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Environmental Concern and Environmental Tax Awareness in Shaping Public Acceptance of Carbon Tax

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ABSTRACT

Purpose—This study aims to examine the direct and indirect effects of environmental concern and environmental tax awareness on public acceptance of carbon tax, emphasizing the interaction between affective and cognitive determinants.

Design/methodology/approach—A quantitative approach is employed using a cross-sectional survey design. Data were collected from 61 respondents and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test direct and mediating relationships among constructs.

Findings—The results reveal that environmental concern positively influences public acceptance of carbon tax but negatively affects environmental tax awareness, indicating a gap between pro-environmental attitudes and policy understanding. Furthermore, environmental tax awareness has a significant negative effect on public acceptance, suggesting that increased knowledge may lead to more critical evaluation of policy fairness and economic burden. However, mediation analysis shows that environmental tax awareness significantly mediates the relationship between environmental concern and public acceptance, highlighting its role as a cognitive bridge in translating environmental values into policy support.

Originality/value—This study contributes to the literature by integrating the Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) theory within a dual-path framework, offering a nuanced understanding of how affective and cognitive factors interact in shaping public acceptance of carbon tax.

Practical implications—The findings suggest that policymakers should prioritize transparent communication, equitable policy design, and public education to enhance trust and social legitimacy of carbon taxation.

1. Introduction

The climate crisis is becoming increasingly urgent, necessitating a fundamental shift in environmental policy frameworks. Carbon taxes have emerged as a pivotal market-based mechanism for achieving net-zero emissions targets by internalizing the negative externalities of greenhouse gas emissions through a monetary cost on carbon-intensive activities (B. Yang, 2025; Rakshit et al., 2025). Despite their theoretical efficiency and robust economic justification, carbon taxes frequently encounter significant public resistance in practice(B. Yang, 2025; Muqattash et al., 2026; Muth, 2025). This opposition is often driven by concerns regarding the perceived economic burden, inequitable distribution of costs, and broader notions of policy injustice. Empirical evidence globally underscores that social acceptance is a prerequisite for the success of environmental fiscal policies; even the most economically optimized designs may fail in the absence of sufficient public support (Klenert et al., 2018; Carattini et al., 2018).

A primary challenge in implementing carbon taxation lies in the disconnect between public environmental awareness and the willingness to accept the direct financial implications of such policies (Mölk et al., 2026). Although environmental consciousness has permeated contemporary society, this awareness does not automatically translate into support for tax-funded policy instruments (Hulth, 2026). Resistance often stems from skepticism regarding policy effectiveness, low levels of institutional trust, and a limited understanding of revenue redistribution mechanisms, such as revenue recycling. Within this paradigm, transparency and perceptions of fairness are decisive factors in determining public acceptance, as individuals are more inclined to support policies perceived as equitable and socially beneficial (Alo, 2025; Belahouaoui and Attak, 2025; Belahouaoui and Attak, 2026).

Theoretically, the relationship between environmental values and policy acceptance can be elucidated by integrating the Theory of Planned Behavior (TPB) with the Value-Belief-Norm (VBN) theory. The TPB (Ajzen, 1991) emphasizes the pivotal role of attitudes and cognitive evaluations in shaping behavioral intentions, while the VBN theory (P. C. Stern et al., 1999) underscores the influence of moral values and ecological convictions on pro-environmental conduct. In this integrated framework, environmental concern represents the affective dimension, reflecting an individual's moral engagement with ecological issues. Conversely, awareness of environmental taxes constitutes the cognitive dimension, denoting an individual's grasp of policy mechanisms and their perceived efficacy. Recent empirical research suggests that public support is significantly bolstered when individuals exhibit both high environmental concern and a systemic understanding of tax policies (H. Zhang and G. Wang, 2026; Feng et al., 2025; Lü et al., 2025; Bürgisser et al., 2026).

However, existing literature yields inconsistent findings regarding the role of cognitive awareness. While some studies suggest that enhanced awareness fosters support through a better understanding of environmental benefits He and Zhu, 2025; Clinch et al., 2006, others indicate that higher knowledge levels may lead to more critical evaluations of economic costs and fairness (Belahouaoui and Attak, 2025; Padi et al., 2025). This inconsistency highlights a significant research gap concerning the interaction between affective and cognitive factors. Furthermore, there is a paucity of empirical evidence explicitly examining the mediating role of environmental tax awareness in translating concern into concrete policy support (H. Zhang and G. Wang, 2026; Amoh et al., 2025; Peñasco and Grossman, 2026). Addressing this gap offers a novel contribution to the literature by clarifying the behavioral mechanisms underlying public acceptance.

To address these limitations, this study investigates the direct and indirect effects of environmental concern and tax awareness on the public acceptance of carbon taxes. By employing a dual-path approach that encompasses both affective and cognitive dimensions, the study facilitates a holistic understanding of attitude formation. This perspective provides a deeper foundation for understanding policy acceptance mechanisms and emphasizes the alignment between emotional engagement and cognitive understanding as a driver of public support. The findings hold strategic significance for policymakers seeking to design more effective, transparent, and socially acceptable carbon tax regimes.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and develops the research hypotheses. Section 3 outlines the research methodology, including data collection, measurement scales, and analytical techniques. Section 4 reports the empirical results and provides an in-depth discussion. Finally, Section 5 concludes the study by summarizing key findings and outlining implications for policy and future research.

2. Literature Review

2.1 Theoretical Background

The implementation of carbon taxation as an environmental fiscal instrument is grounded in Environmental Economics, which frames such policies as mechanisms to internalize negative externalities by assigning monetary costs to pollution (Pigou, 1920). By pricing carbon emissions, governments aim to correct market inefficiencies and promote environmentally sustainable behavior. However, contemporary literature emphasizes that the effectiveness of carbon tax policies is not determined solely by economic efficiency but also by their social acceptability. In this regard, Responsive Regulation Theory highlights that public compliance depends not only on enforcement but also on perceived fairness, legitimacy, and trust in governing institutions (Braithwaite, 2007). Empirical studies further demonstrate that public acceptance of carbon taxation is strongly influenced by policy design, particularly the redistribution of tax revenues. Equitable revenue recycling—such as compensating vulnerable groups or investing in green initiatives can mitigate regressive effects and enhance perceived fairness, thereby strengthening public trust and support for carbon tax policies (Klenert et al., 2018; Muth, 2025; Sing and Sritharan, 2025).

Beyond institutional aspects, the Theory of Planned Behavior (TPB) provides a psychological framework to explain individual acceptance of environmental tax policies (Ajzen, 1991). According to TPB, behavioral intentions are shaped by attitudes and cognitive evaluations. In this context, environmental concern represents the affective dimension reflecting pro-environmental attitudes, while environmental tax awareness captures the cognitive understanding of policy mechanisms and benefits (Niu et al., 2025; Duong, 2025; Mi et al., 2026). The interaction between these dimensions is crucial in shaping public acceptance, as individuals with greater environmental concern are more likely to support carbon taxation, particularly when they possess sufficient knowledge about its objectives and impacts (L. Cao and Ogata, 2026; Xu et al., 2025; H. Zhang and G. Wang, 2026; Bulut and Samuel, 2025; Poortinga, 2025). Furthermore, increased environmental tax awareness has been shown to enhance sustainable behavioral intentions and policy endorsement by improving individuals' ability to evaluate the fairness and long-term benefits of such policies (Sing and Sritharan, 2025; J. Wang, 2024; Shen and Faure, 2024; Bridgen and Collins, 2025). Therefore, the integration of economic rationale, regulatory legitimacy, and behavioral insights underscores that the success of carbon taxation policies depends on the synergy between equitable policy design and enhanced public awareness.

2.2 The Effect of Environmental Concern and Environmental Tax Awareness

Environmental concern is widely recognized as a key effective determinant shaping individuals' pro-environmental attitudes and support for green fiscal policies (Mi et al., 2026; Ajzen, 1991). Within the framework of the Theory of Planned Behavior (TPB), individuals who exhibit a high level of concern toward environmental degradation and climate change tend to develop positive attitudes toward carbon taxation, perceiving it as a necessary moral and collective responsibility to mitigate ecological crises (Mintz-Woo, 2024; Muth et al., 2024; Hedegaard and Kongshøj, 2024). Recent empirical evidence suggests that environmental concern not only strengthens pro-environmental attitudes but also enhances individuals' awareness of the broader functions of environmental taxation, extending beyond its traditional revenue-generating role to include its regulatory and educational dimensions (Owusu Atuahene et al., 2026; Su et al., 2025; Esposito and Jalal, 2025). Furthermore, emotional drivers such as climate anxiety, moral obligation, and long-term

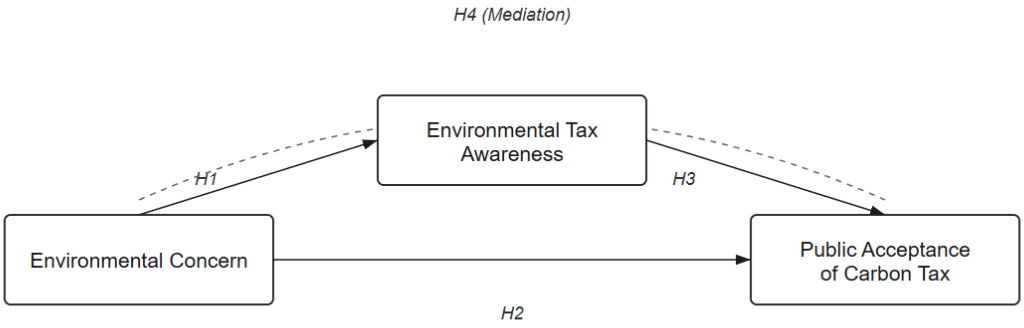

Fig. 1. Research Model: Environmental Concern, Tax Awareness, and Public Acceptance of Carbon Tax

environmental risk perception have been found to significantly influence public support for carbon pricing mechanisms, even in the presence of short-term economic burdens (Drupp et al., 2024; Bertoli et al., 2025; Stoll and Mehling, 2021; T. Li et al., 2025). Individuals who prioritize long-term environmental sustainability are more likely to accept financial trade-offs, reinforcing the argument that environmental concern serves as both a direct and indirect predictor of policy acceptance.

On the other hand, environmental tax awareness represents the cognitive dimension that bridges policy understanding and voluntary compliance behavior. Drawing from the Cooperative Compliance Framework, transparency and clarity regarding tax mechanisms—particularly revenue allocation and policy effectiveness—play a critical role in reducing information asymmetry and fostering trust in fiscal authorities (Y. Wang et al., 2025; Megersa, 2021). Individuals who are well-informed about how carbon tax revenues are redistributed, such as through renewable energy subsidies or social compensation schemes, tend to exhibit higher levels of trust and support toward such policies (J. Kim et al., 2013; Braithwaite, 2007; Braithwaite, 2007; Gangl and Torgler, 2020; Musah et al., 2026). Moreover, tax literacy enables individuals to establish a clear causal link between taxation and environmental outcomes, thereby reducing perceptions of unfairness and resistance (Musah et al., 2026; Ajzen, 1991; Belahouaoui and Attak, 2025; Braithwaite, 2007). Cognitive factors, including knowledge, understanding, and perceived effectiveness of environmental taxation, are therefore essential in strengthening public acceptance and encouraging pro-environmental behavior (Tan et al., 2024; Sawitri et al., 2015; Fu et al., 2020). Consequently, the interaction between affective (environmental concern) and cognitive (environmental tax awareness) dimensions forms a critical foundation for building robust social legitimacy in carbon tax implementation across diverse socio-economic contexts. Based on the above theoretical and empirical arguments, the following hypotheses are proposed:

H1: Environmental Concern has a significant effect on Environmental Tax Awareness.
H2: Environmental Concern has a significant effect on Public Acceptance of Carbon Tax.
H3: Environmental Tax Awareness has a significant effect on Public Acceptance of Carbon Tax.

2.3 The Mediating Role of Environmental Tax Awareness

Environmental tax awareness functions as a crucial cognitive mechanism that bridges the relationship between individuals' affective values and their support for concrete policy instruments. While environmental concern reflects moral anxiety and emotional engagement with ecological issues, such affective responses do not automatically translate into policy support without adequate technical understanding of the fiscal instruments involved (Costa et al., 2025). Within the framework of the Theory of Planned Behavior (TPB), awareness serves as an informational driver that transforms abstract attitudes into rational behavioral intentions (Ajzen, 1991). Recent empirical studies confirm that awareness of carbon tax mechanisms—particularly regarding emission mitigation effectiveness and revenue redistribution—plays a significant mediating role. Without sufficient tax literacy, even individuals with strong environmental concern may remain skeptical toward carbon taxation, perceiving it primarily as an additional financial burden rather than a policy solution (Steffen Kallbekken and Sælen, 2011; Umit and Schaffer, 2020; Carattini et al., 2018; Stefan Drews et al., 2022). Thus, environmental tax awareness operates as a key explanatory pathway through which environmental concern can influence public acceptance.

Furthermore, the mediating role of environmental tax awareness is reinforced by the importance of revenue recycling mechanisms in shaping perceptions of distributive fairness. Individuals who understand that carbon tax revenues are reinvested into green technologies, renewable energy subsidies, or social compensation programs tend to exhibit significantly higher levels of policy acceptance compared to those with similar environmental concern but limited knowledge (Maestre-Andrés et al., 2021; Cherry et al., 2021). Contemporary studies highlight that carbon tax literacy enables individuals to reframe taxation as a systemic solution to climate change cognitively rather than merely a fiscal extraction tool, thereby strengthening long-term political and social support (Alo, 2025; Kurz et al., 2015; Pidgeon, 2012; Ploeg, 2023). This indicates that effective policy communication and transparency are essential in activating the mediating pathway, as awareness provides the logical justification that converts ecological concern into stable policy endorsement. Based on these arguments, the following hypothesis is proposed:

H4: Environmental Tax Awareness mediates the relationship

between Environmental Concern and Public Acceptance of Carbon Tax.

2.4 Research Model Framework

This study develops a conceptual framework by integrating the Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) Theory to explain the underlying mechanisms of public acceptance toward carbon taxation through both affective and cognitive pathways. Within this framework, environmental concern is positioned as the primary exogenous antecedent that reflects individuals' pro-environmental values and moral obligations toward ecological sustainability (P. C. Stern et al., 1999; Ajzen, 1991). This construct is expected to influence public acceptance both directly, through affective and normative motivations, and indirectly, through its impact on environmental tax awareness. The latter represents a cognitive mechanism that enables individuals to interpret and evaluate the purpose, fairness, and effectiveness of carbon tax policies.

Environmental tax awareness is conceptualized as a mediating variable that translates environmental values into rational policy support by enhancing individuals' understanding of fiscal mechanisms, including carbon pricing and revenue recycling. The integration of TPB and VBN frameworks allows this study to capture a dual-path mechanism, where acceptance is shaped not only by emotional engagement with environmental issues but also by cognitive evaluation of policy design. This approach aligns with recent empirical findings emphasizing the importance of combining psychological and informational factors in explaining environmental policy acceptance (Tan et al., 2024; Carattini et al., 2018; Dechezleprêtre et al., 2025). The proposed model is empirically tested using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is particularly suitable for analyzing complex relationships among latent variables and assessing mediation effects in environmental and social research contexts (Hair, Marko Sarstedt, et al., 2024).

Figure 1 illustrates the proposed research model, depicting both the direct effect of environmental concern on public acceptance of carbon tax and the indirect effect mediated by environmental tax awareness.

3. Method

3.1 Research Design

This study adopts a quantitative approach employing an explanatory survey design to examine the causal relationships among environmental concern, environmental tax awareness, and public acceptance of carbon tax. A cross-sectional design is utilized to collect data at a single point in time, enabling an efficient assessment of individuals' perceptions and attitudes toward environmental taxation policies. The explanatory design is particularly appropriate for testing theoretically derived hypotheses and evaluating the direction as well as the strength of relationships among latent variables (Creswell et al., 2019). Recent empirical studies emphasize that survey-based approaches are essential for capturing public legitimacy and social acceptance of climate-related fiscal policies, especially given their often controversial nature in different socio-economic contexts (Ortez et al., 2026; Gulati et al., 2025; Sheta et al., 2025).

Data were collected through a self-administered online questionnaire distributed digitally to ensure broad population reach and high accessibility for respondents. The instrument employed a closed-ended format using a four-point Likert scale (1 = strongly disagree to 4 = strongly agree), intentionally excluding a neutral midpoint to minimize central tendency bias and enhance response discrimination. The use of digital survey methodology aligns with contemporary empirical research practices, which prioritize efficiency in data collection and accuracy in automated data management (Akhtar and Sushil, 2018). Furthermore, the structured design of the questionnaire facilitates the application of advanced analytical techniques such as Partial Least Squares Structural Equation Modeling (PLS-SEM), which is particularly suitable for validating complex theoretical models involving latent constructs in environmental policy research (Hair, Risher, et al., 2019; Hair, Hult, et al., 2021; Hair, Marko Sarstedt, et al., 2024; Gudergan et al., 2025; M. Sarstedt et al., 2022; G.-S. Kim, 2016).

3.2 Sample and Data Collection

The sample in this study consists of 61 respondents, collected between November 23 and November 26, 2025, through the distribution of an online questionnaire across various social media platforms, including Instagram, LINE, and WhatsApp. The study employs a non-probability convenience sampling technique, which is widely adopted in perception-based and exploratory research where accessibility, time efficiency, and response rate are key considerations (Akhtar and Sushil, 2018). This sampling approach is particularly relevant in environmental policy studies that aim to capture public attitudes and behavioral tendencies within a limited timeframe.

Although the sample size is relatively modest, it exceeds the commonly accepted minimum threshold of 30 to 500 observations for statistical analysis in social science research (Lakshman et al., 2000; Y. Cao et al., 2024; Bujang et al., 2024). Recent literature further supports that, in environmental policy and carbon taxation studies, the robustness of findings depends more on the quality of measurement instruments and construct validity than on large sample sizes alone (Peñasco and Grossman, 2026; H. Zhang and G. Wang, 2026). Moreover, the use of Partial Least Squares Structural Equation Modeling (PLS-SEM) as the primary analytical tool provides methodological flexibility, as this variance-based technique is less sensitive to sample size and distributional assumptions. Contemporary methodological guidelines emphasize that the predictive power and reliability of PLS-SEM models are primarily determined by construct reliability and measurement validity rather than absolute sample size (Hair, Marko Sarstedt, et al., 2024). In line with recent empirical trends, studies on carbon taxation and environmental policy acceptance frequently utilize small to medium sample sizes, provided that the structural model is well-specified and the indicators demonstrate strong psychometric properties (Sing and Sritharan, 2025; Amoh et al., 2025; He and Zhu, 2025). Therefore, the sample of 61 respondents is considered adequate and methodologically justified for examining the proposed causal relationships within the research framework.

3.3 Measurement of Variables

This study measures three primary constructs: Environmental Concern (EC), Environmental Tax Awareness (ETA), and Public Acceptance of Carbon Tax (PACT), all operationalized as reflective latent variables. Environmental concern captures individuals' moral and affective orientation toward environmental degradation and climate change, reflecting pro-environmental

Table 1. Measurement of Variables

Variable	Code	Measurement Items (Key Indicators)	Source
Environmental Concern (EC)	EC1–EC5	Human contribution to environmental damage; concern about environmental impacts; support for sustainability; personal responsibility; perceived future risks.	(P. C. Stern et al., 1999; Peñasco and Grossman, 2026; M. J. Stern et al., 2026)
Environmental Tax Awareness (ETA)	ETA1–ETA3	Awareness of environmental tax policies; understanding of tax types; knowledge of externality reduction function.	(Sing and Sritharan, 2025; He and Zhu, 2025; Amoh et al., 2025; H. Zhang and G. Wang, 2026)
Public Acceptance (PACT)	PACT1–PACT7	Awareness of tax implementation; technical understanding; perceived economic burden; willingness to accept; trust in transparency; support influenced by awareness; need for policy education.	(Carattini et al., 2018; Muth, 2025; Mölk et al., 2026; Bürgisser et al., 2026)

values and responsibility (P. C. Stern et al., 1999; Peñasco and Grossman, 2026). Environmental tax awareness represents the cognitive dimension, referring to individuals' knowledge and understanding of environmental tax mechanisms, including their objectives, structure, and role in reducing negative externalities (Sing and Sritharan, 2025; He and Zhu, 2025). Public acceptance of carbon tax measures the extent to which individuals support the policy, encompassing perceived fairness, willingness to comply, and trust in government implementation (Carattini et al., 2018; Steffen Kallbekken and Sælen, 2011; Belahouaoui and Attak, 2026).

The measurement model is supported by recent literature emphasizing that policy transparency, carbon literacy, and institutional trust are critical determinants of environmental policy legitimacy and acceptance (Belahouaoui and Attak, 2025; Lü et al., 2025; Megersa, 2021). All items are measured using a four-point Likert scale (1 = strongly disagree to 4 = strongly agree) to eliminate midpoint bias and improve response discrimination. This approach is consistent with recent methodological recommendations suggesting that forced-choice scales enhance measurement precision and reduce ambiguity in respondents' answers, particularly in PLS-SEM applications (Hair, Marko Sarstedt, et al., 2024; H. Zhang and G. Wang, 2026). The constructs and their corresponding indicators are summarized in Table 1.

3.4 Data Analysis Technique

This study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0 to examine the relationships among latent variables. The selection of PLS-SEM is justified by its robustness in handling complex models with multiple constructs, its suitability for relatively small sample sizes ($n = 61$), and its minimal distributional assumptions (Hair, Marko Sarstedt, et al., 2024). The analysis follows a two-step approach, beginning with the evaluation of the measurement model (outer model) to ensure construct reliability and validity. Convergent validity is assessed through outer loadings (≥ 0.70) and Average Variance Extracted (AVE ≥ 0.50), while internal consistency reliability is evaluated using Cronbach's Alpha and Composite Reliability (≥ 0.70). Discriminant validity is further examined using the Heterotrait-Monotrait Ratio (HTMT) to confirm that each construct is empirically distinct (Hair, Marko Sarstedt, et al., 2024; Hair, Risher, et al., 2019). These procedures ensure that the measurement model satisfies psychometric standards prior to structural evaluation.

The structural model (inner model) is then assessed to evaluate the explanatory and predictive power of the proposed relationships. This includes examining the coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2). Hypothesis testing (H1–H4) is conducted using a bootstrapping procedure with 5,000 resamples to obtain robust t-statistics and p-values for both direct and indirect (mediating) effects. The application of PLS-SEM is particularly relevant in contemporary environmental taxation research, as it allows simultaneous estimation of measurement and structural models while effectively capturing mediation effects involving cognitive and behavioral constructs (Amoh et al., 2025; H. Zhang and G. Wang, 2026). Moreover, recent studies highlight that PLS-SEM is well-suited for exploratory and theory-building research in environmental policy, especially when analyzing complex interactions such as the interplay between environmental concern, tax awareness, and policy acceptance (**m\spacefactor \@m {}olk2026**; Peñasco and Grossman, 2026; Muth, 2025; Bürgisser et al., 2026; Poortinga, 2025; He and Zhu, 2025; Sing and Sritharan, 2025; B. Yang, 2025; Rakshit et al., 2025; Feng et al., 2025).

3.5 Statistical Model Specification

The structural model in this study examines both direct and indirect relationships among variables, reflecting the theoretical framework of the Theory of Planned Behavior (TPB). These equations represent the direct effect of environmental concern (EC) on public acceptance of carbon tax (PACT), as well as the indirect effect mediated through environmental tax awareness (ETA). This dual-path specification captures both affective

(direct) and cognitive (indirect) mechanisms in shaping policy acceptance. Such an approach is consistent with recent methodological developments emphasizing the importance of distinguishing emotional and cognitive pathways in explaining the social legitimacy of green fiscal policies (Ajzen, 1991; Baranzini et al., 2017; Klenert et al., 2018).

The mediation effect is assessed using a non-parametric bootstrapping procedure with 5,000 resamples, which provides more accurate confidence intervals for indirect effects compared to traditional approaches (Amoh et al., 2025; Muth, 2025). This specification enables a deeper understanding of how cognitive mechanisms (environmental tax awareness) translate affective drivers (environmental concern) into policy support (Peñasco and Grossman, 2026; Poortinga, 2025). Furthermore, the structural model is evaluated using model fit indicators and predictive power measures to ensure robustness and empirical validity within the context of global energy transition and environmental governance (B. Yang, 2025; Rakshit et al., 2025; Feng et al., 2025; Muqattash et al., 2026; L. Cao and Ogata, 2026; Mintz-Woo, 2024; Hedegaard and Kongshøj, 2024; Owusu Atuahene et al., 2026).

4. Results and Discussion

4.1 Structural Model

The structural model estimated using PLS-SEM (SmartPLS 4.0) is presented in Figure 2, illustrating the hypothesized relationships among Environmental Concern (EC), Environmental Tax Awareness (ETA), and Public Acceptance of Carbon Tax (PACT). The model reflects a dual-path mechanism, capturing both direct (affective) and indirect (cognitive-mediated) relationships, consistent with the integration of the Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) theory.

The structural model indicates that Environmental Concern acts as the primary exogenous variable influencing both Environmental Tax Awareness and Public Acceptance. Meanwhile, Environmental Tax Awareness serves as a mediating construct that translates environmental values into policy support. The model specification allows for a comprehensive understanding of how emotional engagement with environmental issues interacts with cognitive understanding of fiscal mechanisms.

From a methodological perspective, the use of PLS-SEM enables simultaneous estimation of measurement and structural components, ensuring robust model evaluation even with relatively small sample sizes. This approach is particularly relevant in environmental policy research, where latent constructs such as attitudes, awareness, and acceptance are inherently complex and interdependent (Hair, Marko Sarstedt, et al., 2024; Amoh et al., 2025).

Overall, the structural model demonstrates theoretical coherence and empirical relevance, providing a strong foundation for subsequent analysis of measurement validity, hypothesis testing, and mediation effects. The model also aligns with recent literature emphasizing the importance of integrating psychological and informational factors in explaining public acceptance of environmental taxation (Peñasco and Grossman, 2026; Sing and Sritharan, 2025).

4.2 Measurement Model Evaluation

The evaluation of the measurement model is conducted to ensure that all constructs meet the required standards of convergent validity and indicator reliability. As shown in Table 2, all measurement items exhibit outer loadings above 0.70, indicating that each indicator strongly reflects its respective latent construct. This result confirms that the measurement model satisfies the threshold recommended by Hair, Marko Sarstedt, et al. (2024), where loadings above 0.70 demonstrate substantial explanatory power.

Furthermore, the Average Variance Extracted (AVE) values for all constructs exceed the minimum threshold of 0.50, with values of 0.612 for Environmental Concern, 0.717 for Environmental Tax Awareness, and 0.815 for Public Acceptance. These results indicate that more than 50% of the variance in the indicators is explained by the underlying constructs, thereby confirming convergent validity.

The robustness of these findings suggests that the measurement model is well-specified and capable of capturing the intended constructs accurately. This is particularly important in environmental policy research, where latent variables often involve complex psychological and behavioral dimensions. The strong convergent validity observed in this study supports the reliability of the survey instrument and provides a solid basis for further structural analysis.

4.3 Reliability Analysis

The reliability of the measurement model is assessed using Cronbach's Alpha and Composite Reliability (CR) to evaluate the internal consistency of the constructs. As reported in Table 2, all constructs exceed the recommended threshold of 0.70, indicating a high level of internal consistency among the measurement items. Specifically, Environmental Concern (EC) and Environmental Tax Awareness (ETA) demonstrate strong reliability, confirming that the indicators consistently measure the intended latent constructs. Notably, the Public Acceptance of Carbon Tax (PACT) construct exhibits exceptionally high reliability, with Cronbach's Alpha (α = 0.962) and Composite Reliability (CR = 0.969). These values suggest a very strong correlation among the indicators, indicating that the items are highly cohesive in capturing the underlying construct. According to Hair, Marko Sarstedt, et al. (2024), reliability values within the range of 0.70 to 0.90 are considered satisfactory, while values exceeding 0.95 may indicate very high internal consistency, potentially reflecting redundancy among items. However, in this study, the high reliability of the PACT construct can be justified by the conceptual alignment of its indicators, which consistently capture multiple dimensions of public acceptance, including trust, perceived fairness, and willingness to support carbon taxation policies.

Furthermore, the strong reliability observed across all constructs reinforces the robustness of the measurement instrument and its suitability for structural equation modeling analysis. High internal consistency ensures that the constructs are measured with minimal random error, thereby enhancing the precision of parameter estimates and the validity of hypothesis testing. This is particularly important in PLS-SEM, where reliable measurement models are essential for accurate estimation of structural relationships among latent variables (Hair, Marko Sarstedt, et al., 2024). In addition, the consistency of the measurement items indicates that respondents interpreted the questionnaire in a stable and coherent manner, reducing potential measurement bias. From a methodological perspective, these findings confirm that the instrument meets the psychometric standards required for empirical research in environmental policy and sus-

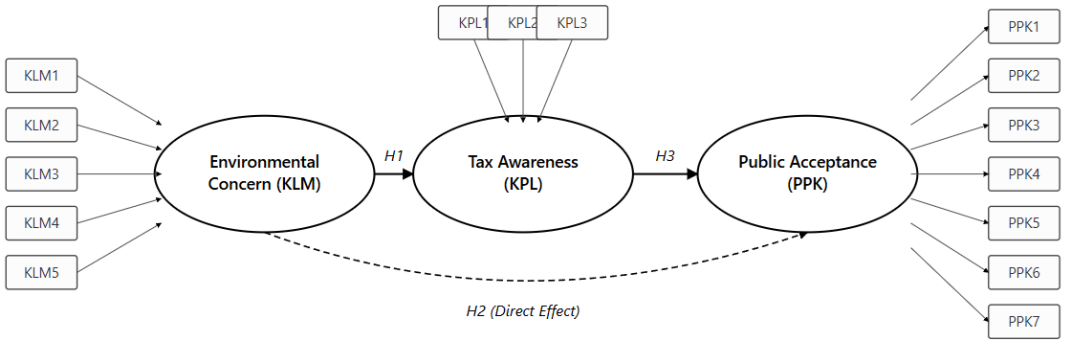

Fig. 2. Structural Model Results (PLS-SEM)

Table 2. Measurement Model Results (Outer Loadings, AVE, and Reliability)

Construct	Indicator	Outer Loading	AVE	Cronbach's Alpha	Composite Reliability
Environmental Concern (EC)	EC1	0.726	0.612	0.841	0.887
	EC2	0.815			
	EC3	0.760			
	EC4	0.847			
	EC5	0.757			
Environmental Tax Awareness (ETA)	ETA1	0.831	0.717	0.804	0.884
	ETA2	0.876			
	ETA3	0.833			
Public Acceptance (PACT)	PACT1	0.907	0.815	0.962	0.969
	PACT2	0.890			
	PACT3	0.916			
	PACT4	0.911			
	PACT5	0.895			
	PACT6	0.887			
	PACT7	0.911			

tainability studies. Consequently, the validated reliability of the constructs provides a solid foundation for subsequent analysis of structural relationships, including direct and mediated effects, and supports the credibility of the study's empirical findings in explaining public acceptance of carbon tax policies.

4.4 Discriminant Validity

Discriminant validity is first assessed using the cross-loadings criterion, which examines whether each indicator loads more strongly on its assigned construct than on other constructs in the model. As presented in Table 3, all indicators demonstrate the highest loading values on their respective constructs, with Environmental Concern (EC) indicators ranging from 0.726 to 0.847, Environmental Tax Awareness (ETA) indicators ranging from 0.831 to 0.876, and Public Acceptance (PACT) indicators exhibiting very high loadings between 0.887 and 0.916. This pattern confirms that each indicator shares more variance with its corresponding construct than with any other construct, thereby satisfying the fundamental requirement for discriminant validity. According to established PLS-SEM guidelines, this condition ensures that the constructs are conceptually and empirically distinct, preventing issues of multicollinearity or construct redundancy (Hair, Marko Sarstedt, et al., 2024). The absence of significant cross-loadings across constructs indicates that there is no measurement overlap, meaning that each construct captures a unique dimension of the theoretical model. This is particularly important in environmental policy research, where constructs such as concern, awareness, and acceptance may be conceptually related but must remain empirically separable to ensure valid structural interpretation. Therefore, the cross-loading results provide strong initial evidence that the measurement model maintains adequate discriminant validity.

In addition to cross-loadings, discriminant validity is further evaluated using the Heterotrait-Monotrait Ratio (HTMT), which is considered a more stringent and reliable criterion for assessing construct distinctiveness. As shown in Table 4, all HTMT values fall below the conservative threshold of 0.85, with EC–ETA = 0.789, EC–PACT = 0.777, and ETA–PACT = 0.733. These results confirm that the constructs are empirically distinct and do not exhibit problematic levels of correlation. According to Henseler et al. (2015), HTMT values below 0.85 (or 0.90 in less strict conditions) indicate that discriminant validity has been established, ensuring that each construct captures a unique

Table 3. Discriminant Validity Assessment Using Cross Loadings

Indicator	Environmental Concern (EC)	Environmental Tax Awareness (ETA)	Public Acceptance (PACT)
EC1	**0.726**	–	–
EC2	**0.815**	–	–
EC3	**0.760**	–	–
EC4	**0.847**	–	–
EC5	**0.757**	–	–
ETA1	–	**0.831**	–
ETA2	–	**0.876**	–
ETA3	–	**0.833**	–
PACT1	–	–	**0.907**
PACT2	–	–	**0.890**
PACT3	–	–	**0.916**
PACT4	–	–	**0.911**
PACT5	–	–	**0.895**
PACT6	–	–	**0.887**
PACT7	–	–	**0.911**

Table 4. Discriminant Validity Assessment Using HTMT Ratio

Construct	Environmental Concern (EC)	Environmental Tax Awareness (ETA)	Public Acceptance (PACT)
Environmental Concern (EC)	–		
Environmental Tax Awareness (ETA)	0.789	–	
Public Acceptance (PACT)	0.777	0.733	–

conceptual domain. The relatively moderate HTMT values observed in this study suggest that while the constructs are theoretically related—reflecting the interplay between affective and cognitive factors—they remain sufficiently independent to avoid redundancy. This distinction is crucial for accurately estimating structural relationships, as overlapping constructs may lead to biased path coefficients and misinterpretation of results. Furthermore, the confirmation of discriminant validity through HTMT strengthens the overall robustness of the measurement model and enhances confidence in subsequent structural analysis. Collectively, these findings demonstrate that the model satisfies rigorous psychometric standards required for high-quality empirical research in environmental and sustainability contexts.

4.5 Hypothesis Testing

The results of hypothesis testing are presented in Table 5, which summarizes the structural relationships among Environmental Concern (EC), Environmental Tax Awareness (ETA), and Public Acceptance of Carbon Tax (PACT). The analysis is conducted using a bootstrapping procedure in PLS-SEM to assess the significance of the path coefficients. The results indicate that all hypothesized relationships are statistically significant, although the direction of the effects reveals a complex and nuanced pattern. First, Environmental Concern has a significant negative effect on Environmental Tax Awareness ($\beta = -0.661$; $p < 0.001$), suggesting that higher levels of environmental concern do not necessarily translate into greater awareness of environmental taxation mechanisms. This finding indicates the presence of a cognitive gap, where individuals may possess strong environmental values but lack sufficient understanding of policy instruments such as the carbon tax. This result highlights the limitation of relying solely on affective factors to enhance policy literacy. Second, Environmental Concern demonstrates a positive and significant effect on Public Acceptance of Carbon Tax ($\beta = 0.486$; $p < 0.001$), confirming that individuals who are more concerned about environmental issues are more likely to support carbon taxation policies. This finding is consistent with prior research emphasizing that pro-environmental attitudes play a crucial role in shaping public support for climate-related fiscal instruments. However, Environmental Tax Awareness shows a negative and significant effect on Public Acceptance ($\beta = -0.331$; $p < 0.01$), indicating that higher awareness may lead to more critical evaluations of the policy, particularly in terms of perceived economic burden and fairness. This suggests that awareness alone is insufficient to guarantee support, and may even reduce acceptance if policy design and communication are not perceived as equitable or transparent. Overall, these results underscore the importance of integrating both affective and cognitive dimensions in understanding public acceptance of carbon tax policies.

4.6 Mediation Analysis

To further examine the indirect relationship between Environmental Concern (EC) and Public Acceptance of Carbon Tax (PACT), this study evaluates the mediating role of Environmental Tax Awareness (ETA) using a bootstrapping procedure in PLS-SEM. The results of the mediation analysis are presented in Table 6.

The results indicate that Environmental Tax Awareness significantly mediates the relationship between Environmental Concern and Public Acceptance of Carbon Tax ($\beta = 0.219$; $p < 0.001$). This finding suggests that the influence of environmental concern on policy acceptance is partially transmitted through individuals' cognitive understanding of environmental taxation mechanisms. In other words, individuals who exhibit

Table 5. Structural Model Results and Hypothesis Testing

Hypothesis	Structural Path	Path Coefficient (β)	T-Statistic	P-Value	Decision
H1	Environmental Concern → Environmental Tax Awareness	−0.661	10.799	0.000	Supported
H2	Environmental Concern → Public Acceptance of Carbon Tax	0.486	4.220	0.000	Supported
H3	Environmental Tax Awareness → Public Acceptance of Carbon Tax	−0.331	3.054	0.002	Supported

Table 6. Indirect Effect and Mediation Analysis Results

Hypothesis	Indirect Path	Path Coefficient (β)	T-Statistic	P-Value	Decision
H4	Environmental Concern → Environmental Tax Awareness → Public Acceptance of Carbon Tax	0.219	2.786	0.0005	Supported

strong concern for environmental issues are more likely to support carbon tax policies when such concern is complemented by an adequate level of awareness regarding how the tax operates and contributes to environmental objectives.

This mediation effect highlights the critical role of cognitive processing in translating affective attitudes into behavioral support. While environmental concern provides the motivational foundation, environmental tax awareness serves as the interpretative mechanism that enables individuals to rationalize and justify their support for the policy. The presence of a significant indirect effect confirms that awareness acts as a cognitive bridge, aligning individual values with policy endorsement.

However, given that the direct effect remains significant, the mediation can be classified as partial mediation, indicating that environmental concern influences public acceptance both directly and indirectly. This underscores the importance of integrating both emotional engagement and policy literacy in enhancing public support. From a policy perspective, these findings suggest that improving public education, transparency, and communication regarding carbon tax mechanisms is essential to strengthening the effectiveness and social acceptance of environmental fiscal policies.

4.7 Predictive Relevance

The predictive relevance of the structural model is assessed using Stone–Geisser's Q^2 value, which evaluates the model's ability to predict endogenous constructs through a blindfolding procedure in PLS-SEM. As presented in Table 7, the Q^2 values for Environmental Tax Awareness (ETA) and Public Acceptance of Carbon Tax (PACT) are 0.414 and 0.473, respectively. According to Hair, Marko Sarstedt, et al. (2024), Q^2 values greater than zero indicate that the model has predictive relevance, while values exceeding 0.35 are considered to demonstrate strong predictive accuracy. Therefore, these results confirm that the model possesses substantial predictive capability in explaining variations in both ETA and PACT.

In addition, the Variance Inflation Factor (VIF) values for all structural relationships are below the critical threshold of 5.0, indicating the absence of multicollinearity issues and ensuring that the estimated path coefficients are not biased due to overlapping predictor variables. The relatively high Q^2 value for public acceptance (0.473) suggests that the combined influence of Environmental Concern and Environmental Tax Awareness provides a strong explanatory framework for understanding public support toward carbon tax policies. This finding highlights the importance of integrating both affective factors (environmental concern) and cognitive factors (tax awareness) in predicting policy acceptance. From a theoretical perspective, these results reinforce the robustness of the proposed dual-path model, while from a practical standpoint, they underscore the need for policymakers to simultaneously enhance environmental awareness and improve public understanding of policy mechanisms to achieve higher levels of acceptance.

4.8 Discussion of Findings

This study provides important insights into the determinants of public acceptance of carbon tax by integrating both affective and cognitive dimensions, namely environmental concern and environmental tax awareness. The findings reveal a nuanced relationship, highlighting that acceptance is driven by the interplay between emotional engagement and cognitive evaluation. Consistent with prior literature, environmental concern is found to have a positive and significant effect on acceptance, indicating that individuals with high ecological worry are more likely to support carbon tax policies (Peñasco and Grossman, 2026; P. C. Stern et al., 1999; Stoll and Mehling, 2021; T. Li et al., 2025). This supports the argument that pro-environmental values and moral norms play a crucial role in shaping public support for climate-related fiscal instruments, as seen in various international contexts (Dechezleprêtre et al., 2025; Ortez et al., 2026; Muqattash et al., 2026; Wolsink, 2024).

However, the study uncovers a contrasting finding where environmental concern has a negative effect on environmental tax awareness, suggesting a significant gap between attitudes and policy understanding. This indicates that individuals may possess strong ecological values without necessarily having sufficient knowledge about how environmental taxation works, a disconnect often cited in behavioral studies (Peñasco and Grossman, 2026; Bertoli et al., 2025; Costa et al., 2025; Kurz et al., 2015). Such a finding aligns with the "paradox of environmental consciousness," where general awareness does not automatically translate into policy-specific literacy (Peñasco and Grossman, 2026; Pidgeon, 2012; Wolsink, 2024; Drupp et al., 2024). This highlights a critical issue in environmental governance: increasing concern alone is insufficient to ensure effective public engagement with complex fiscal mechanisms (Baranzini et al., 2017; Klenert et al., 2018; Megersa, 2021; Sing and Sritharan, 2025).

Furthermore, the results demonstrate that environmental tax awareness has a negative effect on public acceptance, which

Table 7. Predictive Relevance and Collinearity Assessment (Q^2 and VIF Results)

Structural Relationship	VIF	Q^2
Environmental Concern → Environmental Tax Awareness	1.000	0.414
Environmental Concern → Public Acceptance of Carbon Tax	1.774	0.473
Environmental Tax Awareness → Public Acceptance of Carbon Tax	1.774	–

may initially appear counterintuitive. This can be explained by the possibility that increased awareness leads to a more critical evaluation of policy design, particularly regarding perceived fairness and economic burden (Carattini et al., 2018; Umit and Schaffer, 2020; Belahouaoui and Attak, 2026; Bürgisser et al., 2026). Public resistance often arises not from ignorance, but from informed concerns about distributional impacts and the efficacy of revenue recycling (Muth, 2025; Mölk et al., 2026; Hedegaard and Kongshøj, 2024; Ploeg, 2023). In this context, awareness may expose individuals to potential drawbacks, thereby reducing unconditional support unless the policy is perceived as highly transparent (Steffen Kallbekken and Sælen, 2011; Lü et al., 2025; Braithwaite, 2007; Gangl and Torgler, 2020).

The mediation analysis further reveals that environmental tax awareness plays a significant mediating role, functioning as a cognitive bridge that translates environmental values into policy support. However, the mediation is partial, indicating that environmental concern still exerts a direct influence on acceptance, reinforcing the importance of integrating emotional and rational components (Ajzen, 1991; P. C. Stern et al., 1999; Amoh et al., 2025; H. Zhang and G. Wang, 2026). This dual-path mechanism is essential for understanding public attitudes toward green taxes, as it balances value-based motivations with informational processing (T. Li et al., 2025; Tan et al., 2024; Sawitri et al., 2015; Fu et al., 2020). The complexity of this relationship suggests that psychological factors must be considered alongside economic incentives to achieve policy legitimacy (Costa et al., 2025; Bertoli et al., 2025; Mintz-Woo, 2024; Stoll and Mehling, 2021).

From a theoretical perspective, these findings empirically validate the integration of the Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) theory (Ajzen, 1991; P. C. Stern et al., 1999; Sawitri et al., 2015; Niu et al., 2025). The results confirm that both affective and cognitive factors are essential, yet they may operate in different directions depending on how policies are perceived in specific socio-economic environments (Bulut and Samuel, 2025; Poortinga, 2025; Dechezleprêtre et al., 2025; Musah et al., 2026). This highlights the need for a more nuanced understanding of public behavior, where information provision can either enhance or dampen support based on the framing of the message (Maestre-Andrés et al., 2021; T. Li et al., 2025; Cherry et al., 2021; Xu et al., 2025).

From a practical standpoint, the findings suggest that policymakers should focus on improving policy communication and transparency rather than just increasing environmental concern (Klenert et al., 2018; Carattini et al., 2018; Megersa, 2021; Belahouaoui and Attak, 2025). Clear and accessible information about revenue utilization—such as funding renewable energy or social compensation—is vital to mitigate negative perceptions (Muth, 2025; Hedegaard and Kongshøj, 2024; Baranzini et al., 2017; Sing and Sritharan, 2025). Targeted education campaigns are necessary to bridge the gap between concern and understanding, ensuring that carbon taxes are viewed as fair and effective tools for sustainable development (B. Yang, 2025; Rakshit et al., 2025; Muqattash et al., 2026; Owusu Atuahene et al., 2026).

Overall, achieving public acceptance requires a balanced approach that addresses both emotional engagement and cognitive evaluation. Without effective communication and transparent design, increased awareness may produce resistance rather than support (Clinch et al., 2006; Pidgeon, 2012; Umit and Schaffer, 2020; Mölk et al., 2026). Therefore, the success of carbon tax policies depends heavily on their social legitimacy, public trust, and the clarity of their distributive outcomes (Belahouaoui and Attak, 2026; Musah et al., 2026; Lü et al., 2025; Carattini et al., 2018).

5. Conclusion

This study examines how environmental concern and environmental tax awareness shape public acceptance of carbon tax through both direct and indirect pathways. The findings show that environmental concern positively influences public acceptance of carbon tax, indicating that individuals with stronger ecological values and greater sensitivity to environmental problems are more likely to support market-based climate policies. However, environmental concern is found to negatively affect environmental tax awareness, suggesting that general pro-environmental attitudes do not automatically translate into a clear understanding of tax-based policy mechanisms. In addition, environmental tax awareness has a significant negative direct effect on public acceptance, implying that greater awareness may also trigger more critical evaluations of policy costs, fairness, and implementation design. Nevertheless, environmental tax awareness significantly mediates the relationship between environmental concern and public acceptance, confirming its role as a cognitive mechanism through which environmental values are translated into policy support. Overall, the study demonstrates that public acceptance of carbon tax is shaped by a complex interaction between affective and cognitive factors, rather than by environmental concern alone.

Theoretical Implications

This study contributes to the literature by integrating the Theory of Planned Behavior (TPB) and the Value-Belief-Norm (VBN) theory into a unified framework for explaining public acceptance of carbon tax. The findings extend existing research by showing that affective and cognitive determinants may operate in different directions, thereby challenging the assumption that greater awareness necessarily leads to stronger support for environmental taxation. By identifying the mediating role of environmental tax awareness, the study also refines current explanations of policy acceptance, suggesting that awareness functions not merely as an informational variable but as a cognitive filter through which individuals interpret fairness,

burden, and policy legitimacy. In this sense, the study advances the literature by framing carbon tax acceptance as a dual-path behavioral outcome shaped by both moral engagement with environmental issues and evaluative judgments about fiscal policy instruments.

Practical Implications

The findings carry important implications for policymakers seeking to increase public support for a carbon tax. Efforts to improve acceptance should not rely solely on raising environmental concern, as public awareness of environmental issues alone may be insufficient to generate support for taxation-based climate policy. Instead, policymakers should prioritize transparent communication, equitable revenue recycling mechanisms, and public education that clearly explains the objectives, benefits, and distributive consequences of carbon taxation. Particular attention should be given to how carbon tax revenues are allocated, as perceptions of fairness and policy credibility are central to acceptance. Therefore, policy design should combine environmental messaging with accessible and trustworthy explanations of how the tax works in practice and how it contributes to broader sustainability goals.

Research Limitations

Several limitations should be acknowledged. First, the cross-sectional design limits the ability to draw strong causal inferences regarding the temporal dynamics between environmental concern, tax awareness, and public acceptance. Second, the study relies on self-reported survey responses, which may be subject to common method bias and perceptual limitations, despite efforts to ensure measurement reliability and validity. Third, the relatively modest sample size constrains the generalizability of the findings and suggests caution in extending the results to broader populations. Finally, this study focuses on a limited set of explanatory variables, while other potentially relevant factors, such as political trust, perceived economic vulnerability, and policy framing, were not incorporated into the model.

Future Research Directions

Future research could adopt longitudinal or multi-wave designs to examine how public acceptance of carbon tax evolves, particularly in response to policy communication and implementation changes. Comparative studies across countries or institutional settings may also provide deeper insight into how contextual factors influence the relationship between environmental concern, policy awareness, and acceptance. In addition, future studies may incorporate broader explanatory variables, such as trust in government, perceived distributive justice, and climate policy literacy, to develop a more comprehensive model of public support. Qualitative or mixed-methods approaches would also be valuable in uncovering the deeper reasoning processes through which individuals interpret carbon tax policies. Ultimately, future research should continue to explore how environmental values can be effectively translated into socially legitimate support for climate-related fiscal instruments.

Declarations

CRediT authorship contribution statement

Muhammad Ilmi: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing—original draft.
Grimonia Patriosa Pertiwi: Supervision, Conceptual validation, Methodological refinement, Writing—review & editing.
Gabriella Debora: Data collection, Investigation, Literature review, Writing—review & editing.
Agya Niken Larasati: Data curation, Visualization, Literature review, Writing—review & editing.
Agung Setia Budi: Investigation, Data analysis support, Writing—review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical considerations related to participant confidentiality.

Ethics statement

This study was conducted in accordance with established ethical standards for research involving human participants. Participation in the survey was voluntary, and informed consent was obtained from all respondents prior to data collection.

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A. Appendix A. Data Population and Respondent Profile

This appendix presents the demographic characteristics of the respondents involved in this study. The data provide an overview of the population structure, which is essential for understanding the representativeness and distribution of the sample used in the analysis.

Table 8. Respondent Demographic Profile

Category	Sub-category	Frequency (n)	Percentage (%)
Gender	Male	28	45.9%
	Female	32	52.5%
	Prefer not to say	1	1.6%
Age Group	18–25 years	42	68.9%
	26–35 years	12	19.7%
	36–45 years	5	8.2%
	>45 years	2	3.2%
Education Level	High School	10	16.4%
	Undergraduate (Bachelor)	39	63.9%
	Graduate (Master)	10	16.4%
	Doctoral	2	3.3%
Occupation	Student	37	60.7%
	Government Employee	8	13.1%
	Private Sector	12	19.7%
	Others	4	6.5%
Total		**61**	**100%**

Note: The table summarizes the demographic distribution of respondents participating in the study.

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