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A Value–Belief–Norm (VBN) Approach to Visitor Attitudes Toward Carbon Offsetting in Protected Areas

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Abstract

The tourism industry is recognized as a major contributor to greenhouse gas emissions, significantly advancing climate change. Carbon offsetting is often suggested as an ancillary approach to alleviate or counterbalance inevitable emissions generated by tourism activities; nevertheless, what is the public impression of this measure? When are they expected to engage in it? This study employing the Value–Belief–Norm theory (VBN) mainly aims to investigate the influence of visitors' value orientations on their overall perceptions regarding carbon offsetting within the leisure context of protected-area visitation—a realm where leisure pursuits represent a considerable contributor to carbon emissions. A total of 517 protected-area visitors in Spain and 383 in the Netherlands participated in the study. Results indicate that individuals who prioritize biospheric and altruistic values are more likely to exhibit robust support for carbon offsetting initiatives in protected areas, demonstrating the importance of fundamental value orientations in shaping pro-environmental attitudes. In addition, the findings stress human accountability for climate repercussions and reveal offsetting alternatives as ethically justifiable and effectively gratifying. The study offers governance-related implications, indicating that harmonizing carbon offsetting programs with fundamental societal principles may bolster the perceived legitimacy of offsetting initiatives, foster visitor involvement, and lead to improved environmental results.

Keywords: carbon offsetting; value-belief-norm theory; value orientation; protected areas; pro-environmental beliefs; moral norms; attribution of responsibility

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1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) [1] states that global greenhouse gas emissions have persistently risen from 2010 to 2019, resulting from unsustainable energy practices, land-use changes, and varying lifestyles, consumption, and production patterns across different regions, countries, and individuals. Anthropogenic climate change is presently influencing a multitude of weather patterns and climate extremes in every region worldwide. This phenomenon is linked to extensive detrimental effects on food and water security and human health, as well as on economies and societies, alongside associated losses and damages to both nature and individuals. Importantly, the tourism industry is responsible for a substantial and growing amount of greenhouse gas emissions, relying on energy- and resource-intensive activities. Specifically, the carbon footprint of tourism increased from 3.9 to 4.5 Gt CO_2 eq between 2009 and 2013, accounting for 8 percent of global greenhouse gas emissions [2].

Carbon offsetting is often proposed as a way to compensate for greenhouse gas emissions, particularly for those practices that cannot easily be replaced with more sustainable alternatives. With the rise of electric and alternative-fuel cars, road transport is progressing toward decarbonization; however, many people still rely on combustion-engine cars for travel, meaning their visits to, for instance, touristic natural areas are still associated with substantial emissions. As a result, purchasing carbon offsets has thus emerged as a crucial approach in sustainable tourism to reduce inevitable emissions [3,4] until further technological breakthroughs are made. This prompts significant inquiries regarding the societal aspects of these initiatives: How do individuals view carbon offsetting, and under what circumstances are they inclined to engage in it? The inquiries outlined herein constitute the primary emphasis of the current investigation.

Social psychological research is aimed at answering such questions, providing insights into the psychological underpinnings of such preferences and decisions. Social psychological theories have improved our comprehension of human behavior over the past decades, which has resulted in fostering and boosting environmental sustainability [5]. An individual's cognitive framework, including their beliefs, values, and attitudes, affects their intentions for pro-environmental actions [6]. Investigating the relationship between environmental attitudes and actions is crucial for guiding interventions that advance both human well-being and biodiversity conservation [7,8].

Despite the extensive use of the Value–Belief–Norm (VBN) theory [9,10] to elucidate various pro-environmental attitudes and behaviors, its relevance to perceptions of carbon offsetting within protected-area visitor stings is still constrained. Earlier research has mostly focused on eco-friendly behaviors, support for conservation, readiness to adopt sustainable activities, or carbon offsetting within the realms of transportation and aviation. As a result, there is a paucity of understanding about the psychological processes that shape visitors' perceptions of carbon-offset programs in protected areas.

Furthermore, evidence about the applicability of VBN theory in various protected-area visitor contexts is limited. The VBN theory proposes a universal sequence connecting values, beliefs, responsibilities, and personal norms; however, it is uncertain whether these relationships function similarly across different visitor demographics and environmental contexts. Despite its significance, this association remains little explored in the realm of natural resource management, where comprehending psychological motivators might markedly improve policy efficacy and sustainable results [11].

To address these gaps, this research utilizes the VBN framework to clarify views on carbon offsetting among visitors in protected regions in Spain and the Netherlands. Instead of doing a formal cross-national comparison, the study investigates whether the associations suggested by the VBN theory are validated in two separate protected-area settings. The research enhances the existing literature by applying VBN theory to carbon-offsetting attitudes, offering insights from two visitor groups in protected areas, and elucidating the psychological elements related to endorsing climate-mitigation efforts in nature-oriented tourism contexts.

This study investigates how preferences and decisions with regard to carbon offsetting are fundamentally anchored in deeper values—specifically, the principal life goals individuals pursue—by a spectrum of intermediate beliefs and norms. We examine the extent to which value orientations influence individuals' perceptions of their roles in addressing global warming and preserving nature and how these elements subsequently shape their preferences for supporting carbon offsetting initiatives in protected natural areas.

2. Literature Review

2.1. Theory of Value–Belief–Norm (VBN) and Environmentally Conscious Actions

The VBN theory offers a fundamental framework for comprehending pro-environmental behavior, making it a suitable basis for investigating people's involvement in carbon offsetting. The VBN model posits that environmental behaviors arise from a sequence of progressively concrete cognitive precursors, illustrating how overarching value orientations influence more concrete beliefs, which then activate personal norms that drive behavioral decisions [9]. This sequential framework is especially beneficial for examining carbon offsetting since it elucidates how entrenched worldviews—such as biospheric or altruistic values (i.e., deep concerns for nature and society, respectively)—convert into perceptions of environmental accountability (i.e., personal norms) and, eventually, into the readiness to endorse mitigation strategies.

Research indicates that various environmental decisions and behaviors stem from individuals' values, which serve as solid guiding principles that shape their interpretation of environmental challenges and their sense of need to act. Per the VBN paradigm, individuals who firmly uphold biospheric values are more inclined to acknowledge their personal connection to environmental issues. These values enhance awareness of how individual behaviors contribute to the situation while concurrently reinforcing the perceived need to act to alleviate it [10]. This awareness implies a belief that action can alleviate the negative effects. Accepting responsibility for oneself creates a personal norm—a sense of ethical commitment versus the environment—that motivates action [12,13].

Building on the VBN theory, Ghazvini et al. [14] investigated how visitors perceive the optimal use of national parks. The results indicated that visitors believe that engaging in passive or appreciative activities is the best use of these areas. The findings revealed that tourists who prioritize altruism over egoism perceive accommodations (such as hotels and residences), service facilities (such as medical services and gas stations), and motorized activities (such as power boating and car sightseeing) as less compatible with the purpose of protected areas. Visitors with higher biospheric and lower egoistic values deemed hunting and fishing (consumptive activities) inappropriate within national parks. The biospheric value orientation of park visitors was a strong predictor of their preference for national parks as a place for non-consumptive activities (e.g., animal observation, jogging, hiking).

Zhang et al. [15] conducted a cross-national investigation that showed how people's views on sustainable commuting and the advantages of low-carbon transportation options are greatly influenced by self-transcendent values, especially benevolence and universalism. To fully grasp pro-environmental mobility decisions, it is advantageous to keep in mind these ideals, which stress care for both people and the planet. Applying these findings to the realm of carbon emissions in protected areas, it can be concluded that people who highly value self-transcendence are more likely to favor climate compensation measures like carbon offsetting. This is because they might view these measures as morally righteous ways to address the environmental consequences of their mobility. Complementary behavioral science research indicates that psychological variables, especially value-driven moral norms, significantly motivate commuters to transition from high-emission modes, surpassing the effects of structural or infrastructural enhancements [16]. Collectively, these observations suggest that personal values influence preferences for low-carbon transportation alternatives and enhance moral imperatives to adopt carbon-reducing behaviors, such as involvement in carbon offset programs.

2.2. Functional Roles of Values and Pro-Environmental Orientations

Values are first and foremost general opinions on whether specific end-states—like environmental quality, ambition, or equality—are desirable or undesirable. Values therefore

possess an aspect of oughtness [17]. Second, values are abstract and context-independent, influencing attitudes, customs, and behaviors while remaining largely constant over time [18]. This suggests that alterations in values can lead to shifts in attitudes and behaviors, particularly regarding pro-environmental actions. Third, values provide a framework for assessing individuals, occasions, and actions [19], guiding what information is prioritized and how circumstances are assessed [17,20]. Lastly, individuals prioritize different values distinctly, leading to varied decision-making processes even among those sharing cultural values, highlighting that conflicting values can result in diverse decisions based on personal value hierarchies [21].

Values serve as intrinsic motivational compasses that influence people's perceptions of their surroundings, aiding them in discerning what is potentially advantageous or detrimental. Their capacity to affect perceptions and behaviors increases when these values are both prominent and personally significant [22]. Simultaneously, contemplating one's values or examining their significance improves their accessibility, amplifying their influence on future judgements and behaviors [23–25].

Values influence both the consequences that people are likely to consider when making decisions and also their evaluation of these consequences. Individuals possess varied degrees of egoistic, altruistic, biospheric, and hedonic values, each of which may uniquely underpin activities that benefit the environment. Individuals with a higher inclination toward biospheric values, for instance, possess more consciousness and worry about environmental issues that their actions can lead to, whereas individuals with a strong tendency toward egoistic values are more concerned about personal possessions and status [26–28].

Indeed, personal values, especially biospheric and altruistic values, reliably predict energy-saving, conservation, and other carbon-reducing behaviors, according to evidence from broader low-carbon behavioral studies [20,29,30]. According to these results, it can be concluded that people with stronger pro-environmental values are more inclined to participate in carbon offsetting to compensate for carbon emissions that feel inevitable to them.

2.3. Conceptualizing the Transmission of Personal Values into Climate Change Action

Values significantly influence individual participation in climate action by shaping motivating priorities related to environmental, societal, and personal consequences. Biospheric values, which prioritize ecological welfare, strongly promote climate-mitigating behaviors, as actions like carbon offsetting benefit the natural environment [10,31,32]. Altruistic values, which focus on the welfare of others and future generations, also support climate action by highlighting collective benefits from emission reductions and alleviating risks faced by vulnerable groups [19]. A recent study has shown that appeals to altruistic and biospheric values can enhance engagement in environmental protection [33]. In contrast, egoistic values that emphasize self-interest often hinder climate action due to perceived costs associated with low-carbon practices—whether financial, temporal, or behavioral—which may clash with self-enhancement goals [34]. Hedonism prioritizes self-enhancing goals that underlie achievement values, which may overlap with immoral activities [35]. Additionally, hedonic values prioritizing comfort may impede action if pro-environmental choices appear burdensome [36]. Overall, personal value structures serve as significant predictors of intentions and behaviors regarding climate mitigation, with biospheric and altruistic values most closely aligned with pro-environmental actions, often opposing egoistic and, at times, hedonistic values.

However, the impact of values on behaviors and preferences is not often direct. Values generally influence environmental behavior via indirect cognitive processes. Within the VBN paradigm, biospheric and altruistic values mainly influence the development of general

pro-environmental attitudes, including ecological worldviews and knowledge of consequences, which ascertain the moral significance and personal relevance of environmental challenges [9,37].

As individuals become increasingly aware of the environmental consequences of their activities, they may tend to develop a heightened sense of personal accountability and ethical imperative to engage in proactive measures. The findings of recent research indicate that a sense of personal accountability may successfully promote behaviors such as energy efficiency and other environmentally sustainable choices [38–40]. Thus, the ascription of responsibility functions as the corroborative link that facilitates the conversion of broad pro-environmental convictions into moral obligations and environmentally conscious actions.

Personal norms serve as a key motivating force propelling climate mitigation behavior since they embody people's internalized feeling of duty to behave in line with their ethical principles. In the VBN paradigm, moral obligation, defined as personal moral norms, emerges when people see the detrimental effects of climate change and view themselves as personally accountable for its alleviation [9]. In fact, personal norms refer to the self-imposed exceptions and sanctions that individuals maintain, independent of legal enforcement [41]. Upon activation, these moral norms instill a perceived need to adopt low-carbon practices, such as carbon offsetting, notwithstanding potential personal costs or inconveniences. Meta-analytic studies indicated that moral obligation is a significant predictor of climate-friendly and pro-environmental behaviors across several domains, including sustainable transportation, energy efficiency, and other eco-friendly measures [42,43].

Additional research designated that moral obligation serves as a robust and reliable predictor of pro-environmental behavior. This effect is, in part, due to the influence of anticipated emotions like pride and guilt, which bolster individuals' perception of moral responsibility [44]. Bouman et al. [45] proposed that people's strong personal norms and sense of personal responsibility may explain why there were such swift and powerful prosocial reactions to COVID-19 (Figure 1). Consequently, moral norms function as a fundamental psychological motivator that converts environmental concern into tangible climate action.

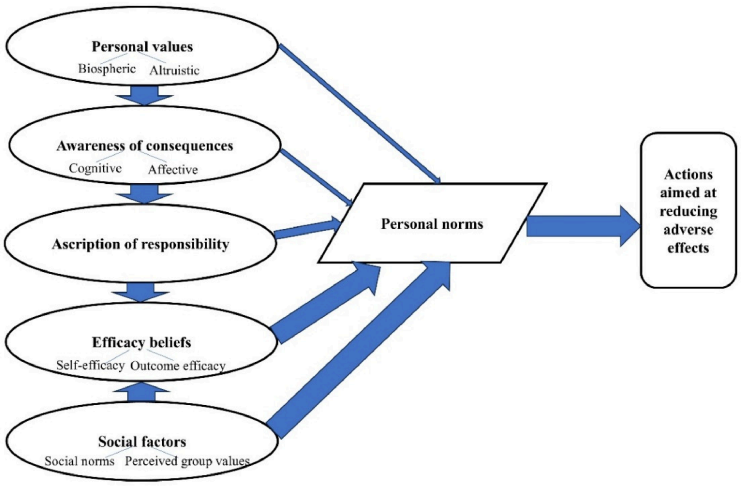


Figure 1. Pathways that drive mitigative measures, adapted from Bouman et al. [45]. Thicker arrows indicate more robust relationships.

In conclusion, the VBN framework provides a theoretically and empirically validated foundation for this study, focusing on how individual values might influence moral principles, ultimately leading to measures with the aim of alleviating climate changes, such as carbon offsetting initiatives in protected areas.

3. Research Methodology

3.1. Research Design, Sampling Strategy and Framings

The research methodology used in this study is a quantitative, cross-sectional design, and it is based on the VBN theory. Through the use of structural equation modeling, the design intends to examine the potential causal connections between the theoretical components, such as values, beliefs, and norms, and their impact on individuals' attitudes and intentions regarding environmental issues.

Visitors to Montseny Natural Park in the vicinity of Barcelona, Spain, or to Biesbosch National Park in Dordrecht, the Netherlands, served as the units of analysis in this study. The Montseny Natural Park was officially designated in 1978, built on a Special Plan from 1977, and recognized as a biosphere reserve by UNESCO for its rich natural diversity. Management is conducted by the Advisory Commission, which includes local stakeholders, and the Coordinating Council, which promotes collaboration among professional associations and public administrations [46]. Over recent decades, it has become one of the most popular protected areas in Catalonia, noted for its biodiversity, including Mediterranean, sub-Mediterranean, and Eurosiberian ecosystems, as well as its beautiful landscapes featuring mountains, forests, and rivers, alongside well-developed trails and visitor facilities.

The Biesbosch National Park is a location for nature lovers and birdwatchers because of its abundant biodiversity and status as a refuge for many bird species. The wetland habitat is acknowledged for its ecological value and is essential for various fish species. Additionally, the park draws people who want to hike, observe birds, explore the natural world, and sail. The ecological and social dynamic of the park is substantial for its integration of human activities with environmental protection. The park, as a protected natural area, is the greatest freshwater tidal basin in Europe, situated between the Meuse and Rhine rivers' tributaries, which meet at the Hollands Diep [47].

3.2. Data Collection Method

To collect data for this research, a survey approach was used, namely a self-administered questionnaire. The self-administered questionnaire was created to gather quantitative information on respondents' insights, beliefs, and actions corresponding to the subject of the research. Data were collected through on-site visitor surveys administered within the selected protected areas. This strategy enabled prompt answers to any questions that participants could have had. This straightforward method guaranteed the accuracy of the information gathered and contributed to making sure data were collected on time [48].

Furthermore, this strategy for acquiring data was carefully prepared with the purpose of increasing response rates and guaranteeing the inclusion of a range of visitor viewpoints inside the park. The same sampling method was employed in both the Spanish and Dutch research. The participants were chosen using a non-probability, quasi-systematic sampling technique. To be more precise, every other visitor was invited to participate in the study voluntarily after or during the visit. Respondents were required to be at least 18 years of age and visitors to the respective protected area. This method was applied to decrease the potential for any bias in participant selection and provide a degree of randomization while still preserving the practicalities needed for on-site data collection. The final samples included 517 participants from Spain and 383 participants from the Netherlands. Table 1 encapsulates the essential socio-demographic characteristics of the respondents in both countries, such as age, gender, educational attainment, and monthly income.

Table 1. Sociodemographic Profile of the Study Samples.

Country	Gender			Age				Education			Monthly Income							
	Male	Female	Others	18 to 30 Years	31 to 45 Years	46 to 60 Years	Above 60 Years	Primary Education	Secondary Education	Bachelor and Above	Zero	Less than 1000 €	1000–2000 €	2001–3000 €	3001–4000 €	More than 4000 €	3001–5000 €	More than 5000 €	No Answer
Spain	56.7	42.9	0.4	19.1	32.7	37.8	10.4	4.6	35.1	60.3	5.6	9.9	46.4	26.3	5.6	6.2	—	—	—
The Netherlands	46.7	52.8	0.5	17.2	24.6	28.7	29.5	0.8	32.1	67.1	1.1	7.1	14.6	32.9	—	—	31.3	10.7	2.3

Note: All values shown in the table are based on the percentage.

The surveys were distributed at several strategic locations within the Montseny Natural Park and the Biesbosch National Park. In Spain, surveys were available in three languages (Catalan, Spanish, and English) to accommodate the diverse linguistic backgrounds of park visitors. In the Netherlands, surveys were available in two languages (Dutch and English). The multilingual approach tried to ensure the inclusion of non-native English speakers' viewpoints in the collected data, foster broader participation, and minimize language barriers.

3.3. Operationalization of the VBN Framework

This research implements the VBN model [10] to interpret visitors' opinions on carbon offsetting. The VBN theory asserts that values act as enduring guiding principles that impact individuals' environmental views, which subsequently form their sense of duty, moral imperatives, and judgement of ecological matters.

In the Spanish sample, egoistic, altruistic, and biospheric values were identified as precursors to general pro-environmental beliefs. In the Duch sample, egoistic, altruistic, biospheric, and hedonistic values were first included due to prior research emphasizing the significance of hedonistic incentives in tourists and leisure settings. According to the VBN paradigm, it was anticipated that pro-environmental beliefs would affect the attribution of responsibility, which would subsequently impact moral norms. Ultimately, it was postulated that moral norms are linked to perceptions of carbon offsetting.

The approach used in this investigation varies somewhat from the original VBN paradigm, using attitudes toward carbon offsetting as the conclusive outcome variable instead of intentions or observable actions. This adaptation signifies the key goal of grasping visitors' favorable perspectives on carbon-offset programs inside protected areas. Accordingly, the outcomes should be seen as clarifying views on carbon offsetting rather than real offsetting conduct.

3.4. Measurements

All constructs in this research were assessed using a structured self-administered questionnaire consisting of multi-item measures derived from the academic literature. Initially, the understanding of the carbon-offsetting concept was evaluated using a multiple-choice categorical question featuring three response options: affirmative, negative, and uncertain. To ensure a common understanding of the concept, all individuals surveyed were supplied with a standardized description of carbon offsetting immediately before the attitude measuring questions. Therefore, those who originally claimed a lack of previous knowledge about

carbon offsetting were provided with essential contextual information before appraising their attitudes. Subsequently, the measures used in this study were biospheric values, altruistic values, hedonistic values, egoistic values, general pro-environmental beliefs, ascription of responsibility, moral norms, and general attitudes toward carbon offsetting.

The aim of the study was to explore the significance of the VBN framework in two samples of visitors to protected areas instead of conducting a formal statistical comparison between Spain and the Netherlands. Accordingly, separate structural models were evaluated for every sample, and the results are interpreted in connection to the affirmation of theoretical association within each setting.

The datasets from Spain and the Netherlands were gathered via two separate research projects carried out in distinct protected-area environments. Despite both studies using essentially analogous metrics based on the same theoretical framework, distinct answer forms were implemented in the survey design. The Spanish survey used a five-point Likert scale, whereas the Dutch survey utilized a seven-point Likert scale to provide enhanced answer distinction. Both forms are extensively used in attitudinal studies; yet, variations in scale formats might influence response distributions and variability. Consequently, the results are analyzed judiciously, prioritizing the exploration of theoretical connections within each sample above straightforward comparisons of actual scores between samples.

Participants indicated their level of agreement with each statement using a Likert scale. The spectrum in Spain varied from (1) negligible importance to (5) extreme importance for value orientation scales, whereas the other scales utilized a continuum from (1) strong disagreement to (5) strong agreement, and the Netherlands adopted a 7-point Likert scale. All research constructs were likewise evaluated using three-item questionnaires adopted or adapted from scholars to ensure methodological consistency.

The value orientation measures assessed the extent to which respondents adhered to biospheric, altruistic, egoistic, and hedonistic values as a guiding principle in their life. The holistic pro-environmental beliefs construct reflected respondents' fundamental views on environmental challenges, the dynamics between humans and nature, and the need for ecological conservation. The ascription of responsibility assessed the extent to which participants acknowledged their duty to address ecological concerns and alleviate their impacts. The moral norms inquiries indicated the participants' feelings of moral obligation and personal dedication to engaging in environmentally friendly practices. Ultimately, the attitudes toward carbon offsetting measured respondents' overall appraisal of this practice, encompassing their perceptions of its desirability, usefulness, and suitability as a strategy for addressing carbon emissions.

Prior to evaluating structural relationships, the reliability of the measuring instruments was analyzed using Cronbach's alpha coefficients. All constructs exhibited adequate internal consistency, with Cronbach's alpha scores surpassing the advised limit of 0.70. Additionally, confirmatory factor analysis validated the adequacy of the measurement model, as all standardized factor loadings exceeded the recommended threshold of 0.50, signifying that the observed indicators effectively reflected their corresponding latent constructs. These findings substantiate the reliability and validity of the measuring instruments used in both samples and endorse their appropriateness for further structural evaluations. Although the results validated the applicability of the measuring instruments, variations in response scales may influence the overall measurement equivalence across samples and should thus be considered when interpreting the outcomes.

Using Cronbach's alpha, this study evaluated the internal consistency of measurement scales. In Spain, biospheric values ($\alpha = 0.90$), altruistic values ($\alpha = 0.71$), and egoistic values ($\alpha = 0.70$) exceeded the suggested threshold [49,50]. In the Netherlands, biospheric ($\alpha = 0.72$), altruistic ($\alpha = 0.71$), egoistic ($\alpha = 0.72$), and hedonic values ($\alpha = 0.71$)

showed satisfactory reliability. General pro-environmental beliefs had acceptable internal consistency in both countries: Spain ($\alpha = 0.72$) and the Netherlands ($\alpha = 0.71$). Ascription of responsibility (AR) and moral norms (MN) were reliably acceptable; AR scored $\alpha = 0.71$ in Spain and 0.74 in the Netherlands, while MN scored $\alpha = 0.75$ in Spain and 0.78 in the Netherlands. General attitudes toward carbon offsetting scales also displayed suitable reliability: Spain ($\alpha = 0.72$) and the Netherlands ($\alpha = 0.77$).

3.5. Process of Data Analysis

The Statistical Package for Social Sciences (SPSS) version 26.0 and AMOS software version 24.0 were used to analyze the data in this study. A comprehensive descriptive analysis was initially conducted to describe the key components of the data and offer insights regarding sample characteristics. To further investigate potential causal relationships in the data and assess the accuracy of the projected links, path analysis and structural equation modeling were executed using the AMOS software.

Structural equation modeling (SEM) was performed using IBM SPSS AMOS version 24.0. The examination adhered to a dual-phased methodology. Initially, the measuring model underwent evaluation by confirmatory factor analysis, examining reliability, convergent validity, and discriminant validity. Secondly, the structural model was evaluated to examine the proposed associations among latent constructs. Statistical significance was determined using a threshold of $p < 0.05$.

This study utilized the Chi-Square divided by the Degree of Freedom (χ^2/df), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), the Incremental Fit Index (IFI), the Goodness-of-Fit Index (GFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR) [51–53]. These metrics are crucial for assessing how well the SEM model fits the data.

Egoistic values were initially included in both national frameworks derived from VBN theory. In the Dutch sample, the relationship between egoistic values and general pro-environmental beliefs was not statistically significant. In accordance with SEM parsimony principles and prior VBN implementations that emphasize empirically validated value dimensions, the construct was omitted from the final Dutch structural model. This modification was executed as a practical enhancement instead of a conceptual dismissal of egoistic principles. Thus, the interpretation of Dutch outcomes should acknowledge that egoistic values remained theoretically relevant but lacked explanatory efficacy within the examined sample.

All hypothesized constructs were defined according to theoretical principles prior to model estimation. The exclusion of egoistic values from the final Dutch model indicates a data-driven improvement intended to enhance model specification, and this modification is explicitly communicated to distinguish post hoc adjustments from theory-based model development.

4. Assessment and Outcomes

4.1. Understanding the Concept of Carbon Offsetting

Regarding the comprehension of the carbon offset concept (Figure 2), it is significant that over half of the respondents in Spain were unfamiliar with the term (56.1 percent, $n = 290$), while approximately one-sixth of the participants claimed an understanding of its meaning (17.8 percent, $n = 92$). Conversely, 26.1 percent of the participants ($n = 135$) indicated that they were aware of carbon offsetting yet lacked a comprehensive understanding of its definition or operational mechanisms.

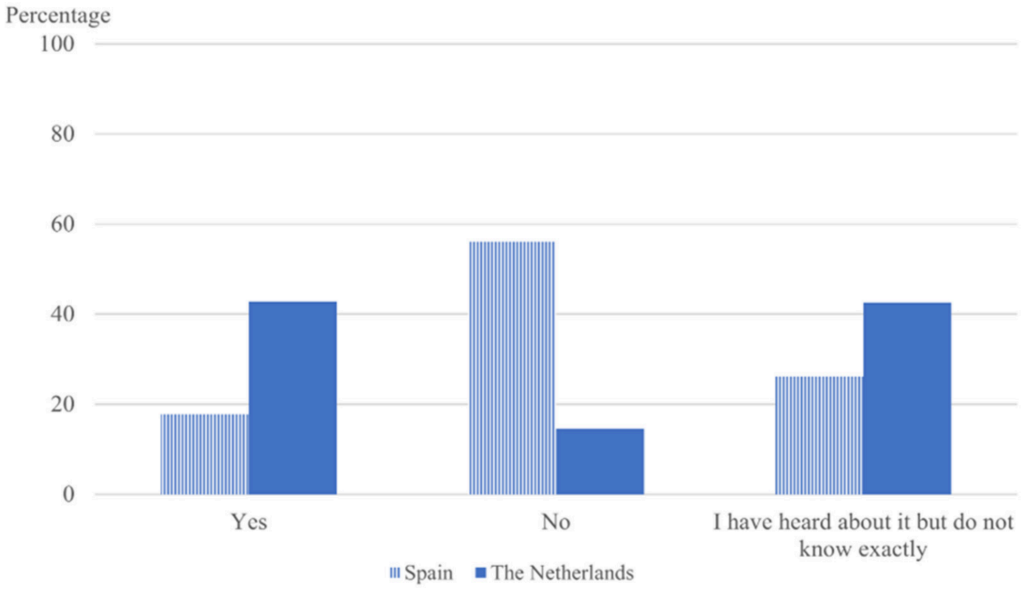


Figure 2. Percentage of respondents' familiarity with the carbon offset concept.

In the Netherlands, instead, almost half of the participants (42.6 percent, $n = 163$) mentioned that they have heard about carbon offsetting but lacked an understanding regarding its meaning or functionality. Figure 2 illustrates that, similar to those familiar with the concept of carbon offsetting yet uncertain about its exact definition or functioning, 42.8 percent of individuals ($n = 164$) recognized carbon offsetting schemes, whereas 14.6 percent of participants ($n = 56$) were entirely unaware of it.

4.2. Evaluating the Structural Model

4.2.1. Structural Equation Modeling Analysis for Spain

Structural Equation Modeling (SEM) is extensively employed in research in the behavioral, educational, social, and psychological sciences to examine complex causal linkages between variables and test theoretical models. A clear theoretical model that outlines the connections between latent and observable variables is necessary for the SEM. This part focuses on the application of SEM with AMOS version 24.0 in the Spain study to investigate the correlations between variables based on the VBN theory.

The model examined tripartite value orientations, general pro-environmental beliefs, environmental responsibility, and moral norms, positing that these various concerns—such as self-interest, altruism, and ecological awareness—indirectly influence general attitudes toward carbon compensation via cognitive awareness. Figure 3 depicts the path analysis between the variables and shared impressions of carbon offset schemes.

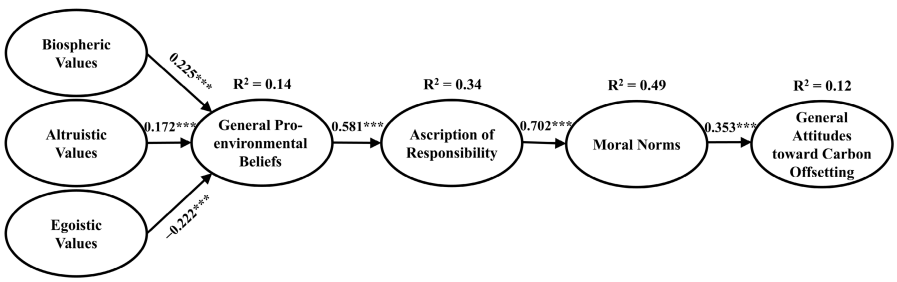


Figure 3. Structural equation modeling of general attitudes about carbon offsetting (Spain). Note: *** $p < 0.001$. $X^2 = 305.328$, $df = 180$, $p < 0.001$, $CFI = 0.962$, $TLI = 0.956$, $IFI = 0.963$, $GFI = 0.948$, $RMSEA = 0.037$, $SRMR = 0.049$.

In this proposed framework, the structural equation model revealed an excellent fit, as various fit indices indicated that the model was well-suited to the data, with moral norms serving as the sole direct predictor of general attitudes toward carbon offsetting compensations (χ^2/df = 1.70, CFI = 0.96, TLI = 0.96, IFI = 0.96, GFI = 0.95, RMSEA = 0.037, SRMR = 0.050).

The findings indicated that the three value orientations—biospheric, altruistic, and egoistic—had substantial but distinct relationships with overall pro-environmental beliefs. The results demonstrated that egoistic and biospheric value orientations had different associations with general pro-environmental viewpoints. Egoistic values had a substantial negative relationship, indicating that those who emphasize self-interest often possess poorer pro-environmental views. Biospheric values were positively correlated with pro-environmental attitudes, suggesting that individuals who prioritize the intrinsic worth of the natural environment are more inclined to support pro-environmental ideologies. Altruistic values exerted a positive but less pronounced correlation, implying that prioritizing the welfare of others can coexist with environmental concern, especially in contexts like community initiatives or conservation efforts that emphasize collective well-being.

General pro-environmental opinions substantially linked to the attribution of responsibility ($\beta = 0.58$), suggesting that people with stronger ecological worldviews are more likely to consider themselves accountable for reducing environmental damage. This finding corresponds with the VBN theory that perceptions about human-environment interactions act as cognitive antecedents to assessments of personal responsibility. The attribution of responsibility exhibited a robust positive relationship with moral norms ($\beta = 0.70$). This pathway serves as a fundamental mechanism within the VBN chain and demonstrates the value of attributing responsibility in engaging moral considerations pertinent to carbon offsetting behaviors, as it encourages individuals to reflect on their actions and their impact on the environment.

Lastly, the association of moral norms with attitudes toward carbon offsetting schemes in protected areas was found to be moderate ($\beta = 0.35$), indicating that internalizing moral incentives is important to determining support for carbon compensation programs associated with environmental conservation.

4.2.2. Structural Equation Modeling Analysis for the Netherlands

The suggested VBN framework and the sequential pathways connecting value orientations to attitudes regarding carbon offsetting schemes in protected areas were strongly supported empirically by the SEM carried out using AMOS 24.0. The resultant model showed a satisfactory overall fit (χ^2/df = 1.63, CFI = 0.95, TLI = 0.94, IFI = 0.95, GFI = 0.94, RMSEA = 0.041, SRMR = 0.080), indicating that the connections between the constructs were sufficiently captured by the proposed structure.

Biospheric, altruistic, and hedonic values demonstrated a significant relationship with overall pro-environmental beliefs among the four value orientations initially considered in the Netherlands study, while egoistic values failed to achieve statistical significance ($p = 0.455$) and were consequently excluded from the final model (Figure 4). Biospheric values surfaced as the most significant predictor of general pro-environmental beliefs, aligning with the fundamental importance of ecological concern in influencing environmental perspectives. Hedonistic values, although less potent than biospheric values, had a somewhat greater standardized association than altruistic values, suggesting that persons driven by comfort, pleasure, or quality of life concerns may nevertheless significantly support pro-environmental ideas. Altruistic values also had a favorable impact, but to a smaller degree, indicating that concern for others' welfare has a significant, albeit relatively minor, influence on our overall pro-environmental beliefs.

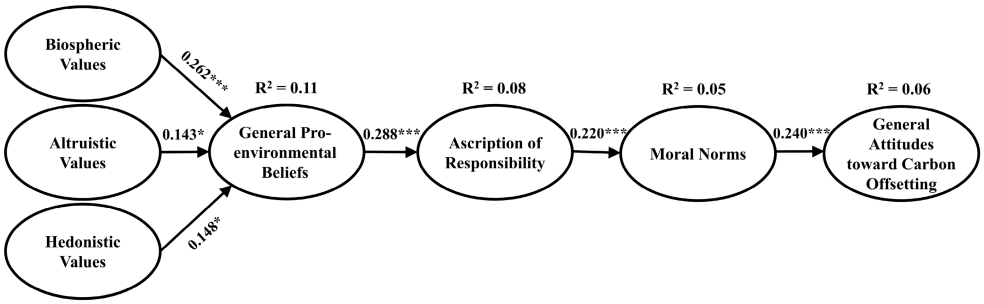


Figure 4. Structural equation modeling of general attitudes toward carbon offsetting (the Netherlands). Note: * $p < 0.05$, *** $p < 0.001$. $X^2 = 262.203$, $df = 161$, $p < 0.001$, $CFI = 0.945$, $TLI = 0.935$, $IFI = 0.946$, $GFI = 0.940$, $RMSEA = 0.041$, $SRMR = 0.080$.

Pro-environmental beliefs emerged a significant predictor; nevertheless, their correlation with the attribution of responsibility was moderate ($\beta = 0.29$). The relationship between the attribution of responsibility and moral norms ($\beta = 0.22$) implies that individuals who perceive themselves as accountable for environmental consequences are more inclined to embrace ethical obligations to engage in pro-environmental activities. Furthermore, moral norms were shown to have a considerable association with views on carbon offsetting initiatives in protected areas ($\beta = 0.24$). This finding indicates that individuals who have a moral obligation to mitigate environmental harm are more inclined to endorse offsetting initiatives, illustrating the importance of internalized ethical motivations in shaping support for conservation-related carbon programs.

Although the structural models demonstrated satisfactory goodness of fit according to recognized SEM criteria, they only explained a limited variation in attitudes toward carbon offsetting. The model accounted for 12% of the variance in the Spanish sample and 6% of the variance in the Dutch sample. These findings reveal that the VBN framework captures a statistically significant but restricted fraction of the determinants affecting visitors' attitudes toward carbon offsetting. Consequently, even if the identified relationships affirm the importance of environmental values, attitudes, responsibilities, and moral norms, a significant percentage of variation remains unexplained.

5. Discussion

5.1. Carbon Offsetting: Structural Equation Modeling and Understanding of the Underlying Processes

The structural equation models utilized in this study offered considerable empirical evidence for the sequential associations postulated by the VBN theory. Individuals who held greater pro-environmental value orientations were more prone to support ecological worldviews, as predicted, since biospheric and altruistic values had a significant positive relationship with environmental beliefs. These beliefs, in turn, demonstrated a strong correlation with the attribution of responsibility, thereby affirming the cognitive progression outlined in the VBN chain. Ascription of responsibility subsequently had a considerable direct association with personal norms, highlighting its function as the immediate precursor of moral obligation within the framework. Ultimately, carbon offsetting attitudes were heavily correlated with moral norms, which supports the VBN theory's assertion that commitment is the principal factor that determines intention and conduct. The proposed models matched the data excellently in Spain and commendably in the Netherlands, and the sequential pathways accounted for a modest ($R^2 = 0.12$) and meaningful ($R^2 = 0.06$) amount of variance in Spain and the Netherlands, respectively.

The comparatively low R^2 values indicate that factors outside the VBN framework may affect visitors' views on carbon offsetting. Prior research has shown the possible influence

of many elements on facilitating climate mitigation initiatives and carbon-offset schemes. These factors include trust in offset initiatives, the perceived effectiveness of carbon-offset efforts, environmental knowledge, destination attachment, perceived fairness, and economic considerations [54–56]. Integrating these factors might enhance the explanatory capacity in future research.

Therefore, it is crucial to differentiate between model fit and explanatory capability. While model-fit indices suggest that defined associations align generally with the observed data, the low R^2 values reveal that the model's capacity to account for variations in attitudes is constrained. Consequently, the results have to be seen as substantiation for the significance of certain psychological processes rather than as offering an exhaustive elucidation of attitudes toward carbon offsetting.

While the original formulation of the VBN theory conceptualizes pro-environmental conduct as the end point of the VBN sequence, the theoretical architecture of the model provides flexibility in the definition of the proximal construct triggered by personal norms. In this study, the last endogenous variable is general attitudes toward carbon offsetting, which represent individuals' evaluative orientations as shown to have a positive correlation with moral norms. Conceptually, attitudes are defined as antecedents of behavioral intention and action in cognitive behavior models. The acquired R^2 values, albeit small, correspond with the effect sizes often noted in environmental psychology, whereby attitudes and moral constructions generally explain around 5 to 15 percent of the variation, influenced by various contextual and individual factors [9,42,57,58].

The effectiveness of carbon offsetting as a strategic tool for furthering the growth of environmentally friendly tourism and recreation in protected areas is fundamentally reliant on the extent of visitors' awareness and understanding of the idea and its practical implementation. It is imperative that visitors possess a comprehension of the subject matter, since it can directly impact their propensity to engage in offsetting activities and, consequently, the overall effectiveness of such programs in reducing tourism-related carbon emissions.

Notwithstanding that carbon offsetting methods are increasingly being included in tourism management frameworks, there is still a shortage of empirical data on how acquainted visitors are with these programs, especially when it comes to protected areas. The present study, which was carried out in protected areas in Spain and the Netherlands, aims to fill this information gap by assessing the level of visitors' awareness and comprehension of the carbon offset concept, as well as their knowledge and familiarity with its operating procedures.

In Spain, the survey showed that most visitors to protected areas lacked knowledge of carbon offsetting: 56.1% (290 out of 517) were unfamiliar with it, 26.1% ($n = 135$) had heard of it but did not understand it, and only 17.8% ($n = 92$) had a clear understanding. In the Netherlands, knowledge was higher but still incomplete: 42.6% ($n = 163$) knew of carbon offsetting without fully understanding it, 42.8% ($n = 164$) understood it clearly, and 14.6% ($n = 56$) knew nothing about it.

These findings are consistent with previous studies indicating that, while carbon offsetting is becoming more widely addressed in the tourism industry, visitors' awareness and comprehension regarding it and their involvement remain restricted. Overall, the results of these investigations suggest that a major obstacle to the adoption and general efficacy of carbon offset programs in the travel and tourism industry is participants' inadequate awareness and comprehension of them [59–61]. According to the study conducted by Gössling et al. [59], a significant percentage of air passengers were either uninformed about voluntary carbon offset schemes or had inadequate comprehension of their objectives and mechanisms, resulting in minimal participation rates.

Likewise, Mair [61] found that visitors' reluctance to participate in carbon offsetting programs was mostly caused by their lack of understanding and skepticism about its effectiveness. Higham et al. [60] further underscored that these knowledge deficiencies constitute a significant barrier to the potential effectiveness of carbon offsetting initiatives, thereby undermining the ability to compensate for emissions within the tourism sector.

Low public awareness of carbon offsetting significantly hinders the mechanism's ability to promote eco-friendly tourism activities in Spain and the Netherlands. Pro-environmental conduct, based on the VBN paradigm, stems from established values, perceptions of environmental impact, and a sense of moral obligation. However, these motivators alone fall short of inspiring effective action in contexts characterized by procedural uncertainty or a lack of understanding.

5.2. Cross-National Variations in Support for Carbon Offsetting in Protected Areas

The observed variations between the Spanish and Dutch samples need not be interpreted as statistically validated national distinctions but instead as sample-specific patterns that may indicate contextual factors necessitating more scrutiny. The findings substantiate the VBN theory in both countries, positing that individuals' self-transcendent values, such as altruism and biospheric values, engender a belief in the significance of environmental protection. This belief subsequently activates their sense of moral obligation, established norms, and ultimately, their attitudes toward carbon offsetting in protected areas.

Altruistic and biospheric values demonstrated positive relationships with general pro-environmental beliefs in Spain, while egoistic values exhibited a negative correlation. This finding aligns with typical VBN research that differentiates between self-enhancement (egoistic) and self-transcendence (altruistic, biospheric) value clusters. Comparable patterns have been observed, wherein biospheric and altruistic values positively correlate with ecological worldviews or the New Ecological Paradigm (NEP), while egoistic values exhibit either a nonsignificant or negative relationship [62–64]. The lack of a significant egoistic path in the Dutch model is in line with previous research showing that, after controlling for altruistic and biospheric values, egoistic concerns do not consistently lead to pro-environmental beliefs [65,66]. This suggests that the motivational significance of self-enhancement for environmental cognition is weaker in some samples.

Earlier research found that hedonistic values have a mostly negative relationship with environmental attitudes and actions; however, in the Netherlands, there is a positive correlation between hedonic values and pro-environmental opinions in general. According to research by Steg et al. [67], there is a negative correlation between hedonic values and pro-environmental choices, such as sustainable transportation and energy use, and these values are empirically separate from egoistic, altruistic, and biospheric values. Recent studies, however, have shown that hedonistic values are linked to environmentally friendly intentions and behaviors, like green purchases, sustainable consumption, or eco-friendly behavior in leisure contexts [68–70]. Therefore, presenting choices as enjoyable or straightforward can align hedonistic motivations with sustainability. Because carbon offsetting is typically low-effort and digital in nature and framed in a "feel-good" way, it caters to rather than competes with hedonic aims, which may explain why it is popular in the Netherlands among individuals who prioritize both enjoyment and sustainability.

In both countries, strong pro-environmental beliefs were a significant predictor of the attribution of responsibility, which is in line with the VBN theory. This theory asserts that acknowledging environmental issues as severe and anthropogenic intensifies individuals' perceived moral duty to act [9,10]. The notably higher coefficient identified in Spain indicates that when Spanish respondents ratify pro-environmental beliefs, they are more inclined to embrace personal responsibility for environmental consequences. Conversely,

Dutch respondents might distribute responsibility more widely among institutional or collective players—a trend that corresponds with academic discourse highlighting the Netherlands' enduring tradition of consensus-driven, corporatist, and institutionally coordinated environmental governance [71–73]. This divergence implies that cultural and governance circumstances significantly influence the translation of broad environmental beliefs into individual moral obligations.

The transition from attributing responsibility to moral norms was significant in both samples, yet notably more pronounced in Spain ($\beta = 0.70$ vs. 0.22). This aligns with research emphasizing the crucial influence of personal norms (moral obligation) as the immediate factor driving pro-environmental intentions within tourism and hospitality settings [66,74]. Prior research utilizing the VBN framework in the realm of tourism and ethical consumption has similarly documented the significant association between personal norms and intentions to engage in pro-sustainable behaviors [75,76]. The diminished Dutch coefficient could suggest that moral norms in this context are influenced by supplementary factors that have not been accounted for, such as institutional trust, social norms, and perceived efficacy [77–80]. These elements have been demonstrated to enhance personal norms in forecasting ethical or sustainable consumption.

Another piece of evidence is that moral norms substantially correlate with attitudes toward carbon offsetting in protected areas in both the Netherlands and Spain, showing that people do not see offsetting as a neutral market mechanism but rather as a behavior with moral significance. Consistent with this trend is experimental evidence that people's moral convictions and emotions influence their assessments of how much carbon compensation is necessary, even when these factors have little effect on the actual emissions that need to be offset [81]. Such findings indicate that people see offsetting not from a strictly utilitarian perspective of reducing emissions cost-effectively, but rather via a moral lens that emphasizes regret, responsibility, and the need to make things right.

According to sociological studies of voluntary carbon markets, this moralized perspective is in line with the idea that offsetting schemes need to be justified in a way that is "morally sound" to gain public support and involvement [82,83]. From this perspective, offsetting serves as a tool for environmental protection and also as a symbolic activity whereby actors negotiate issues of responsibility, ethics, and the veracity of their reputations. The cross-national consistency evident in our data indicates that these moral dynamics may possess a degree of resilience across various cultural contexts, thereby supporting the notion that offsetting is perceived as a mechanism of moral restoration rather than merely a simple transactional exchange.

It is worth noting that the present study focused on attitudes concerning carbon offsetting rather than the behaviors associated with it. As a result, the conclusions provide perspectives on the psychological determinants of attitudinal support for carbon-offset schemes, albeit they fail to explicitly indicate choices related to participation or active engagement.

6. Conclusions

This study utilized the VBN framework to explore support for carbon offsetting initiatives within protected areas. The proposed models identify several significant psychological factors linked to protected-area visitors' attitudes toward carbon offsetting, yet substantial variation remains unexplained, making it necessary to include other aspects in further studies. The model emphasizes the significant influence of visitors' value orientations on their perspectives and intentions regarding carbon offsetting. The findings highlight that biospheric and altruistic values are pivotal in forming favorable attitudes toward carbon offsetting in protected-area tourism. In Spain, biospheric values are the most prominent, whereas in the Netherlands, a combination of biospheric, altruistic, and hedonistic values

prevails. Additionally, the Dutch study suggests that hedonistic ideals, including personal enjoyment and well-being, can motivate environmentally conscious behavior. The consistent dismissal of egocentric values indicates that appeals to personal gain and authority are unlikely to resonate, particularly in contexts where biospheric, altruistic, and hedonistic principles are more influential in shaping attitudes and intentions.

Cross-country comparison of the results emphasizes the significance of placing sustainability strategies within the specific contextual frameworks of each nation. The findings indicate that sustainability efforts would be most effective when they align with the diverse motivational profiles identified in each national sample. The study refrains from advancing cultural interpretations; rather, it advocates for the formulation of context-responsive sustainability strategies that are firmly rooted in the validated predictors present within each dataset. It posits that while universal appeals to social justice and environmental conservation can resonate broadly, incorporating hedonistic elements may enhance engagement in markets like the Netherlands, where personal enjoyment is valued. The sustainability strategies in Spain might benefit from a moral and ecological perspective, whereas those in the Netherlands could focus on experiential and emotional aspects. If carbon offsetting resonates with public values, tourism could evolve into a meaningful endeavor that benefits both the planet and individual fulfillment.

The pronounced effects observed in the Spanish model, especially in the sequence of beliefs, ascription of responsibility, and personal norms, are probably more likely to be explained by contextual and structural variables than by cultural differences. Respondents in the Spanish sample appear to have more prominent and coherently integrated environmental attitudes and moral concerns in their evaluative process. Increased social and environmental pressures, along with higher levels of public participation in sustainability issues, may explain this phenomenon. Furthermore, the overall model coherence, measurement reliability, and construct variance may have all played a role in the considerably greater path coefficients. These circumstances together indicate that the VBN processes functioned with heightened psychological activation in Spain, and the study abstains from promoting culturally based interpretations without scientific evidence.

Fully using the advantages of carbon offsetting within a broader framework for sustainable tourism and climate action requires ongoing collaboration between local communities, tourism companies, and governments in addition to well-defined, transparent, and context-appropriate offsetting activities. Although carbon offsetting offers a practical way to cut down tourism-related carbon emissions, its efficacy is dependent on a number of variables, including accessibility, trust, and economic capability. To ensure that tourism favorably supports environmental conservation initiatives, future studies should examine other behavioral interferences coupled with policy and legislative frameworks to increase involvement in carbon offset schemes.

Travelers visiting protected areas have a key role in carbon-neutrality plans because their involvement in emission-reduction measures and approved offsetting programs strengthens the impact of management initiatives. Managers may encourage responsible climate action habits that support institutional efforts and help preserve protected areas for the future by providing transparent information, behavioral prompts aligned with values, and accessible offsetting options. Carbon-offset programs may benefit from strategic planning, diverse stakeholders' engagement, incentives for operators, and partnerships with accredited carbon-management entities.

7. Research Implications

7.1. Theoretical Implications

This study contributes to the growing body of literature that applies the VBN paradigm in the context of tourism and environmental issues. First, the findings indicate that the VBN framework can effectively expand to interpret attitudes related to carbon offsetting among visitors to protected areas. The substantial correlations shown among values, beliefs, responsibilities, moral norms, and carbon offsetting attitudes validate the persistent importance of the VBN theory in elucidating environmental judgments in tourism scenarios.

Second, the study provides empirical evidence from two distinct visitor groups to protected areas in different national contexts. Rather than systematically comparing nations, the investigation explores how the VBN concept applies in two distinct settings. The findings reveal that the primary logic of the VBN sequence is mostly corroborated in both groups, but minor differences are seen in the relevance of certain value orientations. The nonexistence of a statistically significant association between egoistic values and general pro-ecological attitudes in the Dutch sample implies that the role of particular values may change according to contextual circumstances.

Third, the relatively limited explanatory capacity of the models suggests that the VBN theory encompasses just a fraction of the factors associated with attitudes regarding carbon offsetting. This finding promotes further investigations to amalgamate the VBN theory with supplementary psychological and contextual variables that may contribute to explaining visitor reactions to climate-mitigation efforts.

7.2. Practical Implications

The results have many implications for administrators of protected areas and entities aiming to advance voluntary carbon offset programs. The findings indicate that individuals with supportive views on carbon offsetting tend to possess stronger environmental value, a sense of personal duty, and moral norms. Consequently, educational and communicative approaches that focus on environmental guardianship, personal responsibility, and the effects of climate change may enhance visitors' willingness to engage with carbon offset projects.

Protected-area managers and legislators must concentrate on cutting emissions at the source by increasing the appeal and accessibility of sustainable transportation options, encouraging positive social norms, and making sure that offsetting is utilized in conjunction with real emission reductions rather than in place of them with the purpose of achieving carbon neutrality and the growth of sustainable tourism. The tourism industry can only balance its expansion and visitor access with the need to conserve the environment, be responsible for climate change, and safeguard protected areas via integrated, multi-stakeholder initiatives.

Furthermore, protected-area managers can contemplate enhancing educational initiatives that convey the ecological consequences of tourism-associated carbon emissions and the significance of personal efforts in environmental conservation. Such approaches might create a more conducive attitudinal environment for the execution of voluntary carbon offset schemes.

Nevertheless, this research examines attitudes rather than real engagement in carbon offset initiatives. Thus, the findings should not be interpreted as confirmation that affirmative attitudes automatically lead to participation. Other determinants, such as trust in offset providers, beliefs about performance, and economic restrictions, may impact genuine behavioral decisions. Practically, the outcomes emphasize the necessity of crafting sustainability interventions that are contextually sensitive and matched with the predominant motivational and normative processes within each country's context.

8. Limitations of the Study and Future Research

While the evidence supports the connections postulated by the VBN theory, it is essential to approach the results with the necessary circumspection. The cross-national comparison of the findings must be approached with caution owing to the study's limitations. The use of differing answer formats—a 5-point Likert scale in Spain and a 7-point scale in the Netherlands—may have affected response variability and led to disparities in path strengths, since fewer scale points might provide more concentrated replies and enhanced construct associations.

The disparate incorporation of value orientations across the two samples significantly restricts the understanding of cross-national variations. Cultural inferences need the constant measurement of identical value dimensions across nations to ensure that the foundational motivational framework is both theoretically and practically equivalent. Consequently, the results ought to be understood within the limits of contextual rather than cultural interpretations.

Furthermore, the results must be understood considering the sampling methodology. Given that participation was not mandatory, individuals with heightened environmental concerns may have been more inclined to engage, which might introduce self-selection bias. As a consequence, the outcomes should not be considered representative of all visitors to protected areas in either country.

Future research endeavors should include longitudinal or experimental methods to more thoroughly explore the chronological sequence of the VBN constructs and the potential causal pathways. In addition, extending the analysis from attitudes to actual offsetting behavior, willingness to pay, and participation decisions would provide a more holistic assessment of the impact of carbon offset strategies in protected areas.

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

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