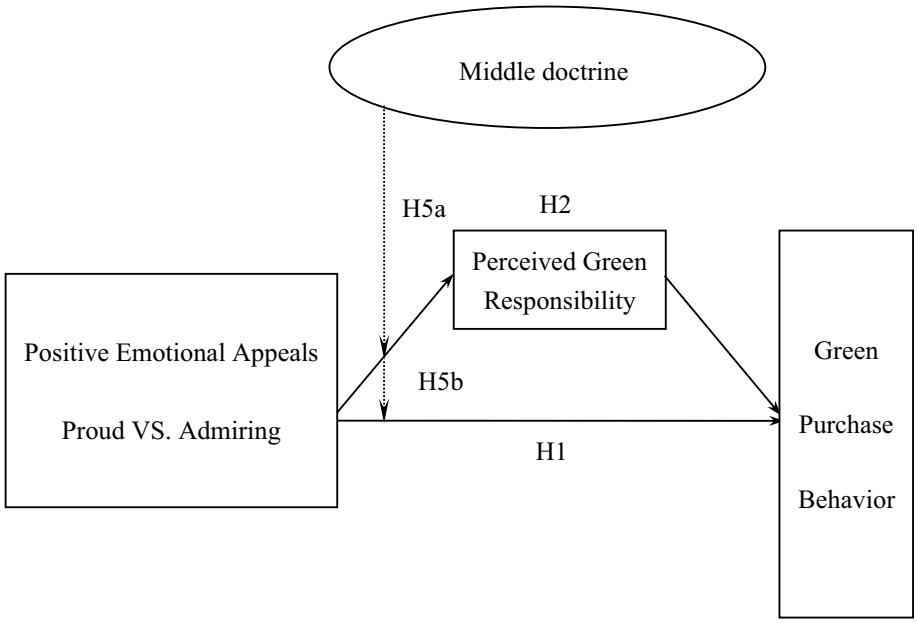

FIGURE 3 | Conceptual model of this study (dimensions of emotions toward the appropriate individual environmental behavior appeals).

system can establish a long-term mechanism for the development of renewable energy. To sum up, now that subscribing the green certificate is a kind of green purchase behavior, regarding the green certificate as an experimental product in this study is scientific and feasible.

In this study, four self-made videos (picture + text + voice + background music) were used as stimulation materials, which had a stronger sense of substitution than simple text description and enabled the respondents to have a deeper understanding of the experimental materials in a more vivid and accurate form. Each video has a short paragraph of text in front of the simple and popular introduction of green certificate, and then follow closely to reflect the corresponding feelings of green video.

By reviewing the existing relevant literature and drawing on the research experience of relevant scholars, this paper summarizes the measurement items of consumers' perceived green value, perceived green responsibility, green purchase behavior, emotional arousal, and middle doctrine in this study. Likert seven-point scale was used to measure all the items in the questionnaire. The specific measurement items of each variable are shown in **Table 1**.

Sample Description

In this study, the positive emotional appeal videos and the measurement questionnaire were edited into four online links and randomly distributed to the respondents through the Internet. The experiment was conducted through respondents watching the video and filling the corresponding questionnaire, the period of which is August to September 2018. After eliminating the invalid questionnaires, a total of 433 valid questionnaires were collected in this experiment and the sample effective rate was 89.2%. In these 433 valid questionnaires, 48.3% were male, and 51.7% were female. Age distribution is generally below 44 years old, accounting for 97.2% of the total sample size. Education is mainly concentrated in the undergraduate degree and above, because they were more capable of understanding the study and more willing to participate in the experiments.

Controllability Test

First, we test the manipulation of four emotional awakening videos. The respondents watched four emotional awakening videos, and then, they fill in the first four questions of the questionnaire. We test the validity of video by the scores of the items (7 = totally agree; 1 = totally disagree). The items include as: (1) After watching video, I will cherish the beautiful ecological environment more. (2) After watching video, I will be more yearning for a better ecological environment in the future. (3) If I subscribe to the green power certificate, I will be proud of my behavior. (4) If someone else subscribes to the green power certificate, I will admire his behavior.

Single factor analysis of variance by 433 samples data, we found that the average score of the cherishing appeal in item (1) was significantly higher than that of other emotions, the average score of the yearning appeal in item (2) was significantly higher than that of other emotions, the average score of the proud appeal in item (3) was significantly higher than that of other emotions, the average score of the admiring appeal mean in item (4) was significantly higher than that of other emotions. This indicates that the experiment of different positive emotional appeals in this study was successfully manipulated.

TABLE 1 | Measurement items of each variable.

Measured variables	Measurement item	Resource
Perceived green value	Subscribing to green electricity certificate helps to save fossil energy and improve energy structure.	Venkatesh et al., 2003
	Subscribing to green electricity certificate helps to cut carbon emissions and mitigate climate change.	
	Subscribing to the green electricity certificate helps to reduce air pollution and improve air quality.	
	Subscribing to the green electricity certificate helps to promote clean energy and sustainable development in China.	
Perceived green responsibility	I have the responsibility to do my best to save resources and protect the environment.	Abrahamse and Steg, 2009
	No matter what others do, I will save resources and protect the environment.	
	Although my personal power is very small, I also want to contribute to environmental protection.	
	In order to save resources and protect the environment, we should try our best to use clean energy.	
Green purchase behavior	I would like to collect and learn more about subscribing to the green electricity certificate.	Dodds et al., 1991; Darley and Smith, 1993
	I am willing to subscribe to the green electricity certificate.	
	I would like to recommend my friends and relatives to know and subscribe to the green electricity certificate.	
	This video will prompt me to subscribe to the green electricity certificate.	
The middle doctrine	Everything should be kept in line and I do not go to extremes.	Pan et al., 2014
	Harmony is the most important thing. Try not to conflict with others.	
	When you make achievements, you should try to remain humble and low-key.	
	When you disagree, you should find a compromise acceptable to all.	

Reliability and Validity Test

Reliability Test

In this paper, the internal reliability index was used to measure the reliability of the scale. As shown in **Table 2**, Cronbach's alpha value of all variable items was greater than 0.9, indicating the consistency and stability of the measurement questionnaire.

Confirmatory Factor Analysis

Confirmatory factor analysis was performed using AMOS 24.0 and the results were as follows: absolute fit indices $\chi^2 / df = 2.954 < 3$, RMSEA = 0.061 < 0.08, GFI = 0.926, AGFI = 0.898; incremental fit measurement NFI = 0.968, TLI = 0.973, CFI = 0.978. The above results show that the model fits well.

Convergent Validity

The output of AMOS24.0 shows that the standardized factor loadings of each measurement item on its corresponding latent variable are between 0.89 and 0.97. As shown in label 2，the average variance extracted (AVE) of each latent variable was greater than 0.5 and the composite reliability (CR) was greater than 0.8. The above results indicated that the scale of this study has good convergent validity.

Discriminant Validity

As shown in **Table 2**, the square root of the AVE value of each latent variable is greater than the correlation coefficient between the latent variable and other latent variables, indicating that the discriminant validity of the scale in this study is good.

Common Method Bias Test

Common method bias: since the measurement of constructs in this paper uses scales, there may be a problem of common method bias. This study adopted a series of control procedures to reduce the interference caused by common method bias, such as emphasizing the anonymity of this study and improving the items and order of the scale. In this paper, controlling for the effects of an unmeasured latent methods factor (ULMC) was used to test whether there was a common method bias in the study. We build two models by using AMOS 24.0. The model with both method and substantive components could be compared to an identical model except with construct correlations constrained to the values obtained in the substantive-only model. If the two models are significantly different, there is evidence of method bias (Richardson et al., 2009). The comparison results of the main fit indicators of the two models are as follows:

$\Delta RMSEA = 0.007 < 0.05$, $\Delta TLI = 0.01 < 0.1$, $\Delta CFI = 0.01 < 0.1$, the above results show that the degree of model fit is not significantly improved after adding the common method factor, so there is no significant common method bias in this study.

RESULTS

Main Effect of Positive Emotional Appeal

According to the results of correlation test, consumers' perceived green value, perceived green responsibility, green purchase behavior, and middle doctrine were highly correlated at the test level of 0.01. Under four different types of positive emotional appeals, the mean comparison of different positive emotions is displayed in figure. As can be seen in figure, compared with the other three emotions, the yearning appeal leads to the highest degree of perceived green value, perceived green responsibility, and green purchase behavior.

Then we classified four kinds of positive emotional appeals into two specific dimensions, and conducted independent sample T test in different groups, the results of which are shown in table. It can be seen from **Table 3** that there is significant difference in the positive effects of the cherishing and yearning appeals on consumers' perceived green value and green purchase behavior, but there is no significant difference in the positive effects on consumers' perceived green responsibility, that is, compared with the cherishing appeal, the yearning appeal has a more positive impact on consumers' perceived green value and green purchase behavior. **Table 3** showed that the results of the proud and the admiring group are different to those of the cherishing and yearning group, that is, there is no significant difference in the positive effects of the proud and admiring group on consumers' perceived green value, but there is significant difference in the positive effects on consumers' perceived green responsibility and green purchase behavior, that is, compared with the proud appeal, the admiring appeal has a more positive impact on consumers' perceived green responsibility and green purchase behavior. Therefore, H1 and H3 are accepted and the results in this section partially support H2 and H4 the results of T test is shown in **Figure 4**.

TABLE 2 | Reliability and validity test.

Measured variables	1	2	3	4
1 Perceived green value	0.952			
2 Perceived green responsibility	0.676	0.877		
3 Green purchase behavior	0.778	0.684	0.938	
4 The middle doctrine	0.713	0.651	0.648	0.880
Cronbach's alpha	0.974	0.929	0.965	0.932
AVE	0.908	0.770	0.879	0.775
CR	0.975	0.931	0.967	0.932

The diagonal value is the square root of AVE and the lower left part is the Pearson correlation coefficient between latent variables.

Mediating Effect Test

In order to further test the mediating effect of perceived green value and perceived green responsibility, we adopted the Bootstrap method proposed by Preacher and Hayes (2008), which supports the use of bootstrapping method to handle cases where the probability distribution of the mediating effect value is unknown. The Bootstrapping method does not need to satisfy assumptions such as normal distribution. According to the suggestion of Jie et al. (2012), we adopted the bias-corrected percentile Bootstrapping method and the 95% confidence interval of the mediating effect size was calculated by repeating the sampling process 5,000 times. Adopting PROCESS 3.3 and select model 4 for analysis. Four positive emotions were divided into two groups according to different dimensions to test the mediating effect. The "positive emotional appeal" was transformed into dummy variables. One group took the cherishing appeal as the control, transforming cherishing into 0 and yearning into 1. In the other group, we transform proud into 0 while admiring into 1. Through the analysis with the PROCESS 3.3, the corresponding model path coefficient diagram is shown in **Figures 5, 6**, and the mediating effect is shown in **Table 4**.

As for the cherishing-yearning group, according to **Table 4**, the confidence interval of perceived green value does not contain 0, indicating that perceived green value plays a

TABLE 3 | Variables' independent sample *T* test.

Group	Var.	*t*	DF	Sig.	MD	SD	95% confidence interval	
							The lower limit	The higher limit
1	PGV	−2.509	212	0.013*	−0.381	0.152	−0.680	−0.082
	PGR	−1.023	212	0.307	−0.107	0.105	−0.315	0.0996
	GPB	−3.133	212	0.002**	−0.519	0.166	−0.845	−0.192
2	PGV	−0.456	217	0.649	−0.076	0.167	−0.404	0.252
	PGR	−2.857	217	0.005**	−0.351	0.123	−0.593	−0.109
	GPB	−3.493	217	0.001**	−0.619	0.177	−0.968	−0.270

PGV = Perceived green value, PGR = Perceived green responsibility, GPB = Green purchase behavior, DF = degrees of freedom, MD = mean difference, and SD=Standard error difference.

*Group 1: the cherishing and the yearning group. Group 2: the proud and the admiring group. *$p < 0.05$; **$p < 0.01$.*

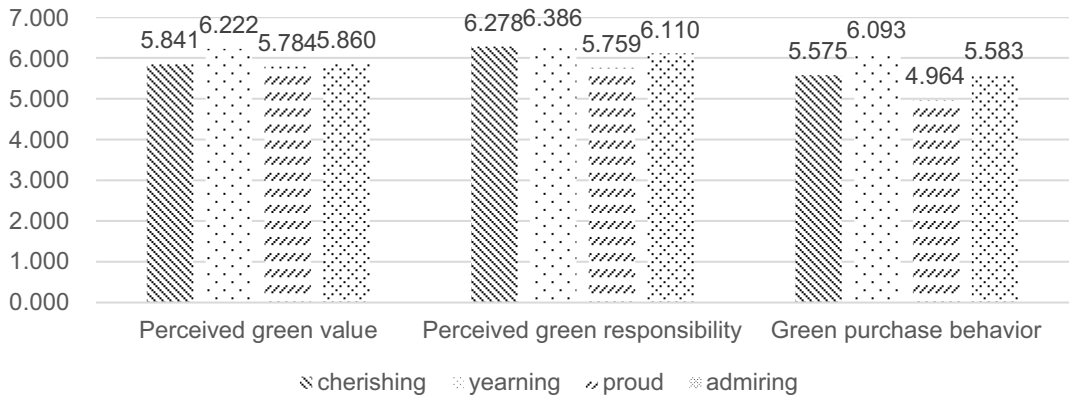

FIGURE 4 | The mean comparison of different positive emotions.

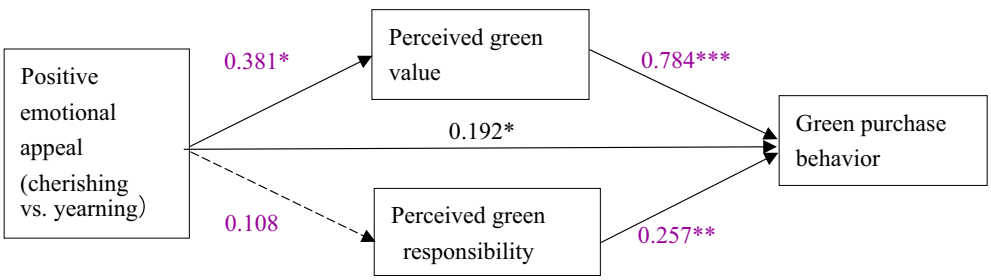

FIGURE 5 | Mediating effect test (cherishing vs. yearning). $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

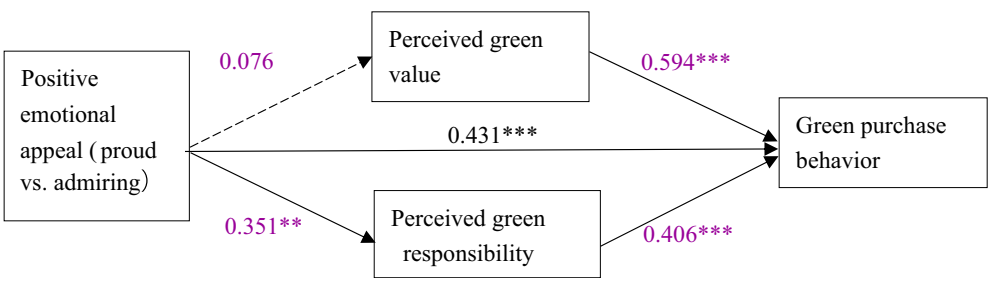

FIGURE 6 | Mediating effect test (proud vs. admiring). $^{**}p < 0.01$; $^{***}p < 0.001$.

TABLE 4 | Mediating effect of theoretical model.

Explanatory variables	Mediator	Coefficient	S.E.	LLCI	ULCI
Cherishing-Yearning group	The direct effect without the mediator	0.192	0.091	0.014	0.371
	PGV	0.299	0.119	0.071	0.533
	PGR	0.028	0.031	−0.023	0.099
Proud-Admiring group	The direct effect without the mediator	0.431	0.1162	0.202	0.660
	PGV	0.045	0.098	−0.165	0.223
	PGR	0.143	0.058	0.041	0.268

S.E. = Standard error, LLCI = Lower limit of the confidence interval, ULCI = Upper limit of the confidence interval, PGV = Perceived green value, and PGR = Perceived green responsibility.

TABLE 5 | Moderating effect test of emotional arousal.

Group	Moderator	Antecedent		PGV			PGR				GPB		
				Coe.	S.E.	*P*	Coe.	S.E.	*P*		Coe.	S.E.	*P*
1	MD	PEA	a_{11}	0.327	0.052	**	0.071	0.075	0.350	c_1'	0.209	0.091	*
		PGV	-	-	-	-	-	-	-	b_1	0.734	0.065	***
		PGR	-	-	-	-	-	-	-	b_2	0.202	0.091	*
		MD	a_{21}	0.801	0.053	***	0.546	0.039	***	c_2'	0.1174	0.071	0.101
		PEA*MD	a_{31}	−0.217	0.108	*	−0.031	0.078	0.691	c_3'	−0.025	0.093	0.786
		R2		0.5473***			0.4940***				0.7293***		
		F		84.6384			68.3525				112.1030		
2	MD	PEA	a_{11}	0.031	0.119	0.794	a_{12}	0.3221	0.097	**	c_1'	0.4465	0.115	***
		PGV	-	-	-	-	-	-	-		b_1	0.5021	0.070	***
		PGR	-	-	-	-	-	-	-		b_2	0.3520	0.086	***
		MD	a_{21}	0.8151	0.06	***	a_{22}	0.5244	0.046	***	c_2'	0.1933	0.078	*
		PEA*MD	a_{31}	0.096	0.112	0.394	a_{32}	−0.077	0.091	0.401	c_3'	0.1094	0.106	0.304
		R2		0.4974***			0.4064***				0.6295***		
		F		70.9188			49.0587				213.0000		

*Coe. = Coefficient, S.E. = Standard error, P = p value, PGV = Perceived green value, PGR = Perceived green responsibility, GPB = Green purchase behavior, PEA = Positive emotional appeal, and MD = Middle doctrine. Group 1: cherishing vs. yearning. Group 2: proud vs. admiring. *p < 0.05; **p < 0.01; ***p < 0.001.*

mediating role between positive emotional appeal and green purchase behavior. The confidence interval of perceived green responsibility contains 0, indicating that perceived green responsibility has no significant mediating effect between positive emotional appeal and green purchase behavior. In the absence of mediating variables, the confidence interval of the direct effect of positive emotional appeals on green purchase behavior does not contains 0, indicating that the direct effect is significant. Therefore, perceived green responsibility plays a partial mediating role between positive emotional appeal and green purchase behavior.

By analyzing the proud-admiring group in the same way, it can be found that the mediating effect of perceived green value is not significant, while the mediating effect of perceived green responsibility is significant. In the absence of mediating variables, the confidence interval of the direct effect of positive emotional appeal on green purchase behavior does not include 0, indicating that the direct effect is significant, which proves that perceived green responsibility plays a partial mediating role in the path of positive emotional appeal affecting green purchase behavior.

In conclusion, H2 and H4 is proved to be true.

Moderating Effect Test of Emotional Arousal

In this section, we test the moderating effect of the middle doctrine on "positive emotional appeals-perceived green value," "positive emotional appeals-perceived green responsibility," and "positive emotional appeals-green purchase behavior." Since the theoretical model of this study is a moderated mediation model, we adopt PROCESS 3.3 of Hayes and select model 8 for analysis. In group 1, the results are displayed in **Table 5**, which showed that coefficients a31 are significant and the sign of the regression coefficient is negative. It turns out that the middle doctrine significantly negatively moderates the influence of positive emotional appeals on perceived green value. H5a are proved to be true. The corresponding moderating effects of the middle doctrine is show in **Figure 7**. We probed this interaction with floodlight analysis using the Johnson–Neyman technique to identify the regions of middle doctrine for which the effect of displayed quantity was significant (Spiller et al., 2012). Results revealed that the impact of yearning appeals on consumers' green purchasing behavior is significant stronger than cherishing appeals' when the degree of middle doctrine was less than 6.46. The corresponding results of moderating effects of the middle doctrine and floodlight analysis are show in **Figure 7**. The coefficients a32 and c3′ are not significant. H5b is not accepted. In group 2, the result showed that all the coefficients a31, a32, and c3′ are not significant, indicating that significant moderating effects of the middle doctrine on the excepted paths above do not exist. H5c and H5d are not accepted. In addition, the R2 of each liner regression model is significant, indicating that independent variables selected in this study have a strong explanatory power for the dependent variable.

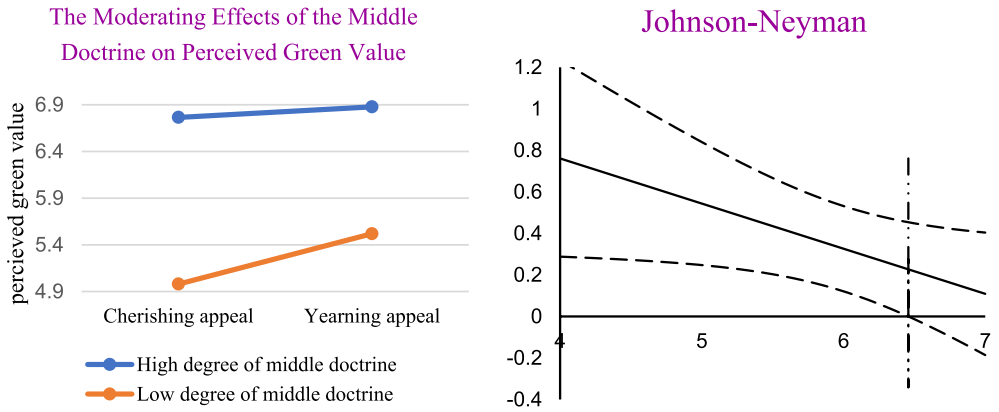

FIGURE 7 | The moderating effects of the middle doctrine on perceived green value and floodlight analysis.

Discussion

The aim of this study was to explore the influence effect and mechanism of positive emotional appeals on green purchase behavior, enriching the research of positive emotions on green purchase behavior. At present, scholars' studies have gradually shifted from the cognitive to the emotional level to seek the influencing factors of green purchase behavior; nevertheless, most of which are lack of relevant empirical studies. Based on the results of previous qualitative research and the direction of national policies, it is the first time that creatively introduces the two specific positive emotions into study, including the cherishing and the yearning. At the same time, combined with the Chinese traditional cultural background, this paper incorporated middle doctrine into this theoretical model as a moderating variable, which is helpful to promote the localization of positive emotion and green purchase behavior in the field of consumer behavior.

In this study, we discovered that the diverse types of positive emotional appeals exerted different influence on consumers' perceived green value, perceived green responsibility, and green purchase behavior. Compared with the cherishing appeal, the yearning appeal is more effective in promoting the perceived green value and green purchase behavior. Compared with the proud appeal, the admiring appeal is more effective in promoting the perceived green responsibility and green purchase behavior. This conclusion confirms Fredrickson's (1998) broaden-and-build model of positive emotion theory. However, it is on the contrary to the results studied by Wang et al. (2017). He found that there is no difference between the proud and the admiring in the green purchase decision-making process.

We found that under the state of positive emotion, perceived green value has significant mediating effect on the relationship between positive emotional appeals (cherishing vs. yearning) and green purchase behaviors. This is consistent with the research conclusions of Shamdasani et al. (1993), Choi and Kim (2005), and Wang et al. (2017). However, perceived green value does not play a mediating role in the path of positive emotional appeals (proud vs. admiring) affecting green purchase behavior. On the contrary, consumers' perceived green responsibility positively affects their green purchase behavior, and it can significantly mediate the relationship between positive emotional appeals (proud vs. admiring) and green purchase behavior. This finding again validates the responsible environmental behavior model proposed by Hines et al. (1987). Furthermore, this is also consistent with the research conclusions of Scott et al. (2000), Chen (2009), Zhang et al. (2013), and Peng et al. (2014) that the sense of responsibility notably improves green consumption. The sense of responsibility reflects the individual's internal quality, as the driving factor, affecting the individual's behavior. The individual internalizes the sense of ecological responsibility in the mind and then obtains the embodiment from the individual's ecological behavior. Under the stimulation of positive emotional appeal, individuals perceive ecological responsibility and externalize it through ecological behavior. However, perceived green responsibility does not play a mediating role in the path of positive emotional appeals (cherishing vs. yearning) affecting green purchase behavior. The above findings support our previous hypothesis.

Finally, middle doctrine significantly negatively moderates the relationship between positive emotional appeals (cherishing vs. yearning) and perceived green value but no evidence was found to support the moderating effect of middle doctrine on the other paths (positive emotional appeals-perceived green responsibility and positive emotional appeals-green purchase behavior). That is, for consumers with different degrees of middle doctrine, admiring appeal (vs. proud appeals) has a stronger impact on the perceived green responsibility and green purchasing behavior. Our explanation for this result is that consumers with strong moderate values hold such a view that the existence of the individual depends on the relationship of the whole and at the same time has an impact on the whole, so the behavior of others has a stronger impact on them. Furthermore, admiring appeal makes consumers with a higher degree of moderate values pay attention to the green buying behavior of others. Therefore, for consumers with a higher degree of moderate values, the effect of admiring appeal is also higher than that of proud appeal.

THEORETICAL CONTRIBUTION

This research makes three main theoretical contributions: First, our study revealed the different effects of the four dimensions

of positive emotional appeal on consumers' green purchase behavior. Existing research on emotional appeal mainly focuses on the difference in the impact of rational appeal and emotional appeal (Matthes et al., 2014), but there is a lack of in-depth research on different dimensions of positive emotional appeals. Based on four typical positive emotions extracted by Wang (2015) through qualitative research, we further revealed their influence on consumers' green purchasing behavior through quantitative methods. Our work fills a gap in previous research.

Second, this research advances understanding of how four dimensions of positive emotional appeals shape consumers' green purchasing behavior. This study verified that cherishing appeal and yearning appeal lead to differences in consumers' perceived green value, which further affects their green purchase behavior. Positive emotional appeals affect consumers' perceived value, which is a brand-new point of view. This study also proved that proud appeal and admiring appeal have different effects on consumers' perceived green responsibility and further influence consumers' green purchase behavior. The above viewpoints and conclusions provide a new perspective, which is helpful to understand the impact of positive emotional appeals on consumers' green consumption behavior. At the same time, this paper incorporated middle doctrine into this theoretical model as a moderating variable, which is helpful to promote the localization of positive emotion and green purchase behavior in the field of consumer behavior.

Third, this study expanded the scope of application of the Broaden-and-Build Theory of positive emotions and prospect theory. For the first time, we use prospect theory to explain that consumers' perceived differences in green value and green responsibility are due to the selection of different reference points (present or future and self or others) under different emotional appeal stimuli. This provides a new perspective for other researchers trying to understand the impact of emotional appeal.

POLICY IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

The research conclusion provides valuable marketing inspiration and policy management experience for both enterprise managers and government policymakers. Firstly, make full advantage of positive emotional appeal to guide consumers to green purchase sustainably. For enterprise, in the process of promoting the products, it is of great significance to add positive emotional attributes to capture the consumer's inner demand and arouse their inner resonance, guiding them to buy. At the same time, the government is supposed to attach prime importance to cultivating and enhancing positive emotional attainments and strengthen their recognition of ecological and environmental behaviors, so as to encourage individuals strive for a green ecological environment and actively participate in the sustainable green purchase. Secondly, the cherishing and admiring appeals should be fully valued. To be specific, enterprises can incorporate beautiful ecological environment pictures or videos into the advertisements. In addition, short films, stories, or music can be broadcast to publicize individuals' green purchase behavior, in order to infect more individuals to join the team for affirming and appreciating others' environmental protection behavior. Finally, emphasize the role of green responsibility to enhance consumers' inner awareness of ecological environmental protection. When making product marketing plans, enterprises should not only comprehensively introduce the unique performance of products, but also integrate some elements which can awaken consumers' awareness of ecological responsibility, urging consumers to be willing to purchase green products.

This work suggests several interesting opportunities for future research. One is to investigate the long-term effects of different types of emotional appeals on consumers' green purchasing behavior. Our experimental study confirms that emotional appeals have an impact on consumers' single green purchase behavior but does not take into account consumers' long-term green purchase behavior. So, researchers can use the Real-time Longitudinal Methods to investigate whether consumers' behaviors in a certain period of time have continuity and whether its green buying behavior increases or decreases over time. Another opportunity for further research is to more deeply explore the role of positive emotional appeals. For instance, future research can be conducted on the effect of a combination of different positive emotional appeals on consumers (e.g., one group of consumers is stimulated by cherishing and pride appeals, another group is stimulated by yearning and appreciation appeals) and the effects of other types of affective appeals on consumers.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

JianmW: conceptualization, data curation, and writing-original draft preparation. ZH: methodology and supervision. JiangW: methodology and software. JB: visualization and investigation. JG: methodology and investigation. XY: conceptualization, methodology, software, and manuscript revision. All authors contributed to the article and approved the submitted version.

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Can empowering leadership promote employees' pro-environmental behavior? Empirical analysis based on psychological distance

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Leadership styles, especially empowering leadership, affect the psychological relationship between employees and organizations, and then affect employees' positive behavior in the organization. In this research, we studied the effects of empowering leadership and psychological distance on employees' pro-environmental behavior and explored the mechanism of green organizational climate (GOC). By adopting correlation analysis, statistical analysis, and regression analysis, we conducted a multisource field study of 873 valid employee questionnaires to verify our theoretical model. The results showed that empowering leadership had a significant positive impact on psychological distance and employees' pro-environmental behavior; and psychological distance played a partly intermediation role in the relationship between empowering leadership and employees' pro-environmental behavior. Moreover, GOC can promote employees' pro-environmental behavior, but it cannot regulate between psychological distance and employees' pro-environmental behavior. The findings obtained some intriguing insights that could help to better guide employees toward pro-environmental behavior.

KEYWORDS

empowering leadership, psychological distance, green organizational climate, employees' pro-environmental behavior, organizational management

Introduction

With the rapid development of China's economy, the problem of resource shortage and environmental pollution becomes more and more serious, and environmental problem is getting more and more attention. Enterprises are both the largest social economic organizations in resource consumption and the largest social agents of pollution emission. For this reason, they must assume the social responsibility to protect the environment advocated by society and government (Liu, 2014). At the

macro level, enterprises should accelerate technological innovation and transform into green development. And at the micro level, environmental practices of enterprises need the response and support of employees. The active participation of employees can greatly improve the environmental governance ability of enterprises (Afsar et al., 2016). Therefore, effectively guiding employees to behave well in pro-environmental behavior has become an urgent problem to be solved.

Employees' pro-environmental behavior is divided into daily work-related pro-environmental behavior and daily spontaneous pro-environmental behavior (Bissing-Olson et al., 2013). Ones and Dilchert (2012) defined employees' pro-environmental behavior as "all measurable behaviors in which employees actively participate that contribute to environmental sustainability or protect the environment from damage." Lu et al. (2016) defined employees' pro-environmental behavior as the positive and proactive environment-friendly behavior showed by employees in enterprise management practice. In general, employees' pro-environmental behavior refers to the friendly behavior that employees spontaneously reduce or eliminate the negative impact in the work environment and strive to create a positive impact on the environment.

Leadership behavior plays a crucial role in effectively guiding employees' pro-environmental behavior. A large number of research results have shown that positive leadership style positively affects employee behavior (Islam et al., 2020; Wang et al., 2020). Since the 21st century, the external environment has become increasingly dynamic and complicate, organizations are flattening their organizational structures and implementing employees self-management to adapt to the external environment. In that way, empowering leadership has attracted the attention of scholars for the advantage of improving employees' self-leadership ability (Gavin, 2019). Relevant studies have suggested that empowering leadership is a positive and effective way of leadership, which can make employees feel that they are valued and trusted, and thus willing to take full advantage of their initiative and stimulate the vitality of the organization. Empowering leadership, as an important positive leadership style, has been proved to have a positive impact on employee behavior, such as organizational citizenship environmental behavior (Jiang et al., 2019), employee innovation behavior (Jada et al., 2019), employee safety behavior (Lee et al., 2019), and so on. Although relevant studies have reached relatively consistent conclusions, previous studies have not explained whether empowering leadership influences employees' pro-environmental behavior and what the influencing mechanism is. Hence, it is necessary to further understand the relationship between empowering leadership and employees' pro-environmental behavior. This research established a model of the influence of empowering leadership and employees' pro-environmental behavior. Relevant studies have pointed out that empowering leadership affects employee psychological perception (Spreitzer, 1995), and the existence of perceived distance affects individuals' organizational identification, which in turn affects individual decision-making behavior (Wang et al., 2013). Psychological distance refers to the subjective feeling of far and near (close and distant) relationship between people, as well as the perception of the emotional fit between people and organizations (He and Zhang, 2020). In addition, Li and Chen (2019) appealed that paying more attention to the emotional state of employees and the degree relationship between employees and the organization has a momentous significance in theory and practice for management research. This article introduces psychological distance, a psychological variable, to explore the potential mediating mechanism of empowering leadership affecting employees' pro-environmental behavior and conduct relevant empirical research.

Except for the influence of social relationship, organizational environment is also very important for individual behavior guidance (Greenberg, 1988). For individual environmental behavior, green organizational climate (GOC) is an important manifestation of the organizational environment. GOC can affect the motivation, attitude, belief, and value of employees in the organization (Tagiuri and Litwin, 1968), where enterprise environmental policies and practices may make the employees have green values (Chou, 2014). Research suggests that environment-friendly work climate may improve employees' pro-environmental behavior in and out of the workplace (Hicklenton et al., 2019). GOC is a crucial element affecting employees' pro-environmental behavior. Based on that, this study proposes that employees seem more likely to develop green values and increase the possibility of achieving pro-environmental behavior in GOC.

Individual behavior depends on the interaction between individual perception and the external environment (Bandura, 1993). When external circumstances are extremely unfavorable or favorable, the behavior may be hindered or facilitated. Psychological distance is an internal psychological factor, and the employee–organization psychological distance (EOPD) perceived by individual may affect his/her decision-making. However, as an environmental factor, green organization climate may strengthen or weaken the influence of psychological factor on environmental behavior. For instance, Chou (2014) noted that GOC can regulate the relationship between individual environmental norms and employees' pro-environmental behavior. Based on former researchers' works, this article further examines the moderating effect of GOC in the relationship between psychological distance and employees' pro-environmental behavior.

The main contributions of this article are as follows: first of all, we adopted the EOPD proposed by Chen and Li, explore the mediating mechanism between empowering leadership and employees' pro-environmental behavior, and dig deep into the psychological process of empowering leadership's influence on employees' pro-environmental behavior. Second, green

organization climate, as an environment variable, is examined for its effect on employees' pro-environmental behavior and the external influence on employees' pro-environmental behavior is further analyzed. Finally, this article explores the moderating role of GOC between psychological distance and employees' pro-environmental behavior, which provides further empirical evidence for exploring the effect of empowering leadership on employees' pro-environmental behavior in the context of green organization management.

Theoretical basis and hypothesis development

Empowering leadership and employees' pro-environmental behavior

Employees' pro-environmental behavior refers to the friendly behavior that employees consciously reduce or eliminate the negative impact and strive to create a positive impact on the environment at workplace. Proactive pro-environmental behavior can not only improve environmental conditions but also affect the environmental attitudes of organizations and individuals (Tian and Robertson, 2019). Employees' pro-environmental behavior, as a kind of extra-role behavior, is altruistic. If the extra-role behavior is carried out, it means that the time for in-role behavior will be reduced (such as the time for doing their own work). Obviously, there is a conflict in the time allocation between extra-role behavior and in-role behavior. So it is particularly important for employees to break through the time allocation conflict from the bottom of their hearts and take the initiative to implement pro-environmental behavior.

Empowering leadership refers to a leadership style that shares power with staff by emphasizing the value of working, providing greater decision-making autonomy, expressing optimism about staff's high performance, and removing barriers to performance (Zhang and Bartol, 2010). Facing the complex and changeable external environment, the organizational structure of enterprises is changing to a flattening in order to improve the adaptability of enterprises. In this context, empowering leadership, characterized by delegating power to employees and emphasizing employee participation, has gradually gained widespread attention in both theoretical and practical fields (Lee et al., 2018). And a wealth of studies have pointed out that empowering leadership has a positive impact on employee job performance, organizational citizenship behavior, employee creativity, employee satisfaction, and so on (Biemann et al., 2015; Dong et al., 2015; Cheong et al., 2016; Lee et al., 2018).

According to the theory of empowering leadership, this study argues that empowering leadership promotes employees' pro-environmental behavior. First, empowering leadership helps employees better understand the meaning of their work and convinces them that their work and behaviors are crucial to organizational development. Second, empowering leadership helps employees gain competence and autonomy by encouraging employees to express their opinions and giving them greater decision-making autonomy and so on. Based on social exchange theory, employees will give feedback and rewards when they are motivated and trusted by their leaders. Specifically, leadership empowerment stimulates employees' intrinsic motivation to contribute to the organization. Then employees will transcend role restrictions and spontaneously safeguard the interests of the organization to realize the corporate vision from the standpoint of the organization. Therefore, they are more inclined to do pro-environmental behavior that is conducive to the green development of the organization. Finally, empowering leadership also alleviates employees' worries about their job challenges, which provides time for employees to do pro-environmental behavior. Based on this, we proposed the following hypothesis:

H1. Empowering leadership is positively related to employees' pro-environmental behavior.

The mediating role of psychological distance

The concept of psychological distance was initiated by psychologist Edward Bullough, meaning that esthetic feelings come from the psychological distance between the subjective sensation of the viewer and the observed object. Chen and Li (2018) applied this idea to the field of organizational management and proposed a new concept of "EOPD" and developed an EOPD scale. EOPD refers to a subjective judgment of the distance from which staff forecast, appraise, and act on the organization according to the real acceptance and the actual willingness to contribute. It is used to describe the fit between the staff and the organization. Consequently, drawing on the conceptual definition of Chen and Li (2018), psychological distance in this article specifically refers to the EOPD.

There are extensive studies on the relationship between leaders and psychological distance. Wade and Tavris (2002) proposed that when the leader reflected the employees' psychological distance, job satisfaction and work efficiency would increase, otherwise, it was opposite. Then, Liberman et al. (2007) put forward that psychological distance would increase distally when leaders ignored employees' survival and status or employees were threatened in the organization. Vanderstukken et al. (2019) suggested that if leaders could

successfully evaluate psychological distance that subordinates may experience at some point, in that way they could readjust their communication methods, thereby exerting greater influence on subordinates. Moreover, Berson et al. (2015) found that the closer the psychological distance between leaders and followers was, the more followers would improve their promises and efforts to achieve personal aims and group aims. Li and Chen (2019) measured the intimacy level of the employee–organization relationship and proposed that managers should strengthen psychological and emotional intimacy with subordinates. This study believes that empowering leadership has an impact on psychological distance, mainly in the following several ways: (1) By helping employees understand work meaning and encouraging employees to make decisions autonomously, employees would have a better understanding of their work and a higher degree of participation, thus enhancing spatial-temporal distance. (2) Empowered employees would improve self-efficacy and have a good expectation for the future development of the organization. Experience distance would be closer. (3) Empowering leadership makes staff understand the value of work, has confidence in employees' high performance, and helps them improve or accumulate working knowledge. Based on this, employees are closer to the organization emotionally and behaviorally, thus enhancing their emotional and behavioral distance. (4) With the help of empowering leadership, employees can better understand the company's mission and values, and their personal values are more likely to converge the organization. The cognitive distance and objective social distance would be drawn closer. Hence, this article suggests that empowering leadership can narrow the psychological distance between employees and organizations. Accordingly, we proposed the following hypothesis:

H2. Empowering leadership is positively related to psychological distance.

Employees' pro-environmental behavior is the result of the interaction of organizational environment, environmental awareness, and environmental motivation. Psychological distance involves the perception of the dynamic relationship between employees and the organization (He and Zhang, 2020). Therefore, this article believes that psychological distance is closely related to employees' pro-environmental behavior. Specifically, (1) when the experiential distance, cognitive distance, and spatial-temporal distance between employees and the organization are closer, employees would have a clearer understanding of the future development of the organization and understand the significance of their behaviors to the organization's development, so they are more likely to engage in pro-environmental behavior. (2) When the emotional distance between employees and the organization is closer, positive subjective cognition would stimulate employees' subjective initiative, and employees are more likely to transcend role restrictions to implement pro-environmental behavior. (3) When the objective social distance between employees and the organization is relatively close, organization's members are familiar with and identify with each other, which is conducive to the communication of internal members of the organization, forming the same green values, and then stimulating the production of pro-environmental behavior. (4) Pro-environmental behaviors are conducive to organizational development. When the behavioral distance between employees and the organization is closer, employees are more likely to adopt pro-environmental behaviors. In addition, Li and Chen (2019) proposed that EOPD could directly express the intimacy of the actual relationship between employees and the organization, and the smaller the psychological distance is, the more likely OCB occurs. Considering employees' pro-environmental behavior as one of the concrete forms of OCB (Tian et al., 2019), we proposed that reducing psychological distance can promote the employees' pro-environmental behavior. Hypothesis 3 is thus proposed as follows:

H3. A reduced psychological distance is positively related to employees' pro-environmental behavior.

In the elaboration of H2 and H3, this study proposes the evidence and logic that empowering leadership can reduce psychological distance and promote employees' pro-environmental behavior, as well as reducing psychological distance can promote employees' pro-environmental behavior. This suggests that psychological distance may play a bridge role in the impact mechanism of empowering leadership on employees' pro-environmental behavior. Mzembe's (2020) study pointed out that the explanatory level of the cognitive object can be changed by changing individual's psychological distance, thereby affecting the individual's decision-making behavior. This suggests that in the mechanism of promoting employees' pro-environmental behavior, empowering leadership can obtain the matching relationship between them by changing the psychological distance. The empowerment and incentive measures of empowering leadership reduce the psychological distance between employees and the organization. Employees tend to take high-level explanations that it is a good opportunity for personal growth, and their positive perceptions and expectations cause positive valence, which motivates them to participate in organizational behavior (Islam et al., 2021). Therefore, employees are more likely to engage in pro-environmental behaviors that benefit the organization. In addition, Cao et al.'s (2021) study also found that psychological distance plays a mediating role in the mediation of stress and employees' innovative behavior. Thus, we proposed that psychological distance plays a mediating role between empowering leadership and employees' pro-environmental behavior.

H4. Psychological distance strengthens the relationship between empowering leadership and employees' pro-environmental behavior.

Green organizational climate and employees' pro-environmental behavior

Organizational climate is an employees' shared perception regarding working environment, particularly formal policies, and guidelines (Norton et al., 2012). Recently, more and more researchers have begun to study different types of organizational climates, such as safety climate, service climate, innovation climate, and social climate. Chou (2014) developed the concept of GOC and proposed that GOC was perceived as a subclass of the organizational climate, which mainly includes green commitments of enterprise social responsibility, green organizational culture, and enterprise environmentalism.

A study has demonstrated that organizational climate noticeably affects staff's emotions, attitudes, and behaviors in terms of work environment (Abdulkarim, 2014). The bulk of empirical studies has examined the impact of organizational climate on employees' behavior. Wang and Peng (2018) proposed that pro-environmental passion climate was an emotional driving force, which made members enthusiastic about environmental actions, and had more driving force and predictive power for actual behaviors. Van der Werff et al.'s (2021) research indicated that the environmental impact of organizations and government would influence pro-environmental behaviors of citizens and employees. Based on the above research, we believe that GOC will affect employees' decisions and behaviors. If employees perceive that they are in a green and environment-friendly organizational climate that encourages environmental behaviors, they are more inclined to implement pro-environmental behavior. Therefore, we hypothesized that:

H5. Green organizational climate is positively correlated with employees' pro-environmental behavior.

The moderating role of green organizational climate

Aside from the direct effect of GOC, we hypothesized that GOC may have a positive moderating effect on psychological distance and employees' pro-environmental behavior. Norton et al. (2012) hypothesized that environmentally friendly organizational atmosphere moderated positive relationship between employees' green knowledge, skills, abilities, and other personal factors and their green behavior. Chou (2014) verified that GOC could regulate the relationship between personal norms and employees' pro-environmental behavior. Therefore, we hypothesized that GOC may regulate the relationship between psychological distance and employees' pro-environmental behavior. When green organization climate is strong, the effect of psychological distance on employees' pro-environmental behavior is stronger. Also, GOC can make employees feel the organization's environmental protection enthusiasm, make them consistent with the values and goals of the organization, shorten the psychological distance, and thus promote employees to implement pro-environmental behaviors. On the contrary, when GOC is weak, the impact of psychological distance on employees' pro-environmental behavior is weakened. Accordingly, we proposed the following hypothesis:

H6. Green organizational climate plays a moderating role in psychological distance and employees' pro-environmental behavior.

In conclusion, a hypothesis model is proposed, as shown in **Figure 1**.

Methodology

Respondents and procedure

The research samples of this study were taken from 10 enterprises and institutions in Jiangsu province and Shandong province of China. To improve the respondents' understanding of the content of the questionnaire as much as possible, a pre-research was conducted before the formal research. And the questionnaire items were revised according to the reliability and validity analysis results of the pre-research and the suggestions of the respondents. At the same time, this study adopted various methods such as anonymous answering, designing reverse questions, and random allocation of items of different dimensions to reduce the impact of public method bias on the research results.

In the pre-research stage, the questionnaires were distributed through social platforms such as WeChat, and employees were invited to fill in questionnaires. After excluding invalid questionnaires with too short answer time, wrong answers to reverse questions, or the basically same answers for measurement items, 183 valid questionnaires were obtained. The questionnaire items were revised according to the results of the pre-research and the suggestions of the research subjects, and the final formal questionnaire was formed. In the formal research stage, we chose to distribute paper questionnaires to MBA students in our college and asked 10 MBA students to send a link to the online questionnaires to their workgroup

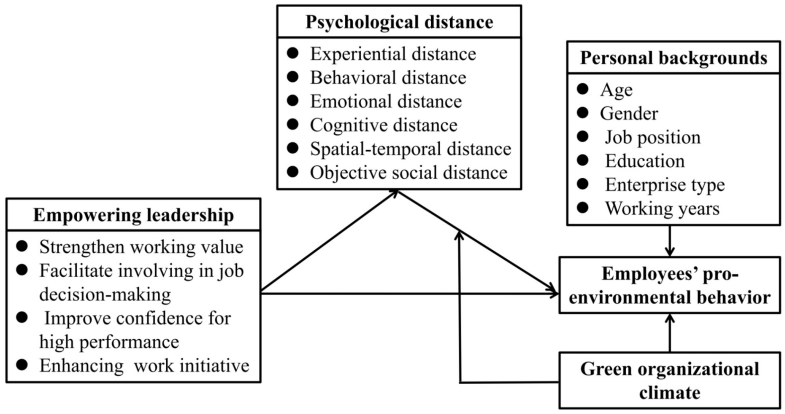

FIGURE 1
Hypothesis model.

to obtain more reliable questionnaires. Finally, altogether 973 questionnaires were obtained, and 873 valid ones were obtained after eliminating the unqualified ones, with an effective rate of 89.72%. The participant's demographic profile in Table 1 shows that the age, gender, education level, position, enterprise type, and working years of the respondents have a wide distribution and good representation.

Data were collected using the questionnaires written by enterprise employees. The entire survey process was divided into two parts, namely, the pre-research and formal research. The former was mainly carried out through the online questionnaires. According to the pre-research results, the final formal questionnaire was formed by revising questionnaire items. At formal research stage, the paper questionnaires and the online questionnaires were mainly used. Finally, altogether 973 questionnaires were obtained, and 873 valid ones were obtained after eliminating the non-conforming ones, with an effective rate of 89.72%. In data analysis, the reverse questions were deleted according to the research need.

Measures

This study collected data of five variables, namely, empowering leadership, psychological distance, employees' pro-environmental behavior, GOC, and personal backgrounds. A five-point Likert scale was adopted in this article ranging from "strongly disagree (1)" to "strongly agree (5)". The measures of the data of these five variables are as follows.

Empowering leadership

The empowering leadership scale developed by Ahearne et al. (2005) was used. This scale consists of 12 questions, including four dimensions: strengthening the value of working, facilitating involving in job decision-making, improving employees' confidence for high performance, and enhancing their work initiative. Confirmatory factor analysis suggested that the four-factor model of empowering leadership had a good structural validity ($\chi^2 = 128.485$, df = 29, $p < 0.001$, NFI = 0.978,

TABLE 1 Participants' demographic profile.

Item	Category	Frequency	%
Gender	Male	401	45.9
	Female	472	54.1
Age	18–25 years	95	10.9
	26–30 years	374	42.8
	31–40 years	232	26.6
	41–50 years	122	14
	51 years or more	50	5.7
Education	Junior college or below	134	15.4
	Bachelor	689	78.9
	Master or above	50	5.7
Position	General staff	602	69
	Front-line manager	144	16.5
	Middle manager	64	7.3
	Senior manager	41	4.7
	Others	22	2.5
Enterprise type	Government	116	13.3
	Public institution	126	14.4
	State-owned enterprise	136	15.6
	Private enterprise	178	20.4
	Foreign-capital enterprise	95	10.9
	Joint-stock enterprise	114	13
	Others	108	12.4
Working years	Under 1 year	176	20.2
	1–3 years	243	27.8
	4–6 years	199	22.8
	7–9 years	158	18.1
	Over 10 years	97	11.1

CFI = 0.971, RMSEA = 0.063). Moreover, Cronbach's α was 0.938. An example item was "My superior will help me understand the correlation between my goals and company's goals."

Psychological distance

The scale developed by Chen and Li (2018) was adopted, consisting of 24 items, which was divided into six dimensions. Confirmatory factor analysis displayed that the six-factor model of psychological distance had a good structural validity (χ^2 = 604.980, df = 174, $p < 0.001$, NFI = 0.962, CFI = 0.938, RMSEA = 0.053). Furthermore, Cronbach's α was 0.972. An example item was "During this time at work, I have been well acquainted with the organization."

Employees' pro-environmental behavior

We used six items from Robertson and Barling's (2013) scale to measure this variable, and Cronbach's α was 0.813. An example item was "I will put recyclables (such as cans, paper, bottles, batteries, etc.) in the recycling bin."

Green organizational climate

Green organizational climate developed by Taiwan scholar Chou (2014) was adopted and revised, and the final subscale included eight items. Cronbach's α was 0.927. An example item was "Our company requires employees to give priority to environmentally friendly products when purchasing office supplies."

Personal backgrounds

Respondents' age, gender, job position, education, enterprise type, and working years were investigated in the first part of the questionnaire.

Results

Descriptive statistics and confirmatory factor analysis

Table 2 offers means, standard deviations, and correlations of the variables in the study. As shown in Table 2, there is a positive correlation between the variables: empowering leadership and employees' pro-environmental behavior (r = 0.229, $p < 0.01$); empowering leadership and GOC, psychological distance (r = 0.164, $p < 0.01$; r = 0.142, $p < 0.01$); psychological distance and GOC, employees' pro-environmental behavior (r = 0.230, $p < 0.01$; r = 0.127, $p < 0.01$); GOC and employees' pro-environmental behavior (r = 0.221, $p < 0.01$).

As empowering leadership, employees' pro-environmental behavior, psychological distance, and GOC were collected from the same source (employees), we first tested the discriminative validity of the four variables through confirmatory factor analysis before testing research hypotheses. The results indicated (as shown in Table 3) that the four-factor model (χ^2 = 2,296.350, df = 773, $p < 0.01$, NFI = 0.918, CFI = 0.944, RMSEA = 0.048, SRMR = 0.048) provided an obviously better fit than three-factor model ($\triangle\chi^2$ = 1,061.057, $\triangle$df = 3, $p < 0.001$), two-factor model ($\triangle\chi^2$ = 5,740.327, $\triangle$df = 5, $p < 0.001$) and one-factor model ($\triangle\chi^2$ = 19,280.295, $\triangle$df = 6, $p < 0.001$), and had a good matching data. The test results of confirmatory factor analysis indicated that the four research variables evaluated by employees, namely, empowering leadership, psychological distance, GOC, and employees' pro-environmental behavior, have good discrimination validity.

Model test of mediating effect

First of all, model 4 in SPSS macro compiled by Hayes (2013) was adopted to test the intermediary role of psychological distance in the relationship between empowering leadership and employees' pro-environmental behavior under the control of gender, age, education, enterprise type, job position, and working years. The results (as shown in Tables 4, 5) indicated that empowering leadership had a distinct predictive effect on employees' pro-environmental behavior (β = 0.227, t = 6.381, $p < 0.001$). Moreover, when the intermediate variable was put into the middle, the direct predictive effect of empowering leadership on employees' pro-environmental behavior was still significant (β = 0.214, t = 5.990, $p < 0.001$). Also, empowering leadership positively affected psychological distance significantly and psychological distance had a positive influence on employees' pro-environmental behavior actively (β = 0.133, t = 3.940, $p < 0.001$; β = 0.096, t = 2.689, $p < 0.01$). In addition, upper and lower limits of 95% confidence intervals of the direct effect of empowering leadership on employees' pro-environmental behavior and the mediating effect of psychological distance do not contain 0 (as shown in Table 5), indicating that psychological distance played a mediating role in the relationship between empowering leadership and employees' pro-environmental behavior. The direct effect and the mediating effect accounted for 94.273 and 5.727% of the total effect, respectively.

Besides, according to the analysis results, age could positively predict employees' pro-environmental behavior significantly (β = 0.074, t = 2.307, $p < 0.05$).

Model test of moderated mediating effect

Using Model 14 in SPSS macro compiled by Hayes (2013), the moderated mediating model was tested while

TABLE 2 The means, standard deviations, and correlations of each variable.

	Variables	Means	Standard deviations	1	2	3	4
1	Empowering leadership	3.811	0.890	1			
2	Employees' pro-environmental behavior	3.827	0.948	0.229**	1		
3	Green organizational climate	3.762	1.005	0.164**	0.221**	1	
4	Psychological distance	3.818	0.881	0.142**	0.127**	0.230**	1

**$p < 0.01$.

TABLE 3 Summary of model fit indexes.

Model	Factor	χ^2	*df*	$\triangle\chi^2$	$\triangle df$	NFI	CFI	RMSEA	SRMR
Model 1	Four-factor: PD; EL; GOC; and EPEB	2,296.350	773			0.918	0.944	0.048	0.048
Model 2	Three-factor: PD; EL; and GOC + EPEB	3,357.407	776	1,061.057	3	0.881	0.906	0.062	0.081
Model 3	Two-factor: PD + EL and GOC + EPEB	8,036.677	778	5,740.327	5	0.682	0.701	0.110	0.187
Model 4	One-factor: PD + EL + GOC + EPEB	12,576.645	779	19,280.295	6	0.553	0.568	0.132	0.221

N = 873, PD, psychological distance (six dimensions); EL, empowering leadership (four dimensions); GOC, green organizational climate (eight items); EPEB, employees' pro-environmental behavior (six items); + means that two factors combine into one factor.

TABLE 4 Mediation model test of psychological distance.

Regression equations (*N* = 873)		Fit index			Coefficient significance	
Outcome variables	**Predictive variables**	***R***	R^2	$F(df)$	β	*t*
Employees' pro-environmental behavior		0.252	0.063	8.386***		
	Gender				−0.059	−0.940
	Age				0.074	2.307*
	Education				−0.056	−0.800
	Enterprise type				0.001	0.036
	Job position				−0.006	−0.189
	Working years				0.021	0.800
	Empowering leadership				0.227	6.381***
Psychological distance		0.173	0.030	3.818***		
	Gender				−0.005	−0.075
	Age				0.053	1.764
	Education				−0.052	−0.780
	Enterprise type				0.005	0.349
	Job position				0.054	1.766
	Working years				0.005	0.190
	Empowering leadership				0.133	3.940***
Employees' pro-environmental behavior		0.267	0.071	8.295***		
	Gender				−0.059	−0.936
	Age				0.069	2.150*
	Education				−0.051	−0.731
	Enterprise type				0.0001	0.004
	Job position				−0.011	−0.351
	Working years				0.020	0.785
	Psychological distance				0.096	2.689**
	Empowering leadership				0.214	5.990***

*$p < 0.05$;**$p < 0.01$; ***$p < 0.001$.

TABLE 5 Breakdown table of total effect, direct effect, and mediating effect.

	Effect value	Boot standard error	(Boot) LLCI	(Boot) ULCI	Relative effect value
Total effect	0.227	0.039	0.152	0.306	
Direct effect	0.214	0.040	0.135	0.295	94.273%
Mediating effect of psychological distance	0.013	0.007	0.003	0.028	5.727%

TABLE 6 Moderating effect test of green organizational climate (GOC).

Regression equations ($N = 873$)		Fit index			Coefficient significance	
Outcome variables	**Predictive variables**	***R***	***R2***	***F*(d*f*)**	**β**	***t***
Employees' pro-environmental behavior		0.314	0.098	9.408***		
	Gender				−0.049	−0.787
	Age				0.061	1.912
	Education				−0.045	−0.648
	Enterprise type				0.002	0.137
	Job position				−0.013	−0.397
	Working years				0.017	0.649
	Empowering leadership				0.191	5.344***
	Psychological distance				0.143	1.158
	Green organizational climate				0.243	2.015*
	Psychological distance × Green organizational climate				−0.022	−0.714

*$p < 0.05$; ***$p < 0.001$.

controlling gender, age, education, enterprise type, job position, and working years. The results (as shown in Table 6) indicated that when GOC was included in the model as a moderating variable, the product of psychological distance and GOC (β = −0.022, t = −0.714, $p > 0.05$) had no significant predictive effect on employees' pro-environmental behavior, indicating that GOC did not regulate the relationship between psychological distance and employees' pro-environmental behavior. However, we could see that GOC had a notable positive prediction influence on employees' pro-environmental behavior (β = 0.243, t = 2.015, $p < 0.05$).

Conclusion

In this study, 873 employee questionnaires were used to investigate the influence of empowering leadership on employees' pro-environmental behavior and the mechanism between them. The results indicated that both empowering leadership and EOPD had significant positive impacts on pro-environmental behavior, and psychological distance played an intermediary role between empowering leadership and employees' pro-environmental behavior. In addition, organizational environment is an important factor influencing employees' individual behavior, so we explored the impact of GOC on employees' pro-environmental behavior. The results manifested that GOC could promote employees' pro-environmental behavior, while GOC could not modulate the relationship between psychological distance and employees' pro-environmental behavior. In a word, most of the hypotheses of this study have been confirmed.

Theoretical implications

This study has important theoretical significance for future work on leadership style and employees' pro-environmental behavior. In this research, we introduced psychological distance to explore the relationship between empowering leadership and employees' pro-environmental behavior. Employees' pro-environmental behavior in the workplace is an active environmental behavior at the individual level, so employees can choose freely whether to carry out the action or not. Furthermore, if employees choose pro-environmental behavior, it would not increase their own benefits, and may even cause inconvenience to work and increase work costs. If not, they also would not lose their own benefits (Zhao et al., 2018). Therefore, it is essential to guide employees to actively implement pro-environmental behavior. When EOPD is closer, the level of alignment or integration between staff and the organization is better (Chen and Li, 2018). Our research is consistent with its indication, which denotes that psychological distance performs the mediating functions between empowering leadership and staffs' pro-environmental behavior. The employee whose psychological distance is closer to the organization will have more pro-environmental behavior. Employees' pro-environmental behavior is an extension and specificity of organizational citizenship behavior (Tian et al., 2019). Our research results support the view proposed by Li and Chen (2019), that

is, the closer the psychological distance is, the easier OCB occurs. Furthermore, our study has stretched the area of psychological distance and confirmed important implication of psychological distance in the organization and management field, hoping to provide some references for future research in the management field.

Although recent literature regarding the influencing mechanism of leadership style on employees' pro-environmental behavior has emerged successively, the research regarding the influence of empowering leadership on employees' pro-environmental behavior has not received much attention. Our study fills the gap in this area. Apart from that, recent studies have also found that the effectiveness of empowering leadership has not been universally supported (Wang and Sun, 2019), even though many studies have supported the positive role of empowering leadership. Our study provides the support of the experiment for the view on the behavior availability of empowering leadership.

Green organizational climate, as a relatively new concept, has less relevant research. Although the direct role of GOC is not the key issue of our study, we found that GOC can promote the employees' pro-environmental behavior. Norton et al. (2012) pointed out that organizational environmental climate could help to understand how employees' green behavior was created and encouraged in the workplace. In other words, there is a certain correlation between organizational environmental climate and employee's green behavior in their workplace. This study offers empirical support for this view and verifies that GOC can stimulate employees' pro-environmental behavior.

Besides, GOC cannot be used as a moderator between the relationship of psychological distance and employees' pro-environmental behavior, which is inconsistent with our research hypothesis. It can be seen from the connotation of psychological distance that psychological distance is a comprehensive judgment result after the individual perceives external things. And it may result in that the level of individual psychological distance measured in this study is a perceptual result formed when other external factors are taken into consideration. In other words, GOC is more likely to be the antecedent variable of psychological distance, and the connection between psychological distance and GOC will be the subject of future research.

Management implications

According to the above research conclusions, some advice is put forward for companies to correctly guide employees' pro-environmental behavior: First, it is feasible to implement empowering leadership in the organization's green development. Our study indicates that empowering leadership promotes employees' pro-environmental behavior. Therefore, organization managers can adopt an empowering style to motivate employees' pro-environmental behavior. Second, the implicit relationship between employees and organizations poses a huge challenge to organizational management, and organizations need to pay special attention to the EOPD. Construal level theory suggests that psychological distance determines people's construal levels of things. That is, employee's psychological distance to the organization will affect employee's organizational identification, work contribution, and future expectations. In an organization, the occurrence of extreme events, abnormal dimensions, job burnout, and other phenomena are specific manifestations of EOPD alienation, which may lead to huge losses for the organization (Chen and Li, 2018). Therefore, the organization and leaders need to focus on EOPD, regular assessment EOPD, and take some measures (e.g., communicating more frequently with employees, helping employees to improve skills, improving employees' self-efficacy, and work wellbeing), which are favorable to the development of organization. Third, the results indicate that GOC can facilitate the generation of employees' pro-environmental behavior. On this account, we suggest that organizations should strengthen the development of internal green climate. For instance, developing environmental policy, purchasing green office supplies, organizing environmental lectures, and so on.

Research limitations and prospects

This research does have some limits. First, we adopted a comprehensive score of psychological distance rather than an in-depth study of each dimension of psychological distance. The latter method can more specifically analyze the role of different dimensions of psychological distance in empowering leadership and employees' pro-environmental behavior. Consequently, prospective researchers can consider the influence of various dimensions of psychological distance as an intermediary between empowering leadership and employees' pro-environmental behavior.

Second, this study used a single point-in-time method to collect data, and a self-report method was used to measure all the variables involved, so common method bias is worthy of attention. Although we used a pre-controlled method to inform participants that there were no right or wrong answers, and to ensure the anonymity of participants, this would reduce the common method bias to some extent. We suppose that longitudinal study methods can be selected and more objective survey methods can be adopted to reduce this bias in the future.

Finally, some of the principles used in the study come from the West, while the tests come from China, which may not have universal research conclusions. In the future, employees'

pro-environmental behavior can be studied from the aspects of organizational culture and other aspects in the context of China's national conditions.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

TY designed the frame and wrote the manuscript. CG collected and analyzed the data and wrote the manuscript. FC wrote the manuscript. LZ analyzed the data. ML collected the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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