

Developing and Evaluating a Cultural Model of Environmental Behavior in Iran: An Exploratory Sequential Mixed-Methods Study

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Article Info

Article type:

Original Research

How to cite this article:

Nasr, M. & Shahnoushi, M. (2027). Developing and Evaluating a Cultural Model of Environmental Behavior in Iran: An Exploratory Sequential Mixed-Methods Study. *AI and Tech in Behavioral and Social Sciences*, 5(1), 1-9. <https://doi.org/10.61838/kman.aitech.5841>



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ABSTRACT

Environmental crises require not only technical and regulatory responses but also sustained changes in citizens' values, norms, and everyday practices. This exploratory sequential mixed-methods study developed a culturally grounded model for addressing environmental threats in Iran and conducted a preliminary quantitative evaluation of selected model relationships. In the qualitative phase, academic and professional experts were recruited purposively and through snowball sampling, and semi-structured interviews were analyzed through open, axial, and selective coding. The resulting paradigmatic model identified environmental education, knowledge and awareness, and environmental values as causal conditions; environmental ethics and pro-environmental behavior as contextual conditions; government support as an intervening condition; environmental culture-building and public participation as strategies; and consolidation of environmental culture and effective environmental protection as outcomes. In the quantitative phase, 390 residents of District 12 of Tehran completed a questionnaire derived from the qualitative categories and relevant literature. Partial least squares structural equation modeling indicated positive associations of environmental education, environmental values, environmental knowledge and awareness, public participation, and pro-environmental behavior with the capacity to address environmental threats. The primary endogenous construct had $R^2 = .847$ and adjusted $R^2 = .842$; communality was .390 and redundancy was .330. Because the design was cross-sectional and complete coefficient-level results were not available for every proposed relationship, the findings should be interpreted as preliminary model support rather than causal confirmation. The study highlights the need to connect environmental education with ethical responsibility, participatory opportunities, and institutional support.

Keywords: *environmental behavior; environmental culture; environmental education; environmental ethics; grounded theory; mixed methods; PLS-SEM; public participation*

1. Introduction

Environmental crises have become central challenges to sustainable development. Climate change, rising temperatures, air pollution, water scarcity, ecosystem degradation, and biodiversity loss increasingly affect public health, economic security, and social well-being

(Intergovernmental Panel on Climate, 2023; United Nations Environment Programme, 2021, 2024).

Technological controls and regulatory measures are necessary but insufficient. Demand-side change and sustainable everyday behavior are also required because household and community practices shape resource use,

waste generation, and exposure to environmental risks (Creutzig et al., 2022; Piao & Managi, 2024).

Pro-environmental behavior includes individual and collective actions intended to reduce environmental harm, such as conserving energy and water, reducing plastic consumption, recycling, using public transportation, and participating in environmental initiatives (Lou & Li, 2023; Tian & Liu, 2022).

A persistent knowledge-behavior gap indicates that awareness alone rarely produces sustained behavioral change. Values, social norms, moral responsibility, perceived efficacy, and contextual opportunities help determine whether knowledge is translated into action (Kollmuss & Agyeman, 2002; Miller & Rice, 2024).

Environmental education can increase knowledge, sensitivity, and behavioral competence. Its effects are more durable when learning is practical, participatory, and connected to ethical reflection and everyday experience (Ardoin et al., 2020; United Nations Educational & Cultural, 2020; Zhao et al., 2024).

Environmental knowledge and awareness can motivate corrective action by clarifying the consequences of ecological degradation. Their behavioral influence is often indirect and depends on attitudes, values, personal norms, and perceived responsibility (Li et al., 2022; Tamar et al., 2021).

Environmental values reflect the importance assigned to nature, intergenerational justice, resource stewardship, and sustainability. Stronger environmental values are generally associated with greater willingness to adopt sustainable practices (Piao & Managi, 2024; Shen & Zhang, 2024).

Environmental ethics concerns moral principles governing the relationship between humans and nature. Moral responsibility, pride, guilt, and internal commitment may bridge the gap between environmental knowledge and actual behavior (Niu et al., 2023; Shipley & van Riper, 2022).

Social and institutional conditions also matter. Social norms, media exposure, public policy, urban infrastructure, and institutional trust can facilitate or constrain sustainable action (Meng et al., 2023; Saracevic & Schlegelmilch, 2021).

Iran faces severe water stress, urban air pollution, land subsidence, and pressure on natural resources. These conditions make the cultural and ethical determinants of environmental behavior particularly relevant to policy and public engagement.

This study developed and quantitatively evaluated an integrated cultural model incorporating environmental education, knowledge and awareness, environmental values, environmental ethics, pro-environmental behavior, public participation, culture-building, and government support.

The study contributes a context-sensitive framework for understanding how cognitive, normative, behavioral, social, and institutional factors jointly shape citizens' capacity to respond to environmental threats.

2. Literature Review

Contemporary environmental research increasingly treats environmental behavior as a multidimensional phenomenon produced by interactions among cognition, motivation, values, ethics, social norms, and institutional context.

Education is an important prerequisite for sustainable behavior, but greater knowledge does not automatically produce action. Intervening mechanisms such as personal values, moral obligation, and social expectations determine whether learning is translated into practice.

Knowledge enables citizens to understand ecological consequences, yet it becomes behaviorally consequential when integrated with personal values, social norms, and perceived responsibility.

Environmental values provide relatively stable guidance for decisions involving nature, future generations, and resource conservation. They may also become part of personal and collective identity.

Environmental ethics provides a normative mechanism through which knowledge and values are internalized as obligations. Moral emotions and personal norms can therefore reduce the awareness-behavior gap.

Institutional and social environments affect the feasibility and desirability of sustainable behavior. Media, infrastructure, public policy, and community expectations can reinforce or undermine individual motivation.

Accordingly, a cultural-ethical framework offers a more comprehensive explanation than single-factor models by integrating cognitive, normative, behavioral, and contextual dimensions.

The conceptual framework is consistent with the theory of planned behavior, value-belief-norm theory, and integrative reviews showing that attitudes, perceived control, personal norms, values, contextual barriers, and opportunities jointly shape environmentally significant

behavior (Ajzen, 1991; Gifford, 2011; Steg & Vlek, 2009; Stern, 2000; Stern et al., 1999).

3. Conceptual Model and Research Hypotheses

The proposed model assumes that environmental threats cannot be addressed solely through technical regulations or managerial interventions. Effective response requires cultural learning, value formation, ethical responsibility, participation, and institutional support.

Environmental education, environmental knowledge and awareness, and environmental values were specified as causal conditions that shape readiness for responsible action.

Environmental ethics and pro-environmental behavior were treated as contextual conditions. Environmental ethics represents internalized responsibility toward nature and future generations, whereas behavior represents observable conservation practices.

Government support was specified as an intervening condition because policy, infrastructure, incentives, monitoring, and institutional coordination may strengthen or weaken the conversion of cultural capacity into action.

Environmental culture-building and public participation were identified as strategies for institutionalizing values and enabling citizens, schools, universities, civil society organizations, and local communities to participate in environmental governance.

The expected outcomes were the consolidation of environmental culture and more effective environmental protection.

The qualitative phase generated the following theory-derived propositions. The quantitative phase evaluated the five direct relationships for which complete significance decisions were available:

P1. Environmental education is positively associated with the capacity to address environmental threats.

P2. Environmental knowledge and awareness are positively associated with the capacity to address environmental threats.

P3. Environmental values are positively associated with the capacity to address environmental threats.

P4. Environmental ethics is expected to support pro-environmental behavior.

P5. Pro-environmental behavior is positively associated with the capacity to address environmental threats.

P6. Environmental culture-building is expected to support the capacity to address environmental threats.

P7. Public participation is positively associated with the capacity to address environmental threats.

P8. Government support is conceptualized as an intervening institutional condition.

P9. Environmental ethics is conceptually positioned between education, awareness, values, and pro-environmental behavior.

P10. Environmental culture-building and public participation are conceptualized as strategic mechanisms linking cultural factors with effective environmental protection.

Overall, the model conceptualizes environmental protection as a multidimensional process in which individual agency and institutional capacity are mutually reinforcing.

4. Methods and Materials

This applied study used an exploratory sequential mixed-methods design. A qualitative grounded-theory phase was conducted first to develop a culturally grounded model, followed by a quantitative phase using partial least squares structural equation modeling (PLS-SEM) to evaluate selected relationships in the model.

4.1. Qualitative Phase

The qualitative phase followed a systematic grounded-theory approach suitable for phenomena that lack a comprehensive context-specific explanatory model.

Participants included university scholars, sociologists, cultural-management specialists, environmental researchers, and executives or experts from environmental organizations. Purposive sampling was followed by snowball recruitment, and interviewing continued until theoretical saturation.

Data were collected through in-depth semi-structured interviews addressing environmental threats, cultural barriers, education, awareness, values, ethics, government support, public participation, and expected outcomes. Written informed consent was obtained before each interview.

Analysis involved open, axial, and selective coding. Initial concepts were extracted line by line, grouped into categories, and organized within a paradigmatic model comprising causal conditions, the core phenomenon, contextual conditions, intervening conditions, strategies, and outcomes.

The qualitative model identified education, awareness, and values as causal conditions; ethics and behavior as contextual conditions; government support as an intervening condition; culture-building and public participation as strategies; and environmental culture and effective protection as outcomes.

4.2. Qualitative Trustworthiness

Credibility was supported through expert sampling, iterative analysis, constant comparison, maintenance of an audit trail from raw data to categories, and continuation of sampling until theoretical saturation.

4.3. Quantitative Phase

Questionnaire items were developed from qualitative categories and the theoretical literature. The instrument assessed environmental education, knowledge and awareness, values, ethics, behavior, culture-building, public participation, government support, and the capacity to address environmental threats using a five-point Likert scale.

The quantitative population comprised residents of District 12 of Tehran. Four hundred questionnaires were distributed, and 390 complete questionnaires were retained for analysis. Participants were recruited from the target district using the sampling procedure specified in the study protocol.

4.4. Measurement Quality

Content validity was evaluated by experts in environmental studies, sociology, and cultural management. Items were revised in response to their recommendations.

Internal consistency was assessed using Cronbach's alpha and composite reliability. Convergent validity was evaluated through average variance extracted, and discriminant validity through the Fornell-Larcker criterion and the heterotrait-monotrait ratio.

4.5. Data Analysis

Quantitative data were analyzed using PLS-SEM. The measurement model was assessed before the structural model. Reported analyses included internal consistency, convergent and discriminant validity, coefficients of determination, predictive relevance, and overall model

indices. The structural analysis focused on the direct relationships reported in the study dataset.

Quantitative data were analyzed with PLS-SEM. The measurement model was evaluated before examining path coefficients, t statistics, significance levels, coefficients of determination, predictive relevance, and overall model fit.

The sequential design combined contextual depth from qualitative inquiry with empirical evaluation of the resulting model.

5. Findings and Results

Results are presented for the qualitative model and the subsequent quantitative validation.

5.1. Qualitative Findings

The interviews indicated that responses to environmental threats in Iran are shaped by cultural, educational, ethical, behavioral, social, and institutional factors rather than by technical or legal measures alone.

Environmental education, knowledge and awareness, and environmental values emerged as causal conditions. Participants emphasized fragmented education, superficial public awareness, and weak incorporation of environmental values into everyday lifestyles.

Environmental ethics and pro-environmental behavior emerged as contextual conditions. Awareness was considered insufficient unless it became internalized responsibility and observable conservation practice.

Government support emerged as an intervening condition involving coherent policy, enforceable regulation, resources, urban infrastructure, monitoring, support for civil society, and incentive or sanction mechanisms.

Environmental culture-building and public participation were the principal strategies. Participants stressed that lasting change requires integration across education, media, families, religious institutions, local organizations, and urban-development programs.

The final outcomes were consolidation of environmental culture and effective environmental protection, characterized by sustainable behavior grounded in social norms and cultural identity.

The quantitative phase evaluated five direct associations in the model. Environmental education, environmental values, environmental knowledge and awareness, public participation, and pro-environmental behavior were positively associated with the capacity to address

environmental threats. These findings provide empirical support for the tested portion of the culturally derived model.

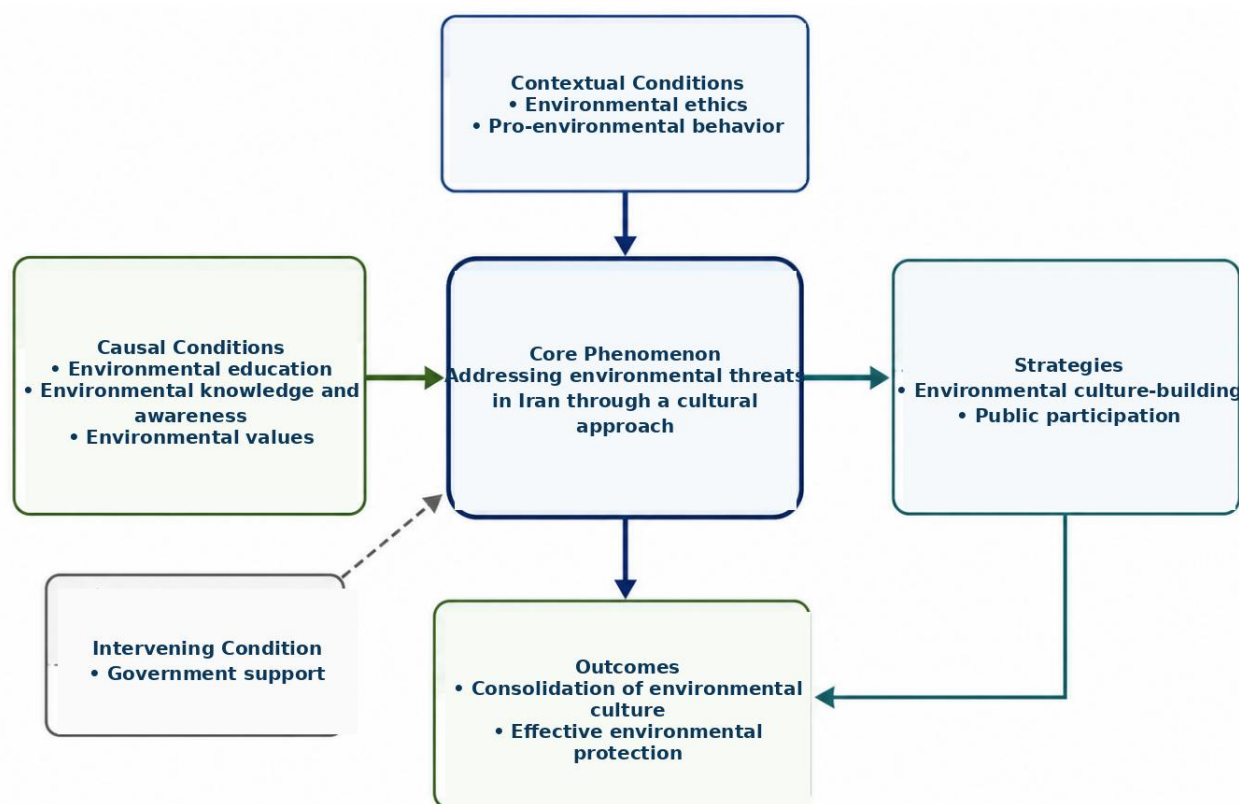
Table 1

Qualitative Findings

Paradigmatic dimension	Main categories	Conceptual interpretation
Causal conditions	Environmental education; environmental knowledge and awareness; environmental values	Initiating factors shaping the cultural capacity to address environmental threats
Core phenomenon	Addressing environmental threats in Iran through a cultural approach	Central phenomenon and principal research problem
Contextual conditions	Environmental ethics; pro-environmental behavior	Cultural and behavioral context required to convert awareness into sustained action
Intervening condition	Government support	Institutional factor that facilitates or constrains the process
Strategies	Environmental culture-building; public participation	Principal actions for changing attitudes, strengthening behavior, and institutionalizing environmental culture
Outcomes	Consolidation of environmental culture; effective environmental protection	Expected results of cultural and participatory strategies

Figure 1

Alternative visual representation of the paradigmatic model.



5.2. Quantitative Findings

The quantitative phase evaluated the model derived from the qualitative analysis using data from 390 citizens.

The structural model indicated positive and statistically significant associations of environmental education,

environmental values, environmental knowledge and awareness, public participation, and pro-environmental behavior with the capacity to address environmental threats.

Environmental education emerged as a prominent factor, while environmental culture-building and public participation were also emphasized across the integrated qualitative and quantitative findings. Together, these results

indicate that knowledge is more likely to be translated into action when supported by social, institutional, media, and participatory processes.

Table 2

Summary of Structural-Model Relationships

Examined path	Direction	Significance	Decision
Environmental education → Addressing environmental threats	Positive	Significant	Supported
Environmental values → Addressing environmental threats	Positive	Significant	Supported
Environmental knowledge and awareness → Addressing environmental threats	Positive	Significant	Supported
Public participation → Addressing environmental threats	Positive	Significant	Supported
Pro-environmental behavior → Addressing environmental threats	Positive	Significant	Supported

The coefficient of determination for the primary endogenous construct was $R^2 = .847$, indicating that the model explained 84.7% of its variance.

The adjusted R^2 was .842. The reported redundancy value was .330, communality was .390, and the overall goodness-of-fit index was .575.

Table 3

Explanatory Power and Model-Fit Indices

Index	Reported value	Interpretation
R^2	.847	Very strong explanatory power
Adjusted R^2	.842	Stable structural model
Communality	.390	Acceptable measurement quality
Redundancy	.330	Satisfactory predictive relevance
GoF	.575	Strong overall model fit

The coefficient of determination for the primary endogenous construct was $R^2 = .847$, indicating that the included predictors jointly accounted for 84.7% of its variance in this sample. The adjusted R^2 was .842. Communality was .390 and redundancy was .330. These values indicate substantial in-sample explanatory power, but they do not establish causality or out-of-sample predictive validity.

5.3. Integration of Qualitative and Quantitative Findings

The two phases converged on the conclusion that environmental threats require a multidimensional cultural model integrating education, awareness, values, ethics, behavior, participation, government support, and environmental culture-building.

The findings imply that environmental policy should be linked with cultural, educational, and social policy rather than treated as an exclusively technical domain.

6. Discussion and Conclusion

The study developed a cultural model for addressing environmental threats in Iran. The qualitative phase identified the structure of the model, and the quantitative phase provided preliminary empirical support for several proposed relationships.

Education, knowledge, and values were identified as causal conditions, but their influence depends on ethical internalization and behavioral expression. This interpretation is consistent with value-belief-norm theory and research on personal norms and moral emotions.

Government support was identified as a critical intervening condition. Institutional infrastructure can enable citizens to act on environmental intentions, whereas weak coordination and inadequate services can suppress sustainable behavior.

Culture-building and public participation emerged as strategic mechanisms. Sustainable policy is more likely to

endure when citizens participate in decision making, implementation, monitoring, and local environmental initiatives.

The high reported R^2 indicates substantial in-sample explanatory power; however, the cross-sectional design, shared self-report measurement, and geographically restricted sample require cautious interpretation. External validation and out-of-sample prediction are needed before the model can be considered broadly generalizable.

The model supports a transition from episodic, directive, and exclusively technical interventions toward coordinated cultural, ethical, participatory, and institutional strategies.

Environmental education is therefore unlikely to produce sustained behavior unless it is linked with values, ethics, participation, and practical institutional support.

7. Practical Implications

Environmental education should be redesigned as practical, skills-based, experiential, and locally relevant learning integrated across schools, universities, public communication, and professional training.

Mass media and social networks should be used for sustained environmental culture-building through scientifically accurate, accessible, and culturally relevant content rather than short-term campaigns.

Environmental ethics should be incorporated into cultural policy through concepts such as intergenerational justice, stewardship of public resources, responsibility toward living systems, and avoidance of waste.

Mechanisms for meaningful public participation should be expanded through local environmental councils, civil society support, volunteer programs, and participatory monitoring.

Government institutions should provide infrastructure for waste separation, recycling, clean public transportation, efficient water and energy use, and incentives for sustainable behavior.

Environmental governance should be coordinated across education, science, municipalities, media, energy, industry, and local institutions.

Cultural impact assessment should accompany technical and economic assessment of environmental policies.

8. Future Research

The model should be tested in other provinces, cities, and rural settings to examine cultural and geographical variation.

Longitudinal research is required to evaluate changes in environmental attitudes and behavior over time and to clarify temporal ordering.

Future mixed-methods studies could combine grounded theory with thematic analysis, Delphi methods, interpretive structural modeling, network analysis, multilevel modeling, and objective behavioral data.

9. Limitations

The quantitative sample was restricted to District 12 of Tehran; national generalization is therefore inappropriate without replication.

The quantitative measures were self-reported and may be affected by social-desirability bias and discrepancies between claimed and actual behavior.

The cross-sectional design cannot establish causal relationships or temporal ordering.

Economic structure, legal enforcement, organizational conflicts of interest, industrial policy, household income, and consumption patterns were not directly modeled.

10. Conclusion

The proposed model portrays environmental response as a cultural, social, and institutional system. Effective environmental protection requires coordinated education, awareness, values, ethics, behavior, participation, culture-building, and government support. Policies focusing on only one component are unlikely to produce durable change.

Authors' Contributions

Mehran Nasr: Conceptualization, methodology, investigation, data collection, formal analysis, and writing—original draft. Mojtaba Shahnoushi: Supervision, methodology, validation, interpretation, and writing—review and editing. Both authors reviewed and approved the final manuscript.

Declaration

Generative artificial intelligence was used only to assist English translation, language editing, and document formatting. It was not used to fabricate data or results. The authors reviewed and approved all AI-assisted content and remain fully responsible for the manuscript.

Transparency Statement

De-identified study materials and data may be available from the corresponding author upon reasonable request, subject to participant-consent, ethical, and institutional restrictions.

Acknowledgments

The authors thank the interview participants, survey respondents, and experts who contributed to instrument development and model evaluation.

Declaration of Interest

The authors report no conflict of interest.

Funding

The authors received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethics Considerations

The study was conducted in accordance with the ethical principles applicable to social and behavioral research. Qualitative participants provided written informed consent, participation was voluntary, and confidentiality was protected. The quantitative survey was anonymous, and participants could decline or discontinue participation without penalty. No clinical intervention was performed and no directly identifying information was reported.

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