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Do Value Orientations and Beliefs Play a Positive Role in Shaping Personal Norms for Urban Green Space Conservation?

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Abstract: Urban Green Spaces (UGS) have a huge contribution to the health of urban ecosystems. However, they are threatened by numerous factors such as rapid urbanization, resource depletion, and climate change. These factors are inextricably linked to human behaviors, guided by the values and beliefs of people. According to value-belief-norm theory and norm activation model, personal norms are defined as self-expectations of pro-environmental behavior influenced by the ascription of responsibility and awareness of consequences in values and beliefs. When the conditions of responsibility and consequence awareness are met, individuals are more likely to experience a sense of moral obligation to exhibit environmentally responsible behavior. To address conservation and better enable UGS to have a positive function, we must explore how to promote the development of personal norms that are beneficial to UGS conservation. This study explored the influence that UGS values and beliefs have on personal norms. A questionnaire was administered to 1641 urban residents in Beijing, China, and Partial Least Square Structural Modeling was used to assess the causal relationship in the formation of personal norms on UGS conservation. The results showed that intrinsic, instrumental, and relational UGS value orientations contribute directly or indirectly to the formation of personal norms for the conservation of UGS through environmental beliefs as mediators, with the most significant effect being the relational value orientations. The results of the study can provide scientific guidance for future public participation in UGS conservation.

Keywords: value orientations; beliefs; personal norms; urban green space; conservation

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1. Introduction

Cities are dense carriers of population, politics, economy, culture, and religion. They are unique ecosystems where human activities are highly compounded with the natural environment [1,2]. Urban ecosystems are open, dependent, and fragile, easily disturbed and damaged by human activities, which causes an imbalance in urban ecosystems [3–5]. With accelerated urbanization and industrialization, the rapid development of urban society and economy has resulted in a series of resource and environmental problems, especially air pollution, urban flooding, and the heat island effect, which have recently posed serious threats to human production and life [6–8]. The increasing deterioration of the urban ecological environment has led to a growing recognition of the importance of green space in promoting urban ecosystem health, optimizing its structure, and improving urban ecosystem function [9–11]. Urban green spaces (UGS) are important components of an urban ecosystem and can be considered an environmental resource [12,13]. Through transpiration, evapotranspiration, absorption, adsorption, and reflection, UGS can reduce temperature, increase humidity, sequester carbon and release oxygen, purify air, reduce noise, and protect biodiversity [10,14–17]. Generally, UGS play a significant role in improving urban microclimate, promoting the development of human health, and maintaining ecosystem stability [18–20]. Therefore, promoting the conservation and rational use of UGS is of great significance and has received increasing attention from academia and policymakers.

Recently, many studies have examined UGS conservation; however, most have focused on cost-benefit analysis [21,22], willingness-to-pay analysis [8,23], or other forms of UGS economic valuation [12], not performing in-depth explorations of how urban residents, who are the subjects of UGS use and conservation, perceive their relationship with UGS and influence the implementation of pro-environmental behaviors. However, a utilitarian perspective makes it difficult to thoroughly explore and understand the complex relationship between humans and nature [24]. Human behavior significantly influences the effectiveness of ecological conservation; therefore, research should be conducted on how to improve society's perceptions of the relationship between humans and UGS, establish conservation goals, and stimulate the formation of personal norms for spontaneous conservation. The first thing needed to establish conservation goals for UGS is exploring the relationship between value orientations, beliefs, and behavior about UGS conservation [25–27].

Value orientations are the guiding principles that influence the attitudes and behaviors of individuals or groups, which are the basis for establishing other forms of human cognition (i.e., orientations, attitudes, norms, intentions, and behaviors) [28,29]. For environmental conservation, attitudes and behaviors toward nature conservation are driven more by values than by socio-demographic factors [30–32]. The term "values" here does not represent the monetary value that nature is assigned by human society, but rather refers to people's perceptions, feelings, meaning, or beliefs related to nature, natural resources, and nature conservation. Thus, the value orientations of people on the environment allow for an in-depth exploration of their different perspectives on how to live in harmony with nature and manage it effectively, thus, more effectively promoting conservation behavior [33–35].

Personal norms are seen as a powerful incentive for pro-environmental intentions and behaviors. Personal norms refer to a sense of moral obligation and self-expectation to do the "right thing" (e.g., reduce timber harvesting to protect the planet) [36,37]. Numerous scholars have studied the influence of values, beliefs, and personal norms on individual behavior in different contexts [28,38–40]. However, as mentioned earlier, the role of human values in promoting the implementation of pro-environmental behaviors by urban residents and the generation of moral obligations for environmental protection by individuals in the context of UGS conservation remains largely unknown. Therefore, recognizing the importance of value orientations and beliefs in conservation, we must examine the relationship between value orientations and UGS conservation to provide scientific guidance and theoretical support for the implementation of UGS conservation programs. With this in mind, we investigated the influence that UGS value orientations (UGSVOs) and beliefs have on a person's ability to form personal norms for UGS conservation behavior. Specifically, we explored the following questions: (1) do intrinsic, instrumental, and relational UGSVOs contribute to personal norms for UGS conservation? (2) Does a personal awareness of the consequences and ascription of responsibility for UGS (environmental beliefs) contribute positively to personal norms for UGS conservation? (3) How do UGSVOs and beliefs influence personal norms?

2. Theoretical Background

Our study is based on the integration of two theoretical frameworks: (1) the value-belief-norm theory of environmental behavior (VBN) [41] and (2) the norm activation model (NAM) [42] (Figure 1). The VBN theory aims to explain what makes people decide to engage in behavior that is beneficial to environmental conservation [43]. This model assumes a causal chain in which value orientations influence the behavior of individuals through specific beliefs and personal norms, and it assumes that Each factor in the causal chain not only affects the next factor in the chain but may even have an impact on other factors [41]. NAM theory posits that Personal norms are the expression of a people's recognition of the moral obligation to perform a particular behavior, and personal norms determine whether an individual performs a certain behavior [44]. Furthermore, personal norms are influenced by the awareness of the consequences of an activity, and the ascription of responsibility. Awareness of consequences refers to an individual's perception of the potential negative

consequences of a situation in which they fail to perform a specific behavior. Ascription of responsibility refers to an individual's sense of responsibility for conducting a specific behavior [42]. In the context of conservation behavior and pro-environmentalism, the convergence of these theories can delineate a theoretical structure and research paradigms that measure the influence of value orientations on nature conservation. This study does not address specific behaviors regarding UGS conservation, but rather focuses on the ethical feelings associated with personal norms.

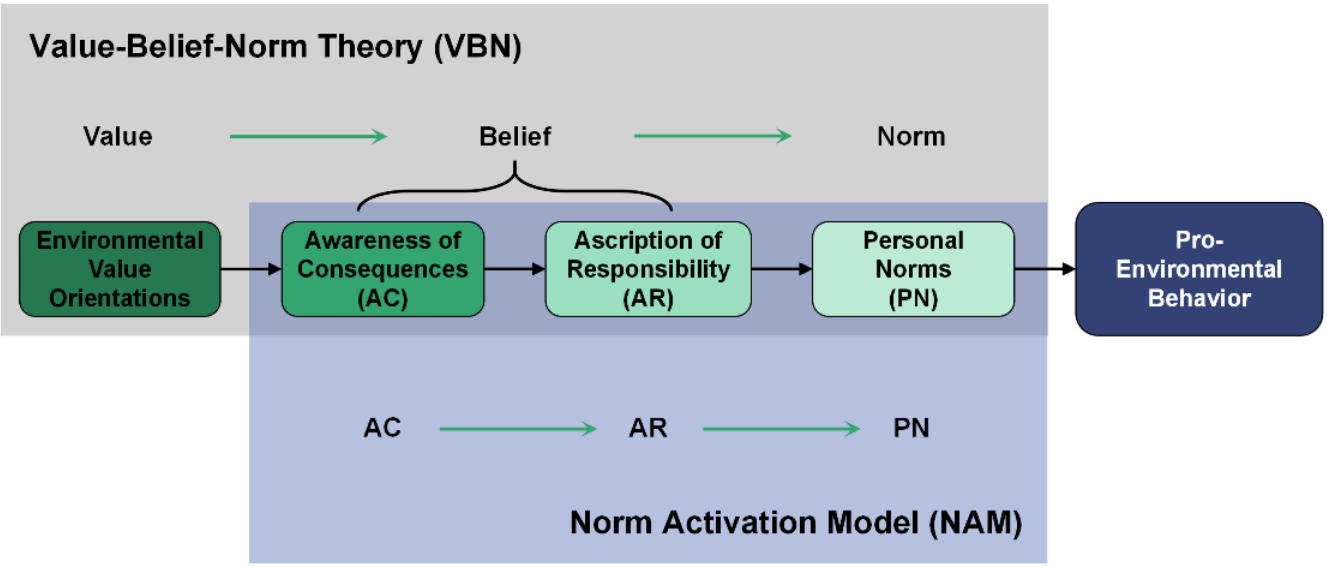


Figure 1. Research theoretical framework based on VBN and NAM [41,42].

Numerous studies have confirmed the proposed causal cognitive chain based on VBN and NAM. For example, Wensing et al. [45] found that pro-environmental values, beliefs, and norms motivate farmers to become more eager and active in bioeconomy activities. Fornara et al. [46] found that ethical norms and biosphere values have a direct influence on nature/biodiversity actions; social norms also show an indirect influence on actions through other dimensions. Wynveen et al. [47] found that responsibility beliefs influence personal norms and willingness to adopt environmental behaviors that conserve the ocean. Groot and Steg [34] also showed that value orientations and beliefs influence individuals' ethics norms and the subsequent acceptance of clean energy policies [34].

Environmental value orientations are based on human perceptions of the value of nature, of which intrinsic, instrumental, and relational value orientations are the three categories widely discussed and recognized by academia [48–51]. Intrinsic value is the one that nature itself possesses, that is, nature has values that are not dependent on any human experience or evaluation, such as the good cycles that ecosystems themselves are supposed to maintain [52]. In contrast, instrumental value is assigned to something to achieve a specific goal; it is the value generated by the environment to satisfy human needs and preferences, natural resources that provide people with jobs and sources of food [51,53]. However, few people make personal choices based only on how things are intrinsically valuable or satisfy their preferences; people also consider the appropriateness of their relationships with nature and others, including decisions and behaviors that are consistent with social value constraints and conducive to a meaningful and fulfilling life [54,55]. Environmental relational value orientations reflect preferences, principles, and virtues associated with relationships both interpersonal and as articulated by policies and social norms, for example, people's care for the natural environment and the reverence for nature in traditional culture [48]. Environmental relational value orientations are expressed specifically in terms of concern and care for the environment [56]. Accordingly, this study assessed people's intrinsic, instrumental, and relational value orientations toward UGS and

investigated how these values influence a person's awareness of consequences, ascription of responsibility (i.e., beliefs), and personal norms. We proposed the following hypotheses (Figure 2):

- Intrinsic UGSVO has a significant positive effect on awareness of consequences (H1), ascription of responsibility (H2), personal norms (H3);
- Instrumental UGSVO has a significant positive effect on awareness of consequences (H4), ascription of responsibility (H5), personal norms (H6);
- Relational UGSVO has a significant positive effect on awareness of consequences (H7), ascription of responsibility (H8), personal norms (H9);
- Awareness of consequences has a significant positive effect on ascription of responsibility (H10), personal norms (H11);
- Ascription of responsibility has a significant positive effect on personal norms (H12).

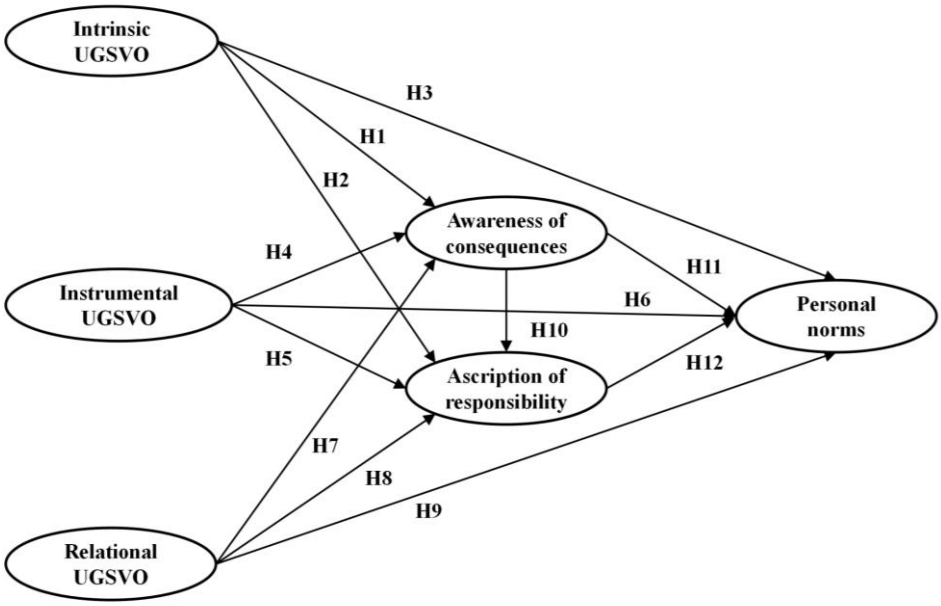


Figure 2. Hypothesized relationships among the constructs.

3. Materials and Methods

3.1. Questionnaire Design

The questionnaire consisted of two parts. The first part covered basic demographic information about the respondents. The second part was designed to document the respondent's UGSVOs, awareness of consequences, ascription of responsibility, and personal norms by asking them to respond to a series of urban green space conservation statements. Existing approaches were applied with minor modifications according to the research context and specific study area. We also designed our own questions based on previous studies and relevant theories, such that they were more consistent with the focus of this study. Among them, the selection of observables for intrinsic, instrumental, and relational UGSVO used the theoretical basis of the concept and research framework for environmental value orientation, as proposed by Tallis and Lubchenco [50], Chan et al. [48], John et al. [57], and Klain et al. [49], incorporating relevant results from previous studies on UGS values [58–62]. To ensure the applicability of the test scale, four experts and six doctoral students involved in relevant research areas were invited to discuss the statements on the measured variables and, where appropriate, adjust them to ensure respondent comprehension. Generally, the reliability of questionnaires is directly proportional to the number of scale measurement points; however, some studies have shown that it is usually difficult for the general population to clearly discriminate between test scale designs with five or more levels [63]. Therefore, the questionnaire used a five-point Likert scale, excluding the personal information section, and respondents were asked to assign a score accord-

ing to their actual situation, ranging from "strongly disagree" (1) to "strongly agree" (5). The final questionnaire included five latent variables and 26 observed variables (Table 1). The reliability of the measurement model was evaluated owing to the presence of some new self-designed questions at the scale of the current study, as well as considering the possibility of multicollinearity among multiple influencing factors at this scale.

Table 1. Questionnaire items and variables considered.

Indicator	Items	Items
Intrinsic UGSVO (INT)	INT1	Providing space for wildlife/biogenetic conservation
	INT2	Carbon sequestration and oxygen release to regulate microclimate
	INT3	Purifies air, water, and soil
	INT4	Conserve soil and water
	INT5	Alleviating the urban heat island effect
	INT6	Maintaining urban ecosystem stability
Instrumental UGSVO (INS)	INS1	In UGS, people can exercise, reduce disease, and save medical costs
	INS2	In UGS, people can get aesthetic enjoyment and keep a happy mind
	INS3	In UGS, people can reduce work and life stress and relieve anxiety
	INS4	In UGS, people can have the opportunity to become closer to nature and improve their knowledge of biodiversity
	INS5	UGS beautifies the living environment
Relational UGSVO—Care (REL)	REL1	I am concerned about the current status of UGS
	REL2	I care about the future development and changes of UGS
	REL3	I am concerned about how I feel in UGS
Awareness of Consequences (AC)	AC1	The health of UGS is at risk
	AC2	Rapid urbanization will reduce UGS
	AC3	The destruction of UGS will upset the balance of urban ecosystems
	AC4	The destruction of UGS will reduce air quality
	AC5	The destruction of UGS will cause problems for member of society
	AC6	Urban areas will face a serious ecological crisis in the future
Ascription of Responsibility (AR)	AR1	It is my responsibility to conserve UGS
	AR2	Even if I don't usually go to UGS, I feel I have a responsibility to conserve them
	AR3	Every person in the social group should be responsible for the conservation of UGS
Personal Norm (PN)	PN1	I think I should actively participate in the conservation of UGS
	PN2	Even without government support, I think I should be actively involved in the conservation of UGS
	PN3	Even if it costs more money and time, I want to do what is good for UGS
	PN4	I feel guilty when I do nothing for UGS conservation
	PN5	I think I should support the government to introduce policies and projects to conserve UGS

3.2. Survey Implementation and Sample Description

Beijing has set a goal to increase UGS and raise the city's green coverage from 46.2% in 2012 to 48.3% in 2018. UGS in Beijing include both man-made and natural green spaces. In 2018, Beijing created a total of 4022 hectares of UGS, including 150 urban recreational parks [23]. Its urban greening level and citizens' recognition and perception of UGS are typical and representative among the major cities of China. Thus, Beijing was selected as the research area for this study, and data were collected via field questionnaires.

In May 2021, a preliminary survey was conducted prior to the formal survey in order to refine the test scale. To try to avoid potential misconceptions, we described the survey goals and questions to the respondents before they were asked. A total of 200 initial questionnaires were sent out and 185 were returned, with a valid return rate of 92.5%. According to the statistics of the initial survey, >95% of the respondents could complete all of the questions with the help of the surveyors. We optimized the survey protocol accordingly and conducted the formal survey from July to November 2021. To minimize

sample selection bias, the questionnaire was made available in spatial locations grouped by urban areas. Randomly selected areas within each urban area with a high pedestrian flow, such as parks, neighborhood green areas, and commercial plazas, were then distributed by random interception. The number of questionnaires in each urban area was controlled such that the final returned questionnaire samples were evenly distributed in each urban area. To ensure that the data were authentic and valid, all researchers were trained to answer the survey-related questions of the respondent on the spot. Overall, 1900 questionnaires were distributed during the research period and 1681 were collected. After eliminating invalid questionnaires that were incomplete and scored consistently for all options, 1641 valid questionnaires remained, with a final questionnaire efficiency of 86.4%.

Based on the preliminary statistics of the questionnaire and the basic composition of the study sample (Table 2), we observed the following characteristics among the respondents. In terms of gender, male participation in the survey, accounting for 46.9% of the respondents, was slightly lower than female. In terms of age composition, 4.7% of the respondents were <17 years old, accounting for the lowest percentage, 29.9% were between 30 and 39 years old, accounting for the highest percentage, 25.3% were between 18 and 29 years old, 15.1% were between 40 and 49 years old, and 12.9% were >60 years old. In terms of marital status, married participants were higher than unmarried respondents, accounting for 59.8%. In terms of education, elementary school and below accounted for 3.4% (the lowest percentage), holding a bachelor's degree accounted for 36.6% (the highest percentage), junior high school accounted for 15.1%, high school accounted for 30.3%, and holding a Master's degree and above accounted for 14.6%. Most respondents were satisfied with their health condition: 65.6% of the respondents stated that their health was relatively good or very good.

Table 2. Sample profile (n = 1641).

Variable	Category	Frequency	Percentage
Gender	Male	770	46.9%
	Female	871	53.1%
Age	≤17	77	4.7%
	18–29	415	25.3%
	30–39	490	29.9%
	40–49	248	15.1%
	50–59	199	12.1%
	≥60	212	12.9%
Marital status	Unmarried	660	40.2%
	Married	981	59.8%
Education level	Primary school and below	55	3.4%
	Junior high school	248	15.1%
	High school	498	30.3%
	Undergraduate	601	36.6%
	Master's degree or above	239	14.6%
Health condition	Very bad	8	0.5%
	Relatively poor	52	3.2%
	Commonly	504	30.7%
	Better	765	46.6%
	Very nice	312	19.0%

3.3. Data Analysis

We employed Partial Least Square Structural Modeling (PLS-SEM) to evaluate the influence of environmental value orientations and beliefs on personal norms in UGS conservation. Studies have increasingly used PLS-SEM methods to model complex real-world problems [64–67]. PLS-SEM uses a component-based analysis, which is generally considered one that can be applied to situations where the sample size is large and the data

do not conform to a normal distribution while maintaining robust results that maximize predictive validity, especially necessary for more complex models. PLS-SEM directly obtains the R^2 value and attempts to maximize the explanation of the variance in the dependent variable. This enables a closer approximation to the data and enhances the precision of exploratory studies and data analysis [65,66,68]. Therefore, we concluded that PLS-SEM could meet the data requirements and study objectives of this study, and data analysis was performed via the SmartPLS3.0 software developed by Ringle et al. [69].

4. Results

4.1. Evaluation of the Measurement Models

The measurement model illustrates how the observed variables quantify the interrelationships of all latent variables, we assessed the reliability and validity of the evaluated measurement models [70]. First, we examined the internal consistency reliability and indicator reliability of the models [70,71]. Cronbach's alpha (α) coefficient and the composite reliability (CR) were used as the test criteria for internal consistency reliability and indicator reliability of the models [70,71]. Generally, a value of <0.35 for Cronbach's α indicates that the scale has low reliability; 0.35 ≤ Cronbach's α < 0.70 indicates that the scale has moderate reliability; and Cronbach's α > 0.70 indicates that the scale has high reliability [72]. The benchmark value for the CR is ≥0.7 [73]. Based on Table 3, the CR and Cronbach's α of all of the latent variables were >0.7, providing evidence of high internal consistency. Generally, the standardized factor loadings of the observed variables were >0.7, indicating that each observed variable had good explanatory power for the corresponding latent variable [74]. Furthermore, all of the standardized factor loadings in this study were >0.7, which indicates that the reliability of the indicator has reached a sufficient level.

Next, we assessed the validity of the measurement model by convergent validity and discriminant validity. In the PLS-SEM, an average extracted variance (AVE) > 0.6 is usually taken as the criterion for assessing the convergent validity [71]. The discriminant validity is evaluated with the standard test where the square root of the latent variable AVE is greater than the correlation value between the latent variables [75]. Based on Tables 3 and 4, the collected data satisfied the above conditions. Additionally, the value of the variance inflation factor (VIF) was <5, which shows that there was no multicollinearity problem in the model (Table 3).

4.2. Evaluation of Structural Models: Measures of Fit

After the reliability and validity of the measurement model is recognized, the next stage is to fit the measurement model to the structural model. The interconnections between the latent variables and their associated indicators are developed in the structural model [76]. The predictive performance of the pls-sem model in this study was evaluated by the multiple coefficient of determination (R^2), Stone-Geisser's Q^2, and goodness of fit (GoF). The R^2 value characterizes the degree to which the independent variable of the current model explains the variance in the dependent variable, ranging from 0 to 1, where 1 indicates a high explanatory power [77]. As listed in Table 5, the R^2 values of 0.196, 0.737, and 0.795 for awareness of consequence, ascription of responsibility, and personal norms, respectively. This indicates a slightly lower explanatory power of the model for consequence awareness, but a high explanatory power of the model for both responsibility attribution and personal norms. Stone-Geisser's Q^2, which is the cross-validation redundancy, characterizes the predictive relevance of the model [77]. In this study, all $Q^2 > 0$ (Table 5), indicating that the model has good predictive relevance. Therefore, the structural model of this study is robust and statistically sound.

Table 3. Validity and reliability of latent constructs in the model.

Indicator	Factor Loading	VIF	Cronbach's α	CR	AVE
Intrinsic UGSVO			0.923	0.940	0.723
INT1	0.748	2.004			
INT2	0.865	3.458			
INT3	0.881	3.558			
INT4	0.885	3.200			
INT5	0.887	3.449			
INT6	0.827	2.436			
Instrumental UGSVO			0.901	0.927	0.719
INS1	0.808	2.161			
INS2	0.901	3.297			
INS3	0.895	3.268			
INS4	0.887	2.894			
INS5	0.737	1.712			
Relational UGSVO—Care			0.887	0.930	0.816
REL1	0.899	2.539			
REL2	0.916	2.807			
REL3	0.895	2.404			
Awareness of Consequences			0.931	0.946	0.745
AC1	0.829	2.462			
AC2	0.832	2.486			
AC3	0.868	2.892			
AC4	0.911	4.506			
AC5	0.899	4.428			
AC6	0.835	2.769			
Ascription of Responsibility			0.888	0.930	0.817
AR1	0.917	2.992			
AR2	0.864	2.102			
AR3	0.929	3.272			
Personal Norm			0.935	0.951	0.795
PN1	0.906	3.501			
PN2	0.829	2.311			
PN3	0.910	3.721			
PN4	0.908	4.398			
PN5	0.902	4.327			

Table 4. Discriminant validity for the variables in the model.

	INT	INS	REL	AC	AR	PN
INT	**0.850**					
INS	0.451	**0.848**				
REL	0.258	0.311	**0.903**			
AC	0.231	0.208	0.424	**0.863**		
AR	0.277	0.338	0.850	0.449	**0.904**	
PN	0.289	0.331	0.806	0.483	0.876	**0.892**

Note: Diagonals (**in bold**) represent the square root of the AVE.

Table 5. Overall model and structural model tests.

	Communality	R^2	Q^2
INT	0.723		
INS	0.719		
REL	0.816		
AC	0.745	0.196	0.162
AR	0.817	0.737	0.592
PN	0.795	0.791	0.530
Goodness of Fit (GoF)		0.642	

We also evaluated the global fit of the model by calculating GoF. GoF considers the performance of both measurement and structural models, and the performance of the full measurement model is measured using the weighted average of all common factor variances (Communality), while the performance of the full structural model is measured using the average R^2 [78]:

$$\text{GoF} = \sqrt{\overline{\text{Communality}} \times \overline{R^2}} \quad (1)$$

The GoF values of 0.1, 0.25, and 0.36 describe the global fit of the model for low, medium, and high, respectively [79]. In this study, the GoF result was 0.642, indicating a good fit for the model (see Table 5).

4.3. Research Hypothesis Test

Table 6 lists the results of the structural model path coefficient test. Intrinsic UGSVO positively influenced awareness of consequences (β = 0.115, $p < 0.001$), thus supporting hypothesis H1. Instrumental UGSVO positively influenced ascription of responsibility (β = 0.064, $p < 0.001$), thus supporting hypothesis H5. Relational UGSVO had a positive effect on awareness of consequences (β = 0.383, $p < 0.001$), on ascription of responsibility (β = 0.0.782, $p < 0.001$), and on personal norms (β = 0.201, $p < 0.001$), thus supporting hypotheses H7, H8, and H9. Awareness of consequences had a significant positive effect on ascription of responsibility (β = 0.0.099, $p < 0.001$) and personal norms (β = 0.097, $p < 0.001$), thus supporting hypotheses H10 and H11. Ascription of responsibility positively influenced personal norms (β = 0.0.648, $p < 0.001$), thus supporting hypothesis H12. Different from expectations, intrinsic UGSVO had no significant effect on the ascription of responsibility and personal norms, thus rejecting hypotheses H2 and H3. Instrumental UGSVO also had no significant effect on awareness of consequences and personal norms, thus rejecting hypotheses H4 and H6 (Figure 3).

Table 6. Results of the path coefficient analysis and hypothesis testing (direct effects).

Hypothesis	Path	β	*t* Value	*p*	Decision
H1	INT→AC	0.115	4.339	***	Supported
H2	INT→AR	0.023	1.470	0.142	Unsupported
H3	INT→PN	0.028	1.802	0.072	Unsupported
H4	INS→AC	0.037	1.325	0.185	Unsupported
H5	INS→AR	0.064	4.328	***	Supported
H6	INS→PN	0.017	1.157	0.247	Unsupported
H7	REL→AC	0.383	12.728	***	Supported
H8	REL→AR	0.782	42.727	***	Supported
H9	REL→PN	0.201	6.025	***	Supported
H10	AC→AR	0.099	5.726	***	Supported
H11	AC→PN	0.097	5.540	***	Supported
H12	AR→PN	0.648	19.182	***	Supported

Note: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

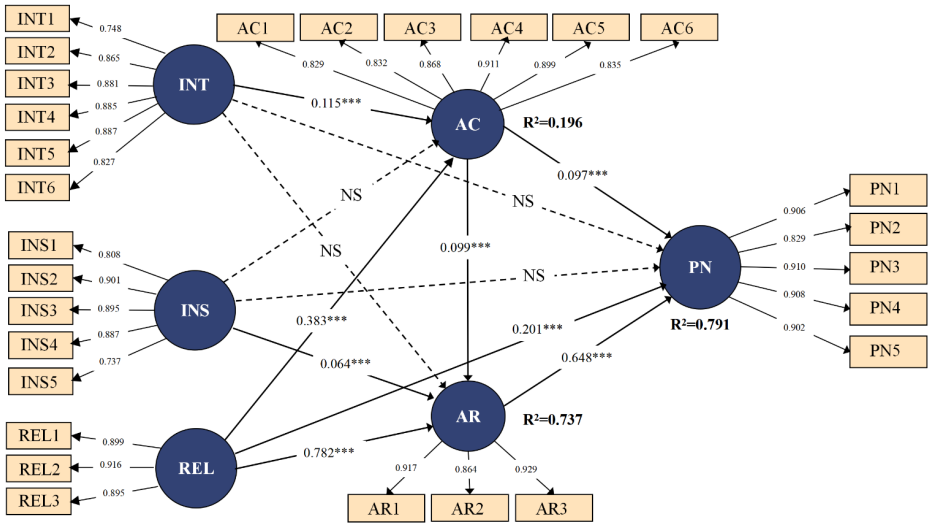


Figure 3. Partial Least Square Structural Modeling (PLS-SEM) model simulation results. (Note: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.)

A mediation analysis was conducted to assess the indirect effect of awareness of consequences and ascription of responsibility on the UGSVO and personal norm constructs via Bootstrapping (Subsamples = 2000). Based on the results (Table 7), all three UGSVOs had an indirect significant positive effect on personal norms through awareness of consequences and ascription of responsibility as mediators. The relational UGSVO had the strongest total effects on awareness of consequences, ascription of responsibility, and personal norms. Among all of the paths (total effects), only the effect of the instrumental UGSVO on awareness of consequences was not significant.

Table 7. Results of path coefficient analysis (indirect and total effects).

Path	β	*t* Value	*p*	Bias-Corrected and Accelerated Confidence Intervals	
				2.50%	97.50%
Specific Indirect Effects					
AC→AR→PN	0.064	5.34	***	0.042	0.088
INS→AC→AR	0.004	1.259	0.208	−0.002	0.01
INS→AC→AR→PN	0.002	1.249	0.212	−0.001	0.006
INS→AC→PN	0.004	1.244	0.213	−0.002	0.010
INS→AR→PN	0.042	4.161	***	0.023	0.062
INT→AC→AR	0.011	3.432	**	0.006	0.019
INT→AC→AR→PN	0.007	3.284	**	0.004	0.012
INT→AC→PN	0.011	3.529	***	0.006	0.018
INT→AR→PN	0.015	1.46	0.144	−0.005	0.035
REL→AC→AR	0.038	4.727	***	0.024	0.055
REL→AC→AR→PN	0.024	4.514	***	0.015	0.036
REL→AC→PN	0.037	4.805	***	0.023	0.052
REL→AR→PN	0.507	17.731	***	0.450	0.562
Total Effects					
AC→AR	0.099	5.726	***	0.066	0.135
AC→PN	0.161	7.714	***	0.121	0.203
AR→PN	0.648	19.182	***	0.581	0.711
INS→AC	0.037	1.325	0.185	−0.016	0.091
INS→AR	0.068	4.553	***	0.039	0.098
INS→PN	0.064	3.522	***	0.029	0.101
INT→AC	0.115	4.339	***	0.065	0.17
INT→AR	0.034	2.227	*	0.003	0.065
INT→PN	0.061	3.133	**	0.023	0.100
REL→AC	0.383	12.728	***	0.324	0.444
REL→AR	0.820	55.241	***	0.790	0.848
REL→PN	0.770	41.12	***	0.732	0.806

Note: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

5. Discussion

This study provided empirical evidence for the VBN and NAM theories in terms of UGS conservation. The findings showed the positive contribution of environmental value orientations and environmental beliefs to the formation of a moral obligation to conserve UGS. Among them, the causal chain of awareness of consequence—ascription of responsibility—personal norms operated clearly, confirming the applicability of the VBN and NAM in UGS conservation. In future UGS management, emphasis should be placed on enhancing stakeholder awareness of the negative consequences of UGS damage and the positive impacts of UGS conservation. This will strengthen stakeholders' ascription of responsibility for UGS and thus promote the formation of personal norms for pro-environmental behavior. For a more in-depth analysis, ascription of responsibility mediated the relationship between awareness of consequences and personal norms. Thus, if the goal of policy implementation is to raise awareness of consequences before focusing on beliefs concerning responsibility, it may have a greater effect because people must first be aware of the activities affecting the UGS to take responsibility for it.

For the environmental value orientations, although not all of the UGSVOs had a significant direct effect on awareness of consequence, ascription of responsibility, and personal norms, our analysis of the mediating effects showed that all UGSVOs had a significant positive effect on personal norms through the mediating effect of environmental beliefs. In previous environmental management strategies, the focus on environmental value orientations has often been expressed as a dualism: conservation for the sake of nature (for intrinsic value) and use for the sake of humans (for instrumental value) [50,80]. Intrinsic value is immaterial, and intrinsic value orientation represents a human belief that nature should exist for its own benefit [52], which leads to nature-centered value judgments [81]. Therefore, intrinsic value orientation is often thought to support nature conservation practices [82]. This was confirmed again in our study. The results of this study revealed that intrinsic UGSVO had a direct effect on awareness of consequence while indirectly influencing personal norms by bridging awareness of consequence and ascription of responsibility.

In contrast, an instrumental value orientation is the one in which humans believe that nature should be used to satisfy human needs or to achieve predetermined ends [52]. This value orientation is egoistical and its base is human-centered [83]. This value orientation has been criticized for its tendency to commodify natural resources: conflicting evidence and opinions exist with respect to whether it can contribute to the formation of conservation behavior [83,84]. This study provided evidence for the positive effect of instrumental value orientation on nature conservation. Similar to the intrinsic UGSVO, instrumental UGSVO did not have a significant direct effect on personal norms, but it directly influenced the ascription of responsibility for members of society. It thus exerted a significant positive indirect effect on personal norms through the ascription of responsibility as a mediator. Overall, we found that both the intrinsic and instrumental UGSVOs must be mediated by environmental beliefs to influence personal norms, which highlights the important role of environmental beliefs as a "bridge" to overcome the gap between one's recognition of environmental values and their initiatives to conserve the environment.

This study showed that relational UGSVO strongly predicted ascriptions of responsibility and awareness of consequences while directly influencing personal norms. Based on the total effect scores, we observed that the relational UGSVO had the highest scores for awareness of consequence, ascription of responsibility, and personal norms. This suggests that while environmental conservation requires the affirmation of nature's intrinsic values, people's relational values can play a greater role in terms of promoting the formation of moral obligations for environmental conservation among members of society. This is because the perception of the appropriateness of one's relationship with the environment and with other environment users also influences human conservation choices. Thus, relational value orientation embodies social altruistic values [56]. In this study, people cared about the current and future status of UGS; the relational UGSVO had a greater influence on one's

ethical norms toward UGS. In the context of environmental protection, care and concern are expressed in the interconnectedness between society and ecosystems, reflecting a nurturing relationship [56]. However, current UGS management and governance rarely consider the relationship between people and UGS. Therefore, empathizing with people's concern for UGS can facilitate their conservation.

6. Conclusions

Effective UGS conservation requires in-depth knowledge and understanding of the environmental value orientations and environmental beliefs of society to promote the formation of pro-environmental personal norms for urban residents. Based on the VBN and NAM theories, this study demonstrated that environmental value orientations and beliefs contribute positively to the formation of pro-environmental personal norms using PLS-SEM. Among them, relational UGSVO had a more direct and stronger positive influence than intrinsic and instrumental UGSVOs. We used a pluralist approach to examine the influence of human values. In contrast to a unidimensional approach using a single scale (e.g., willingness to pay or monetary value) to measure human values, we analyzed the value orientations people hold about UGS conservation based on different perspectives. We obtained novel insights on how value orientations shape the environmental beliefs and personal norms. In future UGS management policy formulation, policy resolution departments should develop policies that fit the local environmental value structure to suit local conditions, taking into account the views and values held by local people about the UGS. In the governance of urban residential behavior, the role of different value orientations should be emphasized, especially to stimulate people's care and concern for UGS, as well as their awareness of consequences and ascription of responsibility, and guide them to develop ethical norms that actively protect UGS and motivate them to follow pro-environmental behaviors.

The limitations of the study should be noted. This study found how relational values can enhance one's moral obligation to conserve UGS. However, studies on relational value orientation remain limited, only the relational value of "care and concern" was included in this study. Other relational values, such as traditional faith-based relationships, among others, were not explored here. However, we should highlight that these values may also influence personal UGS protection behavior. Further research should assess the impact of additional relational value orientations on personal norms.

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