國立臺灣大學理學院氣候變遷與永續發展國際學位學程

碩士論文

International Degree Program in Climate Change and Sustainable Development

College of Science

National Taiwan University

Master's Thesis

影響多元環境行動的因素：基於台灣社會變遷調查的多變量分析

Determinants of Plural Environmental Actions: A Multivariate Analysis Based on the Taiwan Social Change Survey

徐梁育

Hsu, Liang-Yu

指導教授：劉仲恩博士

Advisor: Dr. Chung-En Liu

中華民國 115 年 2 月

Feb, 2026

doi:10.6342/NTU202600747

口試委員審定書

國立臺灣大學碩士學位論文
口試委員會審定書
National Taiwan University Master Thesis
Oral Examination Committee Approval

影響多元環境行動的因素：基於台灣社會變遷調查的多變量分析

Determinants of Plural Environmental Actions: A Multivariate Analysis Based on the Taiwan Social Change Survey

本論文係__徐梁育 R11227122__在國立臺灣大學氣候變遷與永續發展國際學位學程完成之碩士學位論文，於民國_115_年_2_月_2_日承下列考試委員審查通過及口試及格，特此證明。

This master thesis is finished by __Liang-Yu Hsu _R11227122___ at International Degree Program in Climate Change and Sustainable Development on 2/2/2026 of the Republic of China, passed the oral examination by the following examination committees.

口試委員 Oral examination committee：

劉仲恩	
（指導教授 Advisor）	(共同指導 co-Advisor)

doi:10.6342/NTU202600747

誌謝

承心理所論文誌謝。考上心理所後雖然有幸遇到仁和這麼好的老師，但囿於台灣心理學界對環境心理學著墨甚少，剛好遇到了 IPCS 的引路人 Abby 老師，更在入學前的暑假當了婉鈴老師的研究助理，伴隨對永續的深入了解，我明確自己未來的志向將朝永續前進，也因此決定挑戰台大碩士雙主修。

很幸運的我從一開始就找到了以環境社會學為專業的劉仲恩老師，有別於心理所的量化訓練，老師的氣候變遷與社會一門課，帶我們認識更多社會學方法與理論，補充了視角的多元性。同時老師也願意支持我將兩篇論文的主題設定為互補關係，能夠拼湊出個體變因-環境行為-政府政策的完整敘事。

同時也要感謝老師，從碩三上開始我很明顯身心狀況不復以往，論文以外的外務纏身，嚴重拖累了撰寫進度，更在五月面臨了兵役的問題，調整計畫延後畢業，後續參加圓夢計畫又在加拿大適應不良，在倉促中提交論文進度，最後壓線通過口試。期間老師不辭辛勞的修改與包容，讓我深感愧疚與感謝。

在此期間，我也要特別感謝多位師長們，我的心理所指導教授張仁和老師，在統計方法上的建議與幫助；琬鈴老師帶領我完成海草與 TNFD 的相關研究；明光老師聘用我擔任 GIS 助教與國家公餘調適計畫助理；翁葳老師開設 ESG 簡介與實務，讓我明確自己的永續職涯規劃；核四廠廠長王伯輝先生，鼓勵我長期參與社會溝通，各位師長們的教導協助，才能讓我更深入的探索永續與環境議題。

也要感謝朋朋們的陪伴與支持，IPCS 的睫葶、禹嫻、宜靜、陳欣、Yura, Lucy, Alice, Bon, Cindy, Michelle，Formosa Oversee 的凱昱、衍儀、祖丞，水果團的怡均、品蓉、品淳，柏林團的靖旻、以姍、惟殷，心理系的揚詣、亦威、彥汝，王媽媽貓園，雄辯仔，雄十 Ver2.0，國泰團，224/321 朋朋，地質朋，辯圈朋，恐龍家昱安跟立華，小花姐妹，及敏萱、湘純，未表列的朋朋敬請移駕心理所論文。最後要感謝在 IPCS 時期金援我的單位與長官們、台灣綜合研究院的順德和婉庭，廣達電腦的 CK & Bratt，KPMG，Foresight Canada，心理系與夏季學院，國科會/科技部，教育部，當然還有我爹娘包容我讀了這麼久的書…

doi:10.6342/NTU202600747

摘要

在隨著全球氣候危機加劇，台灣及各國紛紛邁向 2050 淨零排放目標，公民的有效參與已成為民主國家推動永續轉型的重要基石。然而，過去環境心理學研究多將「親環境行為」（PEB）視為單一整體的概念，忽略了不同行動背後迥異的驅動機制，導致「環保意識」與「實際行動」之間長期存在落差。為打破這種單一論述，本研究主張不同類型的親環境行為是受不同動機驅動的獨立建構。

本研究透過實證分析，將台灣民眾的環境行動拆解為五大維度：日常習慣、政策支持、支付意願、社區行動與公共行動。並運用調整後的「計畫行為理論」(TPB）與「價值—信念—規範」(VBN）整合模型，深入探討社會人口背景、心理認知、社會規範及情境因素如何共同形塑行為選擇。研究發現，心理距離在環境參與中扮演決定性角色：台灣民眾對廢棄物處理等即時、具體的環境關懷，驅動力遠大於抽象的氣候風險。此外，本研究揭示了台灣公民社會中獨特的「信任悖論」：政府信任雖能有效促進政策支持與財務貢獻等體制內行為，但對政府的不信任並不導致政治冷漠，反而激發了以「警覺公民」為特徵的基層自發動員，呈現出一種繞過國家體制、強調地方能動性的參與路徑。最後，透過典型相關分析（CCA），本研究進一步歸納出四種台灣環境公民模式：覺醒公民（受規範驅動）、社區中心參與者（受地方感與不信任驅動）、公領域動員者（受資源與災害經驗驅動）與青年行動家（受教育與體制外抗爭驅動）。這些發現不僅在理論上拆分了親環境行為的單一面向，實務上有助於根據不同群體的心理與社會特徵，引導民眾採取更具成效的環境行動，加速社會整體的氣候轉型。

關鍵字：親環境行為、價值-信念-規範理論、計畫行為理論、環境公民側寫

doi:10.6342/NTU202600747

Determinants of Plural Environmental Actions: A Multivariate Analysis Based on the Taiwan Social Change Survey

Liang-Yu Hsu

Abstract

As global climate crises intensify and nations—including Taiwan—strive toward ambitious 2050 Net Zero targets, mobilizing effective public action has become a cornerstone of sustainable development. The success of these democratic transitions depends on a nuanced understanding of how citizens engage with environmental issues; however, past research often treats pro-environmental behavior (PEB) as a monolithic concept, which contributes to a persistent gap between environmental awareness and actual action.

This study addresses this gap by disaggregating PEB in Taiwan into five empirically distinct constructs: Daily Habits, Policy Support, Willingness to Pay, Community Action, and Public Action. Using an adjusted TPB-VBN framework, we examine how socio-demographic, psychological, and contextual factors interact to influence these diverse modes of participation.

Our analysis reveals that psychological distance plays a decisive role in engagement, with immediate concerns like waste management carrying significantly more weight than abstract climate risks. Furthermore, we identify a unique "Trust Paradox" in Taiwan's

doi:10.6342/NTU202600747

civil society. While institutional trust fosters state-aligned support and financial sacrifice, distrust in government does not lead to apathy but instead fuels grassroots mobilization through the "Vigilant Citizen" pathway. Finally, by synthesizing these factors via Canonical Correlation Analysis (CCA), this research establishes a typology of four environmental actor patterns: the Awakened Citizen, the Community-Centric Actor, the Public-Sphere Mobilizer, and the Youth Activist. These findings provide a targeted roadmap for policy interventions, guiding individuals toward more impactful environmental engagement based on their specific psychological and social characteristics.

Keywords: Pro-Environmental Behavior, TPB-VBN Framework, Environmental Actor Profiles

doi:10.6342/NTU202600747

Table of Contents

doi:10.6342/NTU202600747

List of Tables

List of Figures

doi:10.6342/NTU202600747

1. Introduction

Environmental protection has become a trend over the past few decades. Both people and governments in most countries, including Taiwan, have begun to treat it seriously, setting policy goals such as the 2050 Net Zero target.

The foundation of a democratic country is to reflect the voice of its people. However, different pro-environmental behaviors vary in effectiveness, with some having a greater impact on government policies than others (Hsu, 2025). To accelerate government commitment to climate policy and foster a more positive social vibe, we should identify the determinants of plural environmental actions to guide people toward more efficient environmental actions. Unfortunately, past research has often treated "Pro-Environmental Behavior" (PEB) as a single, uniform concept (Lange & Dewitte, 2019; Steg & Vlek, 2009), which might lead to an attitude-behavior gap (Lange & Dewitte, 2019).

This study argues that different PEBs are distinct constructs driven by fundamentally different motivations. Understanding why a person chooses one type of action over another is key to designing effective interventions. Thus, this study aims to answer:

- What distinct types of PEB can be empirically identified in Taiwan?
- What specific variables influence each behavioral type?
- What patterns or typologies of environmental citizens exist in Taiwanese society?

To address this gap, this study uses an adjusted framework derived from the TPB-VBN Model to examine how socio-demographics, values and beliefs, norms, and contextual factors influence these behavioral choices. Using a data-driven approach, this study first categorizes PEBs in Taiwan into five distinct constructs: Daily Habits, Policy

doi:10.6342/NTU202600747

Support, Willingness to Pay, Community Action, and Public Action.

Our analysis of these constructs reveals critical divergences in their drivers. We find that psychological distance plays a decisive role, where immediate concerns like waste management outweigh abstract climate risks. Furthermore, we uncover a complex dynamic regarding institutional trust, observing that it does not merely increase engagement but fundamentally alters the mode of participation—shifting actors between state-aligned support and grassroots self-organization. Finally, by synthesizing these factors via Canonical Correlation Analysis (CCA), this study establishes a data-driven typology of Taiwanese environmental citizenship.

Beyond simply categorizing these identities, this paper contributes to the PEB literature in Taiwan in three specific ways:

First, it disaggregates the monolithic concept of "environmentalism" into empirically distinct constructs. Building on the work of Lin, Hsu, and Hsiao (2024), this study not only identifies the variables influencing each PEB but also delineates the core differences among them. Specifically, we distinguish "Policy Support" from "Willingness to Pay," demonstrating that fundamentally different mechanisms drive them. While Social Norms and Habit Consequences primarily drive Policy Support, Willingness to Pay is uniquely dependent on Trust in Government and Political Affiliation. This implies that supporting state regulations versus making personal financial sacrifices requires entirely different psychological prerequisites.

Second, it challenges the role of institutional trust by identifying a unique "Trust Paradox" within Taiwan's civil society. Contrary to general assumptions that institutional trust is a prerequisite for all environmental actions (Lee, 2022), this study finds that distrust in the government does not lead to apathy but instead fuels grassroots

doi:10.6342/NTU202600747

mobilization. This finding introduces the concept of the "Vigilant Citizen"—an actor whose local engagement is a reaction to, rather than a form of, cooperation with state power.

Third, it moves beyond linear variable analysis to establish a holistic typology of Taiwanese actors. Most local research examines how isolated variables (e.g., gender, SES) predict behaviors (Tien & Huang, 2023; Chen & Hsieh, 2016). By integrating demographics, values, and contextual factors, this study maps four distinct Patterns: the Awakened Citizen, the Community-Centric Actor, the Public-Sphere Mobilizer, and the Youth Activist. This typology provides a more nuanced roadmap for targeted policy interventions than generic demographic trends.

By establishing this theoretical and practical foundation, this paper aims to encourage individuals to take more effective actions to influence the government and society based on their specific psychological and demographic characteristics.

doi:10.6342/NTU202600747

2. Literature Review

2.1 Theories of Pro-Environmental Behaviors

Pro-environmental behavior (PEB) is typically defined as behavior that "harms the environment as little as possible, or even benefits the environment" (Steg & Vlek, 2009). Over the years, scholars have proposed various theories to explain the drivers of PEB. Among the most influential are the Theory of Planned Behavior (TPB), the Norm Activation Model (NAM), and the Value-Belief-Norm Theory (VBN) (Steg & Nordlund, 2018).

The TPB posits that behavior is primarily driven by intention, which is shaped by three factors: Attitude (evaluation of the action), Norms (social pressure), and Perceived Behavioral Control (ease of performance) (Ajzen, 1985). This model emphasizes a rational decision-making process in which individuals weigh the costs, benefits, and social expectations to make informed choices. TPB is renowned for its predictive power and flexibility (Setiawan et al., 2020). However, its reliance on rational processing is also its limitation; it often overlooks "irrational" drivers, such as habitual behaviors or deeply held moral values (Stern, 2000).

In contrast to the rational focus of TPB, the Norm Activation Model (NAM) emphasizes morality, suggesting that behaviors are driven by personal norms activated by an awareness of consequences and a sense of responsibility (Schwartz, 1977).

Building directly on NAM, Stern (2000) proposed the Value-Belief-Norm (VBN) theory. This model extends the moral framework by creating a causal chain, positing that fundamental values (biospheric, altruistic, and egoistic) influence beliefs about environmental threats, which in turn activate personal norms to act. While VBN provides

doi:10.6342/NTU202600747

a comprehensive map of the psychological roots of environmentalism, it often struggles to account for external constraints and social pressures as effectively as TPB (Chen & Tung, 2014).

Table 1

Comparison between different PEB models

Theory	Variables	Strengths and Weaknesses
Theory of Planned Behavior	• Attitude • norm • Perceived behavioral control • Intention	Strengths: • Strong predictive power • Parsimony • Flexibility Weaknesses: • Overemphasis on rational processing • Typically applied to a single, specific behavior.
Norm Activation Model	• Problem awareness • Ascription of responsibility • Outcome efficacy • Self-efficacy	Strengths: • Explains altruistic behavior • Specifies activation conditions Weaknesses: • Limited predictive power alone • The gap between attitude and behavior
Value-Belief-Norm (VBN) theory	• Values (Biospheric, Altruistic, Egoistic) • Beliefs (Ecological worldview, Awareness of consequences, Ascription of responsibility) • Pro-environmental personal norms	Strengths: • Comprehensive causal chain • Explains the source of motivation Weaknesses: • Lack of attention to social norms • Oversimplification of the linear relationship

doi:10.6342/NTU202600747

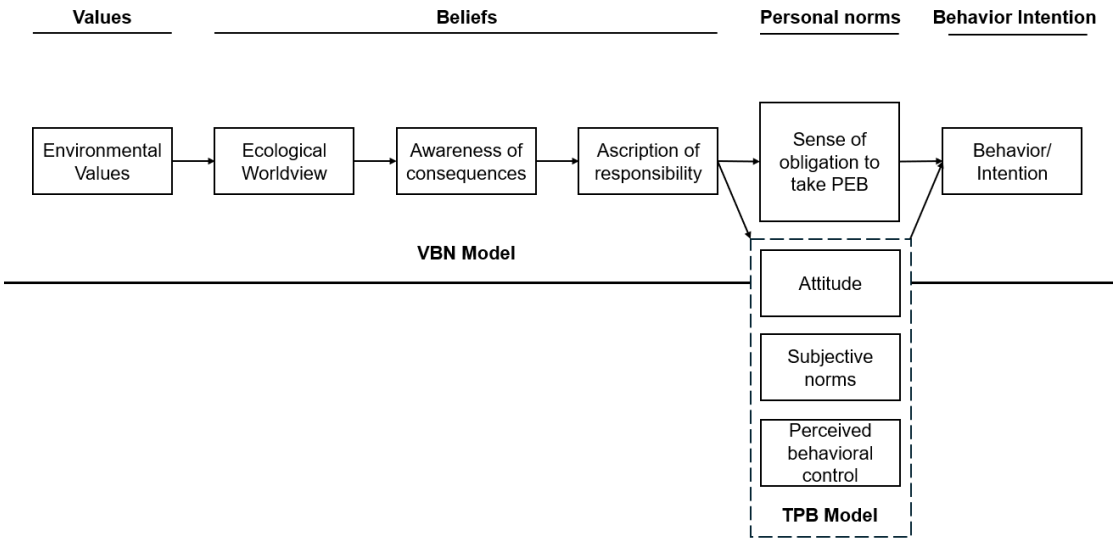
Steg (2018) indicates that no single theory covers the full spectrum of environmental action. For instance, TPB focuses on "gain goals" (self-interest), while VBN focuses on "normative goals" (morality). Empirical studies support this distinction: Kaiser et al. (2005) found that TPB better predicts specific behavioral intentions (accounting for 95% of the variance), whereas VBN is superior at explaining the underlying moral background (64%). Moreover, recent meta-analyses suggest that integrating these models provides a more robust framework for predicting complex behaviors that involve both high costs and moral obligations.

To capture a broader view of what drives PEB in Taiwan—ranging from low-cost daily habits to high-cost policy support—this study follows Zulkepeli et al. (2024). It integrates the predictive precision of TPB with the moral depth of VBN.

The theoretical core of the framework in this study combines the logic of these two theories (Figure 1). By integrating them, I account for both the internal "why" (values and beliefs from VBN) and the external "how" (social norms and context from TPB).

Figure 1

The VBN-TPB Model



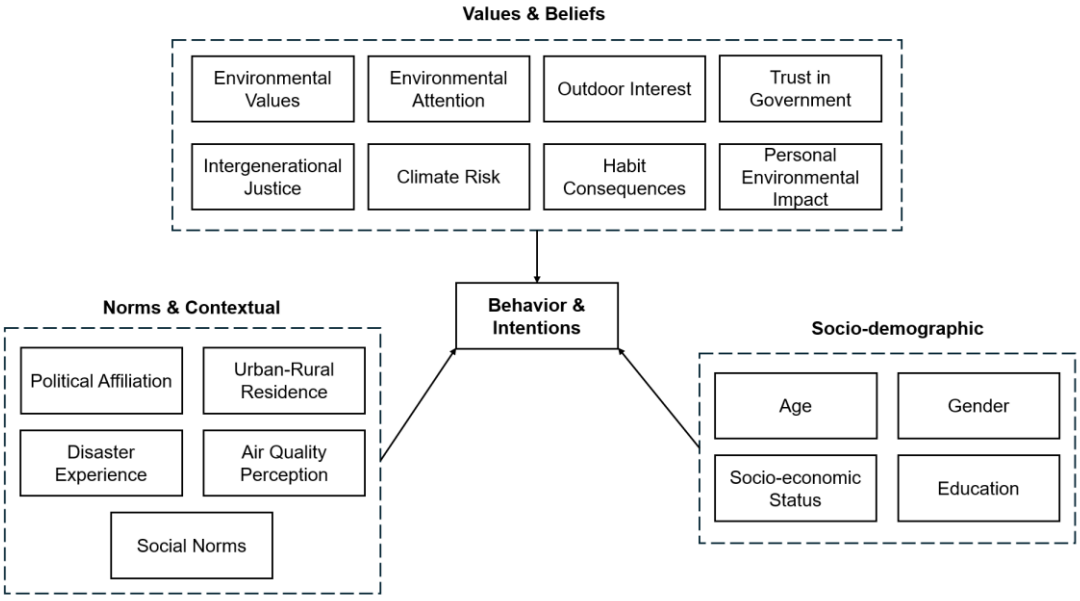
doi:10.6342/NTU202600747

Given that this study employs secondary data from the Taiwan Social Change Survey, I adopt a pragmatic operationalization of the theoretical framework. While secondary data constraints prevent a direct psychometric replication of all original constructs (e.g., specific items for Perceived Behavioral Control), I conceptually map available proxy variables to the theoretical domains of the TPB-VBN model.

Accordingly, the framework used in this study organizes the variables into three distinct orientations that mirror the theoretical model: Socio-demographics, Values and Beliefs (operationalizing the internal VBN chain), and Norms and Contextual Factors (operationalizing the external pressures of TPB), as shown in Figure 2. This approach allows us to rigorously examine the drivers of behavior while maximizing the utility of the available empirical data.

Figure 2

Framework of This Study



2.2 The Application of the Framework

The VBN-TPB Model suggests that values, beliefs, and personal norms are the

doi:10.6342/NTU202600747

primary antecedents of behaviors and intentions. Past studies also identify similar components that influence PEB. For instance, Lin, Hsu, & Hsiao (2024) highlight six key social factors driving Taiwan's climate transition: environmental consciousness, socio-economic status (SES), social capital, gender roles, industrial interests, and political affiliation. Their findings suggest that personal income and education determine the economic capacity to bear environmental costs, while "social capital"—manifested through participation in environmental groups—acts as a primary driver for policy support. This local evidence strongly supports the inclusion of these variables in our research framework. To evaluate the efficacy of this theory within our specific context, I review how these variables operate globally and how Taiwanese studies affirm or refine these relationships.

Values and Beliefs Factors

It is widely established in the literature that fundamental values—whether biospheric (concern for nature), altruistic (concern for others), or egoistic (concern for self)—are the root drivers of environmental action (Steg et al., 2014). Research in Taiwan strongly resonates with this consensus, identifying a strong Environmental Values orientation as a significant predictor of PEB (Chang, 2024). However, local studies add a layer of depth regarding the nature of this motivation; consistent with the moral component of VBN theory, Yang & Lee (2021) found that for Taiwanese citizens, environmental awareness often translates directly into a moral willingness to sacrifice, reframing protection not merely as a preference but as an ethical duty.

Closely linked to these values is the psychological "connectedness to nature," often fostered by Outdoor Interest. While general research indicates this connection is strongly

doi:10.6342/NTU202600747

associated with pro-environmental behavior (r=.42) (Mackay & Schmitt, 2019), Taiwanese studies emphasize that this emotional affinity is most effective when paired with cognitive competence. Studies by Kuo (2015) and Huang (2016) suggest that confidence in one's Environmental Knowledge is as critical as emotional connection, particularly for technical behaviors like energy conservation.

Beyond positive affinity, the perception of threat plays a critical role. According to Construal Level Theory, reducing "psychological distance"—making a threat feel local and immediate—generally increases the likelihood of action (Trope & Liberman, 2010). In the Taiwanese context, however, applying this theory reveals a paradox regarding Climate Risk. While high risk perception effectively drives personal defense mechanisms such as disaster preparation (Yang & Lee, 2021) and private habits (Tsai & Wu, 2021), it does not always translate into policy support. Shih (2012) noted that although Taiwanese people perceive climate change as a high risk, their willingness to support passive policies remains low because the impact still feels temporally distant. This suggests a divergence where risk perception drives adaptation (private) more effectively than mitigation (public).

Besides, whether these private concerns translate into support for state-led mitigation often hinges on institutional trust. Standard political theories argue that high institutional trust is a prerequisite for citizens to support state-led environmental policies, acting as a buffer against the risks of policy failure (Kulin & Johansson, 2021). This dynamic is clearly evident in Taiwan, where Trust in Government positively correlates with support for energy policy (Lee, 2022). However, local scholarship highlights that this trust is notably fragile. Shih (2012) observes that Taiwanese citizens frequently criticize climate policies and demand high transparency, indicating that trust is not a static resource but a volatile variable that can quickly become a significant barrier to public-

doi:10.6342/NTU202600747

sphere engagement if the government is perceived as corrupt.

Norms and Contextual Factors

Most research highlights that Social Norms are among the strongest predictors of behavior, often mediating the effect of personal attitudes (Helferich et al., 2023). In Taiwan's collectivist culture, this social context is paramount, yet it extends beyond secular peer pressure to include unique cultural drivers. Zhou (2013) found that non-mandatory social norms—specifically participation in religious activities—significantly increase PEB frequency, illustrating how spiritual networks serve as critical channels for fostering environmental responsibility.

Just as the cultural environment shapes behavior, the physical environment exerts a tangible force. While general studies indicate that local weather anomalies influence climate beliefs (Lee et al., 2015), Taiwan's high disaster vulnerability makes Disaster Experience a more potent predictor. Yang (2013) found direct associations between physical environmental quality and behavioral intentions, and Yang & Lee (2021) further noted that direct exposure to disasters positively predicts mitigation efforts. This reinforces the notion that, for Taiwanese citizens, environmental action is often a reactive measure against tangible, physical threats rather than an abstract concern.

Finally, these social and physical factors operate within a distinct political landscape. Generally, political orientation (Left vs. Right ideology) is considered a robust predictor of environmentalism (Hornsey et al., 2016). In Taiwan, however, the dynamic is defined by Political Affiliation (specific party identity) rather than broad ideology. Lee (2022) found that support for energy policy is primarily driven by alignment with the ruling party, and Huang & Yu (2024) noted that party identification determines the acceptance of

doi:10.6342/NTU202600747

energy price hikes. Furthermore, Lin, Hsu, and Hsiao (2024) argue that environmental preferences in Taiwan are highly susceptible to political polarization and interest group manipulation. Partisan ideologies often fragment public support for environmental protection and can fluctuate dramatically following major events, such as the Fukushima nuclear disaster or local power outages. This confirms that environmental policy in Taiwan is filtered through a partisan lens, distinct from the Western ideological spectrum.

Socio-demographic Factors

A robust finding across cultures is that women report greater engagement in PEB, often attributed to socialization theories and an "ethics of care" (Gilligan, 1982). Taiwanese studies align with this trend, showing women consistently exhibit stronger Environmental Values (Tien & Huang, 2023). However, local research identifies a distinct trade-off. Lin, Hsu, and Hsiao (2024) highlight a complex contradiction in gender roles. While women generally exhibit higher environmental risk perception and support low-carbon public transportation, they show significant resistance to policies that increase household financial burdens, such as hikes in electricity or water prices. This finding complements Tien & Huang (2023), who noted that while women dominate private-sphere habits, men in Taiwan are conversely more willing to pay higher taxes. Additionally, males are more inclined toward Community Action (Chu & Yang, 2013), suggesting gendered pathways of participation.

This nuance in participation extends to generational differences. Contrary to the stereotype that older individuals are resistant to change, meta-analyses indicate a positive relationship between age and PEB (Wiernik et al., 2016). Research in Taiwan supports this "theory of generativity" (McAdams, 2013), noting that the elderly engage in more

doi:10.6342/NTU202600747

personal PEB and take more environmental actions than younger generations (Chiang, 2014).

Beyond biological characteristics, acquired capital—specifically Education and Socioeconomic Status (SES)—remains a powerful predictor. Higher Education is a consistent general predictor of environmental concern, helping to bridge the "information deficit" (Kollmuss & Agyeman, 2002; Meyer, 2015). This is held in Taiwan across various behaviors (Chang, 2024; Lee, 2022). Regarding SES, while international studies show complex, non-linear relationships, Taiwanese findings offer a specific clarification: social status appears to have a more substantial influence on behavior than economic status, with income showing a "threshold effect"—it matters only up to a point before its influence plateaus (Chen & Hsieh, 2016).

The Unaddressed Complexity - From Variables to Profiles

Summarizing the literature above, Taiwanese scholars have provided a rich inventory of predictors for PEB, ranging from Environmental Values and Social Norms to Political Affiliation and Disaster Experience. However, a significant research gap remains. Most existing studies examine these variables in isolation or within linear models, failing to capture how they interact to form distinct "types" of environmental actors in the real world.

Crucially, standard theories often assume linear relationships that may not hold in a complex reality. For instance, while risk perception is generally assumed to drive action (O'Connor et al., 1999), it remains unclear why some individuals exposed to severe Disaster Experience might retreat into private habits rather than engage in public advocacy (Cunsolo & Ellis, 2018). Similarly, while high Trust in Government is known

doi:10.6342/NTU202600747

to facilitate policy support, we have yet to determine whether "distrust" merely leads to apathy or paradoxically fuels alternative forms of grassroots mobilization in local communities (Fairbrother, 2016).

Therefore, this study aims to bridge this gap by moving from a variable-based to a person-centered analysis. By integrating these diverse antecedents, I aim to uncover heterogeneous patterns among Taiwanese citizens. The goal is not merely to identify what variables influence behavior, but to understand who these actors are and how different combinations of psychological and contextual factors interact to either induce or hinder specific types of environmental action.

Table 2

Direction of Different Variables Influencing PEB

Variables	Direction	Studies
Gender (female)	Mixed: Females generally show stronger Environmental Values, attitudes, and engagement in Private-Sphere/Daily Habits (Ethics of Care). Males may show higher Willingness to pay taxes or engage in Community Action based on outcome efficacy.	Gilligan (1982); Chang (2024); Lee (2022); Tien and Huang (2023); Yang (2013); Chiang (2014); Kuo (2015); Chu &Yang (2013)
Education level	Positive: Consistently predicts environmental knowledge, concern, and Policy Support. It reduces information deficit barriers, though higher education does not always guarantee high-cost behavioral change.	Meyer (2015); Kollmuss & Agyeman (2002); Chang (2024); Lee (2022); Yang & Lee (2021); Tien & Huang (2023); Yang (2013); Zhou (2013); Chiang (2014); Yuan (2016); Kuo (2015); Lu (2017)
Age	Mixed: Older individuals show higher engagement in Daily Habits and Community Action (Theory of Generativity). Younger individuals are often more likely to engage in Public Action or hold more radical	Wiernik et al. (2016); McAdams (2013); Tien & Huang (2023); Yang (2013); Chiang (2014)

doi:10.6342/NTU202600747

	environmental views.	
Income/SES	Non-linear: High SES/Income predicts high-cost behaviors (e.g., buying green products). Low SES often predicts curtailment behaviors (e.g., saving energy) driven by financial concerns. Social status may have a more substantial influence than economic status.	Diamantopoulos et al. (2003). Trotta (2018); Lee (2022); Tien & Huang (2023); Lu (2017); Yang & Lee (2021); Zhou (2013); Chen & Shieh (2016)
Environmental Values and Attitudes	Positive: Strong predictor of behavioral intention. Biospheric/Altruistic values drive Public-Sphere and Policy Support, while Egoistic values may drive Private-Sphere behaviors.	Steg et al. (2014). Stern (2000); Chang (2024); Tien & Huang (2023); Huang (2016); Tsai & Wu (2021); Zheng (2018); Kuo (2015)
Environmental Attention / Knowledge	Positive: Confidence in knowledge and paying attention to issues lowers the barrier to action, particularly for technical behaviors such as energy conservation.	Zsóka et al. (2013); Chang (2024); Kuo (2013); Huang (2016); Tien & Huang (2023); Kuo (2015)
Risk Perception / Climate Risk	Mixed: High risk perception drives Private Habits and disaster preparation. However, abstract Climate Risk often fails to drive Policy Support compared to concrete daily risks (Psychological Distance).	Trope & Liberman (2010). Hornsey et al. (2016); Yang & Lee (2021); Zhou (2013); Tsai & Wu (2021); Kuo (2015); Shih (2012)
Social and Government Trust	Mixed: High Trust predicts Policy Support and Willingness to Pay. Low Trust predicts grassroots Community Action and self-organization.	Kulin & Johansson (2021). Fairbrother (2016); Lee (2022); Huang & Yu (2024); Shih (2012)
Political Affiliation	Mixed: Support for environmental/energy policy is primarily determined by alignment with the ruling party rather than broad ideology.	Hornsey et al. (2016). Lee (2022); Huang & Yu (2024)
Closeness to Nature	Positive: Connection to nature and social pressure are strong predictors, especially in collectivist cultures. Includes non-mandatory norms (e.g.,	Helferich et al. (2023); Mackay & Schmitt (2019); Lu (2022); Zhou (2013)

doi:10.6342/NTU202600747

	religious participation).	
Disaster Experience	Mixed: Can motivate mitigation/preparation, but overwhelming trauma can trigger psychological coping and retreat into the private sphere.	Lazarus & Folkman (1984). Cunsolo & Ellis (2018); Yang & Lee (2021); Wu (2020)

2.3 The Heterogeneity of Pro-Environmental Behaviors

While the theories previously mentioned explain how to evoke PEB, it is crucial to recognize that PEB should not be viewed as uniform behaviors. Although some common variables influence all types of environmental actions, individuals show different tendencies when choosing which behaviors to adopt. For instance, Lin (2013) examined how the TPB model explains PEB across various sectors—including dietary, clothing, housing, recreation, and transportation—finding that the relative importance of attitude and norms varies significantly between behaviors. Similarly, Yu et al. (2020) demonstrated that individuals have distinct motivations (e.g., protecting the environment versus saving money) for different actions, such as recycling versus using public transportation. This distinction is critical for both theoretical and practical reasons.

Theoretically, treating PEB as a single, unidimensional construct obscures the distinct psychological mechanisms underlying different types of behavior. Research indicates that the drivers of private-sphere lifestyle changes differ vastly from those of public-sphere political support; conflating them often leads to inconsistent findings and the "attitude-behavior gap" (Lange & Dewitte, 2019). In practice, recognizing this heterogeneity is essential for policy design, as a strategy that successfully encourages a low-cost habit, such as recycling, may fail to mobilize support for high-cost policies, such as carbon taxes. To guide people toward more efficient environmental actions, scholars have proposed

doi:10.6342/NTU202600747

various classification frameworks, starting with functional attributes. The most instinctive taxonomy categorizes PEB by their purpose; for example, Hungerford et al. (1985) and Hines et al. (1987) identified types such as ecological management, consumer behavior, legal action, and political persuasion. This functional perspective receives strong empirical support in the Taiwanese context, where scholars have differentiated behaviors by sphere of action. Chen and Shieh (2016) identified three types: "normative PEB" (compliance), "individual PEB," and "comprehensive PEB." Furthermore, Tsai & Wu (2021) explicitly distinguished between "public PEB" and "private PEB," highlighting that these are not just different actions but are driven by fundamentally different values and perceptions. This local evidence reinforces the global consensus that private lifestyle changes and public advocacy must be treated as distinct constructs.

Beyond function and sphere, behaviors are mechanically differentiated by cost, directness, and frequency. The "low-cost hypothesis" posits that environmental attitudes are strong predictors of low-cost behaviors (e.g., recycling) but lose their predictive power for high-cost behaviors (e.g., switching to public transportation) (Diekmann & Preisendörfer, 2003; Stern, 1992). In terms of directness, actions differ in their immediacy; direct actions yield immediate environmental impacts, whereas indirect actions (such as policy support) require systemic transformations (Bord et al., 1998; Kollmuss & Agyeman, 2002). Tobler et al. (2012) empirically combined these dimensions into categories such as "direct/low-cost" and "indirect/high-cost."

Closely related to cost is the dimension of frequency. Casaló et al. (2019) found that behavior frequency and cost attributes significantly mediate the attitude-behavior linkage. This dimension of social effort is also evident in Taiwanese typologies; Lu (2022) categorized actors into "Personal PEB," "Community PEB," and "Environmental Social

doi:10.6342/NTU202600747

Movements," suggesting that in the local context, the "cost" is often social, distinguishing between private habits and the higher commitment required for community engagement. Finally, distinctions in behavioral intent—whether abstract or specific—also matter, as general intentions do not always predict specific activities accurately (Broomell et al., 2015).

Ultimately, these varying attributes confirm that PEBs are widely conceptualized as multidimensional constructs involving clusters of lifestyle, citizenship, and advocacy behaviors (Bain et al., 2015; Markle, 2013; Kaiser et al., 2003). Consequently, given that the survey structure used in this study covers multiple aspects of PEB, a single existing taxonomy cannot simply be applied. Following the suggestion of Hall et al. (2018), this study employs a data-driven method, Exploratory Factor Analysis (EFA), to classify PEB based on statistical results. We expect the results to reflect the diverse patterns mentioned above, grouping behaviors not just by their physical similarities, but by their underlying psychological structure—such as a "Daily Habits" category representing high-frequency, low-cost actions.

2.4 The Adoption of Different Pro-Environmental Behaviors

The decision to adopt a specific PEB is not random; it is influenced by a complex interplay of external conditions, the intrinsic nature of the action, and a wide array of internal psychological factors. Understanding why one individual is willing to take public transportation but refuses to support Willingness to Pay (green taxes) requires looking beyond simple measures of environmental concern.

Values, Beliefs, and the Sphere of Action

From the start, an individual’s values play a pivotal role. Perceiving the threat of an

doi:10.6342/NTU202600747

environmental problem, such as air pollution, is a powerful motivator, particularly when coupled with a belief in "response efficacy"—the conviction that one's actions can make a difference (Baldassare & Katz, 1992). However, this motivation is not uniform across all behaviors. Research in Taiwan refines this by distinguishing how values target different spheres of action. Tsai and Wu (2021) found that environmental values function differently across categories: altruistic values primarily influence public-sphere PEB, whereas egoistic values (concern for self) tend to influence private-sphere PEB. This suggests that while general concern matters, appeals to personal health may drive private habits, while appeals to the collective good are necessary for public policy support.

Socio-demographic Difference

Socio-demographic factors also play a crucial role in shaping behavioral choices. Globally, studies show that families with lower incomes are often willing to save energy primarily to reduce expenses (Mills & Schleich, 2012). However, evidence from Taiwan suggests the picture is more detailed, particularly regarding gender. While international studies often show women generally engage more in PEB, Tien and Huang (2023) highlight a specific trade-off: men tend to be more willing to pay higher taxes. However, they are less willing to reduce their living standards. Women, conversely, focus more on their "ability" to act and tend to adopt personal daily habits consistently. Furthermore, distinct patterns emerge in the mode of participation; while females often dominate personal PEB, males in Taiwan are more inclined toward community action (Chu & Yang, 2013).

Regarding class, the relationship is equally complex. While high SES generally predicts "individual" or "comprehensive" PEB, Chen and Hsieh (2016) noted that social

doi:10.6342/NTU202600747

status has a larger influence than economic status. Crucially, economic status shows a "threshold effect"—meaning income only matters up to a certain point before its influence plateaus.

Contextual Constraints

Beyond individual traits, external social and contextual factors create significant structural opportunities or barriers. International studies emphasize that access to services—such as convenient public transportation—is a primary determinant of behavior (Guagnano et al., 1995).

In the specific context of Taiwan, the concept of "context" is heavily defined by political and geographical factors. Lee (2022) found that political affiliation is a critical predictor of energy policy support; specifically, supporters of the ruling party were positively associated with support, while supporters of other parties showed no significant association. Geographically, the mode of engagement is dictated by location. Lu (2022) found that living in urban or rural areas influences participation styles: people living in rural areas are more likely to join community action groups rather than engage in broader environmental social movements.

Additionally, perceptions of authority play a unique role. Tsai and Wu (2021) noted that perceived government authority has a greater effect on private PEB than public ones. This implies that when the government is viewed as authoritative, citizens may feel more compelled to align their personal lifestyles with state goals, even if they do not actively participate in public advocacy.

Barriers and the Research Gap

Finally, even with sufficient motivation, psychological barriers can prevent action.

doi:10.6342/NTU202600747

Blake (1999) categorized these impediments into individuality, responsibility, and practicality. Expanding on this, Gifford (2011) identified seven "dragons of inaction," including limited cognition and ideological worldviews.

Summarizing the above, while previous research has identified various drivers—ranging from gender and politics to cost and values—most studies either compare only a few specific conditions or organize main barriers. There is a significant lack of research that integrates these diverse antecedents to explain how they cluster into distinct types of actors (Sarkis et al., 2010). Specifically, we do not yet understand which combinations of variables lead a citizen to become a "Financial Contributor" rather than a "Youth Activist." This study aims to fill that gap by exploring how multiple antecedent variables induce or handicap each type of PEB tendency.

2.5 Research Questions

Summarizing past studies' gaps and the problems we are addressing, the following are the research questions this study tried to answer:

1. What distinct types of PEB can be empirically identified in Taiwan?
2. What specific variables influence each behavioral type?
3. What patterns or typologies of environmental citizens exist in Taiwanese society?

doi:10.6342/NTU202600747

3. Data and Methods

3.1 Data Description

This study uses data from the "2020 Taiwan Social Change Survey (Round 8, Year 1): Environment" (Wu, 2022). The Taiwan Social Change Survey (TSCS) is funded by the National Science and Technology Council to collect long-term tracking data on social trends in Taiwan.

The survey uses a multi-level stratified sampling method to ensure a representative sample. Given that this study used numerous question sets, many samples were lost due to insufficient data to meet the criteria. The lost questions primarily concerned government trust (78 samples), generational justice (65 samples), and policy support (65 samples). The final valid sample consisted of 1,383 respondents (original N = 1,839). Females accounted for 55.4% (n=758) and males for 44.6% (n=610). Regarding age structure, 33.3% of respondents were aged 20–39, 41.4% were aged 40–59, and 22.9% were aged 60 or older.

Variables

Variables were categorized into four main dimensions: Pro-environmental Behavior, Socio-demographic Factors, Values and Beliefs, and Norms and Contextual Factors. Table 3 summarizes these variables, while full descriptions, including specific questions and Likert-scale metrics, are provided in the Appendix.

Notably, due to the survey's structure, I must integrate both actual actions and behavioral intentions into the PEB discussion. This integrative approach is grounded in TPB, which identifies intention as the most immediate proximal predictor of action.

doi:10.6342/NTU202600747

Moreover, given that many policy initiatives revolve around hypothetical frameworks, gauging intentions or expressed support is the sole empirical pathway for capturing pro-environmental behavior when direct, real-world action is not yet feasible.

To ensure data quality, I assessed the reliability and validity of each construct using Cronbach's alpha and Pearson's correlation. I ensured that the questions within each variable were consistent and aligned with the study's primary purpose. I also conducted an Exploratory Factor Analysis (EFA) to classify the different types of environmental behaviors, which is detailed in the Statistical Methods section.

Table 3

Variables Used in This Study

Pro-environmental Behavior	Daily Habits Policy Support (air pollution) Willingness to Pay Community Action Public Action
Socio-demographic Factors	Age Gender Socioeconomic Status (SES) Education
Values and Beliefs Oriented Factors	Environmental Values (ESVS) Environmental Attention Outdoor Interest Intergenerational Justice Climate Risk Habit Consequences Trust in Government Personal Environmental Impact
Norms and Contextual Factors	Social Norms Urban-Rural Residence Air Quality Perception Disaster Experience Political Affiliation

doi:10.6342/NTU202600747

3.2 Statistical Methods

Exploratory Factor Analysis (EFA)

To identify the underlying structure of environmental actions in Taiwan, I used Exploratory Factor Analysis (EFA) with IBM SPSS Statistics 27. We selected Principal Component Analysis (PCA) as the extraction method. To obtain mathematically distinct and interpretable behavioral dimensions, I applied a Varimax rotation.

I determined the number of factors to retain based on two criteria: an eigenvalue greater than one, and an examination of the scree plot. I assigned items to specific factors if their factor loading was greater than .40, while also checking for cross-loadings. This approach follows standard recommendations for factor analysis (Watkins, 2018).

Lasso Regression

To determine which variables best predict environmental behavior, this paper employed the Least Absolute Shrinkage and Selection Operator (Lasso) regression. Lasso regression is a regularization method that adds an L1 penalty term to Ordinary Least Squares (OLS) regression, constraining the magnitudes of the regression coefficients. The objective function is defined as:

$$\min_{\beta_0,\beta}\left\{\sum_{i=1}^{n}\left(y_i-\beta_0-\sum_{j=1}^{p}\beta_j x_{ij}\right)^2+\lambda\sum_{j=1}^{p}|\beta_j|\right\}$$

Where λ is the regularization parameter that controls the strength of the penalty. When $\lambda = 0$, the model reduces to a standard OLS regression. As λ increases, some coefficients are shrunk to zero, effectively enabling variable selection. This property makes Lasso particularly suitable for high-dimensional data or cases with multicollinearity among predictors.

doi:10.6342/NTU202600747

This feature makes Lasso particularly useful for this study because it includes many variables that might overlap (multicollinearity). By removing weak predictors, Lasso helps us identify the most critical variables without overfitting the data.

I standardized all independent variables (z-score) before analysis to ensure they were comparable. I used 10-fold cross-validation to find the optimal penalty value (λ). The analysis was performed using the R packages “glmnet” and “boot” with 5,000 bootstrap samples.

Our result reports on two models:

The Optimal Model: This model includes all variables that contribute to prediction accuracy. It provides the most comprehensive view.

The Reduced (1SE) Model: This is a simpler, stricter model (within one standard error of the optimal model). It identifies only the most robust and essential predictors.

Comparing these two models allows us to see both the broad factors (Optimal) and the critical drivers (Selected) of environmental action.

Canonical Correlation Analysis (CCA)

Finally, this study employed Canonical Correlation Analysis (CCA) to investigate how the set of independent variables jointly influences the set of dependent variables. CCA is a multivariate technique that constructs pairs of "canonical variates"—linear composites from each set—that maximizes the correlation between the two sets. This enables us to identify the unique contributions of individual predictors to specific dimensions of the outcome.

A key advantage of CCA is its ability to reveal patterns. It shows which independent variables are most strongly associated with particular combinations of dependent variables. By examining canonical loadings, I can see how each predictor contributes to

doi:10.6342/NTU202600747

each function. For example, a predictor might show a strong association with one canonical variate (linked to a specific subset of behaviors) while showing no association with others, illustrating a divergent pattern.

I utilized IBM SPSS Statistics 27 for this analysis. All variables were standardized (z-scores) before analysis. The results include canonical correlations, loadings, and structure coefficients. The statistical significance of each function was assessed using Wilks' Lambda and F-tests. Only functions found to be statistically significant were retained for interpretation

doi:10.6342/NTU202600747

4. Findings

4.1 Exploratory Factor Analysis (EFA)

First, to validate the structure of environmental behaviors in Taiwan, I conducted an EFA. The data met all necessary statistical assumptions. The KMO value was .780, indicating a middling to good level of sampling adequacy (Kaiser, 1974); Bartlett's test of sphericity was significant ($\chi 2(325) = 7{,}189.32$, $p < .001$), suggesting that the correlation matrix was suitable for factor analysis.

The analysis yielded five distinct behavioral constructs, explaining a significant portion of the variance (Table 4):

- Daily Habits: Private-sphere actions like reducing plastic.
- Policy Support: Agreeing with government regulations on pollution.
- Willingness to Pay: Financial sacrifice through taxes or prices.
- Community Action: Local, collaborative engagement.
- Public Action: Civic engagement, like petitions and donations.

To reduce complexity and avoid confounding results, I excluded from the subsequent analysis any PEB items that could not be clearly categorized into these factors.

doi:10.6342/NTU202600747

Table 4

The EFA Result of PEBs

EFA results	Questions	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Uniqueness
Daily Habits	Disposable utensils (A)	.709					.462
	Bottled water (A)	.597					.697
	Shopping bag (A)	.563					.714
	Own utensils (A)	.552					.600
	Disposable utensils (I)	.549					.681
	Own utensils (I)	.428					.806
Policy Support (air pollution)	Old car (I)		.781				.421
	Emission standard (I)		.776				.446
	Subsidize public transportation (I)		.695				.551
	Pollution tax (I)		.467				.797
	Energy tax (I)		.455				.727
Willingness to Pay	Pay higher taxes (I)			.955			.267
	Pay higher prices (I)			.909			.344
Community action	Community PEB (A)				.874		.279
	Community disaster report (A)				.845		.280
	Community pollution report (A)				.703		.445
	*Environmental NGO member (A)				.584		.672
Public Action	Donating to an Environmental NGO (A)					.654	.641
	Sign petition (A)					.520	.736
Others	……						
Notes: (I) stands for the question is asking intention, (A) stands for the question is asking real action							

Despite the inclusion of both intent-based and action-based items, the variables statistically converged into five distinct, conceptually coherent constructs. This statistical convergence suggests that behavioral intentions and actual practices share a consistent

doi:10.6342/NTU202600747

psychological foundation among the respondents

4.2 Reliability and Validity Analysis

. I tested the internal consistency of these constructs (Tables 5.1–5.5). Most questions significantly correlated with other questions within the same construct ($p < .001$), and most showed good reliability (Cronbach's $\alpha > .700$), indicating good internal consistency across the groups.

However, one item within the Community Action construct—"Membership in an Environmental NGO"—showed inconsistent correlations with other local actions. Since formal membership represents a different level of commitment than neighborhood participation, this paper excluded this item from the "Community Action" construct to ensure analytical precision and consistency.

Table 5-1

The Correlation Table of Daily Habits

Daily Habits	**AVG**	**STD**	**1**	**2**	**3**	**4**	**5**
Disposable utensils (A)	3.19	1.26					
Bottled water (A)	3.36	1.27	.424***				
Shopping bag (A)	4.62	0.66	.220***	.196***			
Own utensils (A)	4.10	0.99	.325***	.310***	.530***		
Disposable utensils (I)	3.94	0.82	.211***	.190***	.257***	.286***	
Own utensils (I)	3.14	1.07	.252***	.248***	.317***	.447***	.278***
N = 1,383. *p < .05, **p < .01, ***p < .001. Cronbach's α = .703							

doi:10.6342/NTU202600747

Table 5-2

The Correlation Table of Policy Support

Policy Support (air pollution)	**AVG**	**STD**	**1**	**2**	**3**	**4**
Old car (I)	4.07	0.77				
Emission standard (I)	4.00	0.79	.357***			
Subsidize public transportation (I)	3.52	1.03	.284***	.262***		
Pollution tax (I)	3.42	1.04	.237***	.336***	.443***	
Energy tax (I)	3.22	1.10	.219***	.278***	.454***	.544***
N = 1,383. *p < .05, **p < .01, ***p < .001. Cronbach's α = .725						

Table 5-3

The Correlation Table of Willingness to Pay

Willingness to Pay	**AVG**	**STD**	**1**
Pay higher taxes (I)	3.05	1.13	
Pay higher prices (I)	2.75	1.14	.675***
N = 1,383. *p < .05, **p < .01, ***p < .001.			

Table 5-4

The Correlation Table of Community Action

Community action	**AVG**	**STD**	**1**	**2**	**3**
Community PEB (A)	1.25	0.66			
Community disaster report (A)	1.53	0.81	.292***		
Community pollution report (A)	1.57	0.83	.282***	.706***	
*Environmental NGO member (A)	0.03	0.18	.349***	.099***	.046
N = 1,383. *p < .05, **p < .01, ***p < .001. Cronbach's α = .644 (.703) after adjustment					

Table 5-5

The Correlation Table of Public Action

Public Action	**AVG**	**STD**	**1**
Donating to an Environmental NGO (A)	0.10	0.30	
Sign petition (A)	0.11	0.31	.348***
N = 1,383. *p < .05, **p < .01, ***p < .001.			

doi:10.6342/NTU202600747

4.3 Correlation Analysis

Table 6 presents the descriptive statistics and correlations for all variables.

Relationships among Values and Beliefs

First, I examine the relationships within the Values and Beliefs dimensions. A consistent pattern of positive correlations exists among values, concerns, and risk perceptions. The strongest relationship observed was between Intergenerational Justice and Habit Consequences ($r = .38, p < .001$), suggesting that individuals who care about future generations are keenly aware of the impact of their daily waste. Similarly, Environmental Attention is moderately correlated with both Environmental Values ($r = .31, p < .001$) and Habit Consequences ($r = .30, p < .001$). These linkages indicate that general values and specific risk perceptions tend to cluster together.

Furthermore, different types of environmental risks are positively correlated with each other. For instance, a significant positive correlation is observed between Climate Risk and Habit Consequences ($r = .16, p < .001$). Additionally, when individuals believe Their Personal Environmental Impact is high, they also report higher perceived risks from both daily waste ($r = .20, p < .001$) and climate change ($r = .14, p < .001$).

Outdoor Interest is positively associated with nearly all other pro-environmental variables, including Environmental Attention ($r = .24, p < .001$) and Environmental Values ($r = .20, p < .001$). This implies that direct engagement with nature fosters a more positive and environmentally conscious attitude.

The outlier in this category is Trust in Government. It is not significantly correlated with most other values or belief variables. This suggests that institutional trust operates independently from a person's environmental worldview and may influence behavior

doi:10.6342/NTU202600747

through a different pathway.

Relationships among Norms and Context

Next, I examine the Norms and Contextual Factors. There is a strong correlation between Air Quality Perception and Disaster Experience (r = .41, p < .001). Both variables exhibit very weak correlations with Urban-Rural Residence (r = −.03 *and* r = −.04, *ns*), suggesting that subjective environmental sensitivity may be more important than objective geographical location.

Social Norms also relate significantly to environmental conditions. They show a positive correlation with Disaster Experience (r = .12, p < .001) and Air Quality Perception (r = .18, p < .001). Additionally, people living in cities are more likely to perceive stronger Social Norms regarding plastic use (r = −.10, p < .01), which aligns with the higher density of commercial activity in urban areas.

Political Affiliation only shows positive relationship with Trust in Government (r = .17, p < .001). This suggests that political identity in Taiwan is relatively insulated from other social norms and contextual factors, influencing behavior in its own distinct manner.

Correlations between Variables and PEBs

1. Daily Habits

Daily Habits were significantly positively correlated with Age (r = .21, p < .001), Education (r = .12, p < .001), and SES (r = .17, p < .001). They were negatively correlated with Gender (r = −.28, p < .001) and Urban-Rural Residence (r = −.17, p < .01) (where Rural = High). This suggests that women, older individuals, those with higher levels of education and social status, and city residents tend to exhibit better daily environmental habits.

doi:10.6342/NTU202600747

Values and Beliefs: The strongest correlation was with Habit Consequences ($r = .41$, $p < .001$), followed by Environmental Attention ($r = .33$, $p < .001$), Environmental Impact ($r = .18$, $p < .001$), Environmental Values ($r = .18$, $p < .001$), and Intergenerational Justice ($r = .20$, $p < .001$).

Norms and Context: Daily Habits were significantly positively correlated with Social Norms ($r = .37$, $p < .001$) and Air Quality Perception ($r = .12$, $p < .001$). However, correlations with Disaster Experience ($p = .385$) and Political Affiliation ($p = .344$) did not reach statistical significance.

2. Policy Support

Socio-demographics: Policy Support was significantly positively correlated with Education ($r = .17$, $p < .001$) and SES ($r = .21$, $p < .001$). It showed a significant negative correlation with Urban-Rural Residence ($r = -.13$, $p < .001$), indicating that urban residents are more supportive of air pollution policies. Relationships with gender and age were not significant.

Values and Beliefs: This behavior correlated positively with most value-based variables, especially Habit Consequences ($r = .30$, $p < .001$), Intergenerational Justice ($r = .23$, $p < .001$), and Trust in Government ($r = .13$, $p < .001$).

Norms and Context: Policy Support correlated positively with almost all contextual factors, including Social Norms ($r = .34$, $p < .001$), Disaster Experience ($r = .15$, $p < .001$), Air Quality Perception ($r = .09$, $p < .01$), and Political Affiliation ($r = .09$, $p < .01$).

3. Community Action

Socio-demographics: Community Action was significantly positively correlated with Age ($r = .21$, $p < .001$) and Gender ($r = .07$, $p < .01$).

Values and Beliefs: This behavior correlated positively with Environmental

doi:10.6342/NTU202600747

Attention ($r = .28$, $p < .001$), Outdoor Interest ($r = .18$, $p < .001$), Environmental Values ($r = .11$, $p < .001$), and Environmental Impact ($r = .12$, $p < .001$). Notably, Community Action was significantly and negatively correlated with Trust in Government ($r = -.14$, $p < .001$), suggesting that distrust in the state may drive local self-organization.

Norms and Context: Community Action was positively correlated with Social Norms ($r = .12$, $p < .001$), Air Quality Perception ($r = .14$, $p < .001$), and Disaster Experience ($r = .08$, $p < .01$).

4. Willingness to Pay

Socio-demographics: Willingness to Pay was significantly and positively correlated with Education ($r = .18$, $p < .001$) and SES ($r = .17$, $p < .001$). Respondents from urban areas showed a higher willingness ($r = -.14$, $p < .001$).

Values and Beliefs: This willingness correlated positively with Habit Consequences ($r = .21$, $p < .001$), Intergenerational Justice ($r = .19$, $p < .001$), Environmental Attention ($r = .13$, $p < .001$), and Environmental Values ($r = .11$, $p < .001$).

Norms and Context: Willingness to Pay showed a strong positive correlation with Social Norms ($r = .17$, $p < .001$) and weaker but significant correlations with Air Quality Perception ($r = .06$, $p < .05$) and Political Affiliation ($r = .06$, $p < .05$), which appears to be a primary contextual driver for financial commitment. Other factors, like disaster experience, did not reach significance.

5. Public Action

Socio-demographics: Public Action was positively correlated with Education ($r = .22$, $p < .001$) and SES ($r = .17$, $p < .001$). However, it was negatively correlated with Age ($r = -.12$, $p < .001$) and Urban-Rural Residence ($r = -.12$, $p < .001$). This suggests that younger individuals and those residing in urban areas are more likely to participate

doi:10.6342/NTU202600747

in protests or sign petitions.

Values and Beliefs: Positive correlations were found with Intergenerational Justice ($r = .13$, $p < .001$), Environmental Attention ($r = .13$, $p < .001$), Outdoor Interest ($r = .10$, $p < .001$), and Habit Consequences ($r = .11$, $p < .001$).

Norms and Context: Public Action was significantly positively correlated with Disaster Experience ($r = .09$, $p < .01$), Air Quality Perception ($r = .07$, $p < .05$), and Social Norms ($r = .08$, $p < .01$).

doi:10.6342/NTU202600747

Table 6 *The Correlation Table of Variables in This Study*

	Mean	STD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Socio-demographic																							
1. Gender	.45	0.49																					
2. Age	4.12	1.57	-.06*																				
3. Education	13.2	1.10	.05	-.40***																			
4. SES	34.08	11.73	.02	-.15***	.75***																		
Values and Beliefs																							
5. Env Value	6.22	0.97	-.10***	.18***	-.11***	-.07**																	
6. Env Attention	3.39	0.60	-.06*	.31***	-.05	.01	.31***																
7. Outdoor Interest	3.05	0.82	.04	.11***	.06*	.11***	.20***	.24***															
8. Generation Justice	3.81	0.68	-.07*	-.09**	.16***	.14***	.20***	.17***	.11***														
9. Climate Risk	7.66	2.00	.01	.06**	.01	-.01	.16***	.14***	.10***	.19***													
10. Habit Consequences	4.05	0.55	-.14***	.11***	.06*	.12***	.20***	.30***	.20***	.38***	.16***												
11. Trust in GOV	3.99	2.45	-.06*	-.15***	.04	.00	.04	-.04	-.05	-.02	-.17***	-.01											
12. Env impact	3.80	0.82	-.10***	.09**	.06*	.04	.18***	.21***	.10***	.20***	.14***	.20***	-.01										
Norms and Contextual																							
13. Social Norm	3.94	0.60	-.09**	.08**	.03	.07*	.11***	.20***	.13***	.25***	.05	.51***	.01	.11***									
14. Urban-Rural	2.31	1.10	.08**	-.08**	-.15***	-.18***	-.04	-.04	-.02	-.01	.02	-.06*	-.08**	-.02	-.10**								
15. Air Quality	2.52	1.19	-.07**	-.02	.11***	.07*	.14***	.15***	.12***	.21***	.14***	.15***	-.06*	.18***	.07**	-.03							
16. Disaster Experience	2.40	1.27	-.02	-.11***	.05	.02	.07*	.06*	.04	.16***	.17***	.12***	-.01	.12***	.13***	-.04	.41***						
17. Political Affiliation	.20	1.16	.02	.09**	-.04	-.01	.02	.00	-.02	.05	-.02	.06*	.17***	.01	.01	-.07**	-.05	.00					
PEBs																							
18. Daily Habits	3.73	0.62	-.28***	.21***	.12***	.17***	.18***	.33***	.20***	.20***	.02	.41***	-.02	.18***	.37***	-.17**	.12***	-.01	-.00				
19. Policy Support	3.65	0.66	-.05	.04	.17***	.21***	.08**	.10**	.07*	.23***	.03	.30***	.13***	.07*	.34***	-.13***	.09**	.15***	.09**	.20***			
20. Community action	1.45	0.61	.07**	.21***	.00	.03	.11***	.28***	.18***	.03	.11***	.09***	-.14***	.12***	-.01	.05	.14***	.08**	-.02	.12***	-.01		
21. Willingness to Pay	2.92	1.03	.03	.00	.18***	.17***	.11***	.13***	.08**	.19***	.04	.21***	.10**	.10***	.17***	-.14***	.06*	.05	.06*	.20***	.33***	.04	
22. Public action	.11	0.25	-.06	-.12***	.22***	.17***	.03	.13***	.10***	.13***	.05	.11***	-.01	.08**	.07**	-.12***	.07**	.09**	.03	.16***	.12***	.10***	.12***

N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

doi:10.6342/NTU202600747

4.4 Lasso Regression

To isolate the most critical drivers for each behavior, I compared the Reduced Model and the Optimal Model. The Optimal Model provides the most accurate explanation with the best prediction error. The Reduced Model is a simplified version (within one standard error of the optimal model) that highlights only the most robust and essential variables.

Daily Habits

The Reduced Model (λ = .034, MSE = .298, R^2 = .320) indicates that a mix of demographics and immediate cognitions primarily drives Daily Habits. The core robust predictors were Gender (β = -.107), Age (β = .049), Environmental Attention (β = .087), Habit Consequences (β = .110), and Social Norms (β = .100). Specifically, women and older individuals were more likely to engage in these habits. Although Outdoor Interest (β = .023), and Education (β = .032) were included in the model, they did not reach statistical significance ($p > .05$).

On the other hand, the Optimal Model (λ = .001, MSE = .290, R^2 = .345) retains all 17 variables. It confirms the importance of the core predictors identified in the Reduced Model (Gender, Age, Environmental Attention, Habit Consequences, and Social Norms). Also, it reveals secondary drivers that help explain a broader range of behavioral variance. For instance, Education (β = .116) and Outdoor Interest (β = .051) contribute to predicting pro-environmental habits. Additionally, this model identifies the role of variables excluded from the reduced model. Interestingly, higher perceived Climate Risk (β = -.044) and Disaster Experience (β = -.043) were associated with lower engagement in daily habits, suggesting that overwhelming abstract threats or direct disaster stress might not easily translate into simple daily routines (Table 7-1).

doi:10.6342/NTU202600747

Table 7-1

Lasso Regression Results for Daily Habits

Variable	Optimal Model Coefficient	Optimal CI (95%)	Reduced Model Coefficient	One-SE CI (95%)
(Intercept)	3.719***	[3.690, 3.748]	3.719***	[3.690, 3.750]
Gender	-.145***	[-.173, -.114]	-.107***	[-.137, -.075]
Age	.111***	[.072, .148]	.049**	[.013, .084]
Education	.116***	[.065, .160]	.032	[.000, .072]
SES	.006	[-.034, .052]	.022	[.000, .063]
Environmental Values	.020	[-.008, .052]	-	-
Environmental Attention	.095***	[.056, .132]	.087***	[.048, .122]
Outdoor Interest	.051**	[.018, .085]	.023	[.000, .057]
Intergenerational Justice	.010	[-.021, .043]	-	-
Climate Risk	-.044**	[-.075, -.013]	-	-
Habit Consequences	.116***	[.075, .158]	.110***	[.068, .150]
Trust in Government	-.011	[-.043, .016]	-	-
Personal Environmental Impact	.029	[-.003, .063]	-	-
Social Norms	.127***	[.088, .165]	.100***	[.058, .139]
Urban-Rural Residence	-.021	[-.052, .007]	-	-
Air Quality	.022	[-.010, .056]	-	-
Disaster Experience	-.043*	[-.078, -.010]	-	-
Political Affiliation	-.010	[-.040, .016]	-	-

doi:10.6342/NTU202600747

N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Policy Support (Air Pollution)

The Reduced Model (λ = .056, MSE = .367, R^2 = .165) clarifies the most stable predictors of policy support. The core predictors that remain significant are SES (β = .055), Habit Consequences (β = .063), Social Norms (β = .120), Trust in Government (β = .030), and Urban-Rural Residence (β = -.054). The negative coefficient for residence confirms that people living in urban areas are more supportive of these policies. Although Intergenerational Justice (β = .036) and Disaster Experience (β = .014) were included in this simplified model, neither reached the standard threshold for statistical significance. Other variables, such as Education, Gender, and Environmental Values, were excluded as their coefficients shrank to zero.

The Optimal Model (λ = .011, MSE = .353, R^2 = .205) retains 10 variables for a more comprehensive view. It confirms the importance of the core predictors identified in the Reduced Model—Education, Habit Consequences, Social Norms, and Urban-Rural Residence—while also highlighting additional drivers. For instance, Intergenerational Justice (β = .056), and Disaster Experience (β = .044) emerge as statistically significant predictors in this more sensitive model.

This model reveals nuances that the stricter model missed. The significance of factors such as Intergenerational Justice and Trust in Government in this version indicates that they are valid secondary drivers of policy support, even if less robust than social norms or education (Table 7-2).

Notably, while political affiliation is theoretically expected to influence policy support, its direct impact in this analysis was minimal. This is likely attributable to the high proportion of respondents—58.7%—who identified as independent, neutral, or

doi:10.6342/NTU202600747

declined to state a preference, thereby diluting the statistical signal of partisan identity. However, the potential influence of political orientation may still be inferred indirectly through the significant role of Trust in Government found in the Optimal Model. Since trust often aligns with support for the incumbent administration, this variable likely captures some of the underlying political sentiment that the explicit affiliation data failed to reveal.

Table 7-2

Lasso Regression Results for Policy Support

-	**Optimal Model Coefficient**	**Optimal CI (95%)**	**Reduced Model Coefficient**	**One-SE CI (95%)**
(Intercept)	3.654***	[3.624, 3.686]	3.654***	[3.622, 3.687]
Gender	-	-	-	-
Age	.020	[.000, .060]	-	-
Education	.008	[.000, .063]	-	-
SES	.079**	[.027, .114]	.055**	[.014, .089]
Environmental Values	-	-	-	-
Environmental Attention	-	-	-	-
Outdoor Interest	-	-	-	-
Intergenerational Justice	.056**	[.018, .093]	.036	[.000, .072]
Climate Risk	-	-	-	-
Habit Consequences	.071***	[.028, .114]	.063**	[.019, .105]
Trust in Government	.062***	[.029, .095]	.030*	[.000, .062]
Personal Environmental Impact	-	-	-	-
Social Norms	.135***	[.094, .176]	.120***	[.075, .161]
Urban-Rural Residence	-.074***	[-.107, -.040]	-.054**	[-.086, -.020]
Air Quality	-	-	-	-

doi:10.6342/NTU202600747

Disaster Experience	.044*	[.009, .076]	.014	[.000, .046]
Political Affiliation	.023	[.000, .053]	-	-
N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.				

Community Action

The Reduced Model (λ = .043, MSE = .332, R^2 = .115) indicates which predictors for community participation are the most robust. In this highly restricted model, two core predictors remain statistically significant: Environmental Attention (β = .099) and Age (β = .037). This suggests that community engagement is fundamentally driven by cognitive attention to environmental issues and is more prevalent among older individuals. Although Trust in Government (β = -.021), Outdoor Interest (β = .025), Air Quality Perception (β = .014), and Gender (β = .001) were included in the model, their confidence intervals included zero, indicating they are less stable predictors in this strict selection.

In contrast, the Optimal Model (λ = .003, MSE = .318, R^2 = .163) retains all 17 variables, providing a much richer picture. It confirms Environmental Attention (β = .121) and Age (β = .091) as primary drivers but also reveals numerous secondary predictors. The model identifies positive associations with Outdoor Interest (β = .052), Urban-Rural Residence (β = .037), Air Quality Perception (β = .040), and Gender (β = .047).

Interestingly, this model confirms two significant negative predictors: Trust in Government (β = -.049) and Social Norms (β = -.043). This suggests that higher institutional trust and strong social pressure are, counterintuitively, associated with lower community participation. The emergence of Age and Gender as significant predictors in this comprehensive model underscores the role of demographic resources

doi:10.6342/NTU202600747

in enabling local action, supporting the Pattern of the "Community-Centric Actor" (Table 7-3).

Table 7-3

Lasso Regression Results for Community Action

Variable	Optimal Model Coefficient	Optimal CI (95%)	Reduced Model Coefficient	One-SE CI (95%)
(Intercept)	1.444***	[1.413, 1.474]	1.444***	[1.412, 1.476]
Gender	.047***	[.018, .078]	.001	[.000, .032]
Age	.091***	[.051, .130]	.037*	[.003, .071]
Education	.033	[-.006, .079]	-	-
SES	.003	[-.035, .052]	-	-
Environmental Values	.003	[-.021, .034]	-	-
Environmental Attention	.121***	[.084, .156]	.099***	[.062, .133]
Outdoor Interest	.052**	[.017, .084]	.025	[.000, .058]
Intergenerational Justice	-.014	[-.050, .011]	-	-
Climate Risk	.015	[-.010, .047]	-	-
Habit Consequences	.012	[-.019, .052]	-	-
Trust in Government	-.049**	[-.082, -.015]	-.021	[-.055, .000]
Personal Environmental Impact	.025	[.000, .053]	-	-
Social Norms	-.043*	[-.081, -.008]	-	-
Urban-Rural Residence	.037*	[.002, .071]	-	-
Air Quality	.040*	[.004, .076]	.014	[.000, .047]
Disaster Experience	.031	[.000, .067]	-	-
Political Affiliation	-.001	[-.030, .023]	-	-

N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

doi:10.6342/NTU202600747

Willingness to Pay

The Reduced Model (λ = .043, MSE = .332, R^2 = .115) identifies the most stable predictors of financial willingness. Only Habit Consequences (β = .085) are significant and shown as the core predictors in this restricted model. Other variables such as Education (β = .073), SES (β = .019), Urban-Rural Residence (β = -.045), Environmental Attention (β = .017), Intergenerational Justice (β = .061), Trust in Government (β = .019), and Social Norms (β = .026) did not pass the significance test in this strict iteration. Demographic factors such as Gender and Age were excluded entirely.

The Optimal Model (λ = .003, MSE = .318, R^2 = .163) retains 13 variables. It confirms the importance of Habit Consequences (β = .097) in the reduced model and reveals several other significant drivers. Gender (β = .057), Intergenerational Justice (β = .087), Urban-Rural Residence (β = -.088), Habit Consequences (β = .097), and Trust in Government (β = .080) emerge as statistically significant predictors.

This model clarifies the role of variables that were non-significant or excluded in the stricter model. Factors such as Intergenerational Justice or Trust in Government are proven to be valid predictors, albeit requiring a more sensitive model to be detected. The emergence of Gender and Environmental Attention as significant predictors in this model is also a key finding, indicating that they play a secondary but important role in predicting an individual's willingness to bear financial costs for environmental protection (Table 7-4).

Table 7-4

Lasso Regression Results for Willingness to Pay

Variable	Optimal Model Coefficient	Optimal CI (95%)	Reduced Model Coefficient	One-SE CI (95%)

doi:10.6342/NTU202600747

(Intercept)	2.922***	[2.868, 2.978]	2.922***	[2.870, 2.976]
Gender	.057*	[.001, .113]	-	-
Age	.019	[-.008, .086]	-	-
Education	.120**	[.036, .194]	.073	[.000, .131]
SES	.033	[.000, .118]	.019	[.000, .101]
Environmental Values	.047	[.000, .102]	.005	[.000, .060]
Environmental Attention	.047	[.000, .106]	.017	[.000, .075]
Outdoor Interest	-	-	-	-
Intergenerational Justice	.087**	[.023, .151]	.061	[.000, .125]
Climate Risk	-	-	-	-
Habit Consequences	.097**	[.023, .166]	.085*	[.009, .148]
Trust in Government	.080**	[.024, .136]	.019	[.000, .075]
Personal Environmental Impact	.030	[.000, .089]	-	-
Social Norms	.058	[.000, .124]	.026	[.000, .093]
Urban-Rural Residence	-.088**	[-.142, -.030]	-.045	[-.097, .000]
Air Quality	-	-	-	-
Disaster Experience	-	-	-	-
Political Affiliation	.013	[-.010, .067]	-	-
N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.				

Public Action

The Reduced Model (λ = .030, MSE = .061, R^2 = .043) selected none of the variables as a robust predictor of Public Action. This indicates that none of the variables is strong enough to predict public action under a strict assumption.

However, the Optimal Model (λ = .003, MSE = .058, R^2 = .106) retains 13 variables and provides a broader view of the factors influencing public engagement.

doi:10.6342/NTU202600747

The predictors that reached statistical significance in this model include Age (β = -.028), Education (β = .036), Environmental Attention (β = .032), and Urban-Rural Residence (β = -.022).

Although Gender (β = -.010), SES (β = .009), and several risk variables were included in the model, none reached statistical significance. The fact that none of the variables survived the stringent selection of the Reduced Model suggests that, while the Optimal Model identifies a broader array of relevant factors, those relationships should be interpreted with caution, as their effects may be less stable than those of socio-demographic resources (Table 7-5).

Table 7-5

Lasso Regression Results for Public Action

Variable	Optimal Model Coefficient	Optimal CI (95%)	Reduced Model Coefficient	One-SE CI (95%)
(Intercept)	.107***	[.094, .120]	.107***	[.094, .121]
Gender	-.011	[-.024, .000]	-	-
Age	-.028**	[-.046, -.012]	-	-
Education	.036**	[.011, .051]	-	-
SES	.002	[-.006, .025]	-	-
Environmental Values	-	-	-	-
Environmental Attention	.032***	[.019, .046]	-	-
Outdoor Interest	.013	[.000, .026]	-	-
Intergenerational Justice	.007	[-.003, .022]	-	-
Climate Risk	.001	[-.008, .016]	-	-
Habit Consequences	.006	[-.003, .019]	-	-
Trust in Government	-.008	[-.022, .000]	-	-

doi:10.6342/NTU202600747

Personal Environmental Impact	.004	[-.004, .018]	-	-
Social Norms	.000	[-.011, .018]	-	-
Urban-Rural Residence	-.022**	[-.035, -.008]	-	-
Air Quality	-	-	-	-
Disaster Experience	.010	[.000, .025]	-	-
Political Affiliation	.009	[.000, .024]	-	-
N = 1,383. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.				

4.5 Canonical Correlation Analysis (CCA)

Finally, to analyze what characteristics incline toward one specific type of PEB rather than others, I used CCA to explore the multivariate relationships. The results are shown in the following tables.

Table 8-1 displays five canonical functions, each representing a distinct pattern of association between the independent variables (predictors) and dependent variables (behaviors). The overall model was highly significant (Wilks' λ = .396, F(85, 6071) = 15.101, p < .001), indicating a strong relationship between the two groups. Further analysis confirmed that the top four canonical functions were statistically significant.

Table 8-1

Summary of Canonical Correlation Analysis Results

Function	Canonical Correlation (Rc)	Eigenvalue	Wilks' Lambda	F Value	df1	df2	P value
1	.654	.747	.396	15.101	85	6071	<.001
2	.408	.199	.691	8.760	64	4919	<.001
3	.317	.112	.829	5.406	45	3735	<.001
4	.248	.066	.922	3.724	28	2516	<.001
5	.132	.018	.983	1.712	13	1259	.053

doi:10.6342/NTU202600747

The Awakened Citizen (*Rc* = .654)

The first canonical function (Table 8-2) represents the strongest relationship. It explains 13.7% of the variance in the predictor variables and 28.8% of the variance in the environmental action variables, making it the most important pattern in the dataset.

This function describes the concept of the "Awakened Citizen." This Pattern is defined not by demographics but by a robust set of psychological cognitions. The strongest predictors are Habit Consequences (loading = .718) and Social Norms (loading = .665), which are also coupled with high Environmental Attention (loading = .528) and Personal Environmental Impact (loading = .302). This indicates that the primary drivers of engagement are concrete, visible, and socially relevant threats (such as plastic pollution). In contrast, weak loading is observed in abstract risk, for example, Climate Risk (loading = .068).

This psychological state translates most strongly into private-sphere actions, such as Daily Habits (loading = .875), as well as strong Policy Support (loading = .602). This Pattern is also associated with a Willingness to Pay (loading = .417) and, to a lesser extent, Public Action (loading = .300).

Table 8-2

Key Canonical Loadings for the Awakened Citizen

Variable Set	Variable Name	Loading
Predictors	Habit Consequences	.718
	Social Norms	.665
	Environmental Attention	.528
	Intergenerational Justice	.422
	Socioeconomic Status	.383
	Outdoor Interest	.335
	Education	.314

doi:10.6342/NTU202600747

	Gender	-.341
	Urban-Rural Residence	-.303
	Environmental Values	.296
	Personal Environmental Impact	.302
Outcomes	Daily Habits	.875
	Policy Support	.602
	Willingness to Pay	.417
	Public Action	.300

The Community-Centric Actor (*Rc* = .408)

The second canonical function (Table 8-3) identifies a distinct pathway to environmentalism that differs from the first. This function paints a picture of the "Community-Centric Actor."

Demographically and geographically, this actor is significantly older (Age, loading = .541) and resides in a rural area (Urban-Rural Residence, loading = .371). Psychologically, they share a high level of Environmental Attention (loading = .534) with the "Awakened Citizen," but their defining feature is a profound lack of Trust in Government (loading = -.467).

Behaviorally, their engagement is almost exclusively channeled into Community

doi:10.6342/NTU202600747

Action (loading = .770). Critically, this local action comes at the expense of engagement with the state system, as evidenced by a strong negative loading on Policy Support (loading = -.540). They act locally, not nationally.

Table 8-3

Key Canonical Loadings for the Community-Centric Actor

Variable Set	Variable Name	Loading
Predictors	Age	.541
	Environmental Attention	.534
	Urban-Rural Residence	.371
	Trust in Government	-.467
	Outdoor Interest	.319
	Education	-.294
Outcomes	Community Action	.770
	Policy Support	-.540

The Public-Sphere Mobilizer (*Rc* = .317)

The third canonical function (Table 8-4) identifies a pattern of environmentalism driven by a unique intersection of social resources and firsthand experience. This Pattern, termed the "Public-Sphere Mobilizer," is characterized by being male (loading = .624), possessing a higher level of Education (loading = .418), and reporting a higher SES (loading = .329). The critical catalyst for this group is personal Disaster Experience (loading = .434), which serves as a potent trigger for mobilization.

The behavioral response of this Pattern is exclusively oriented toward public and collective domains. This group shows significant engagement in Community Action (loading = .534), a high Willingness to Pay (loading = .457), and involvement in Public Action (loading = .497). Notably, this public-facing activism is coupled with a negative tendency toward private-sphere Daily Habits (loading = -.366). This suggests that for

doi:10.6342/NTU202600747

individuals with greater socio-economic resources, firsthand experience with extreme weather events does not necessarily lead to personal lifestyle changes, but instead fosters a drive toward systemic, financial, and community-based solutions.

Table 8-4

Key Canonical Loadings for the Public-Sphere Mobilizer

Variable Set	Variable Name	Loading
Predictors	Gender	.624
	Disaster Experience	.434
	Education Level	.418
	Socioeconomic Status	.329
Outcomes	Community Action	.534
	Willingness to Pay	.457
	Public Action	.497
	Daily Habits	-.366

The Youth Activist (*Rc* = .248)

The fourth function isolates a distinct pattern of environmentalism (Table 8-5). While this function is statistically significant ($p < .001$), the canonical correlation is relatively low ($Rc = .248$), suggesting a weak association between the two sets of variables. The Pattern identified here, the "Youth Activist," is characterized by youth (Age, loading = -.596) and higher education (loading = .402). Their behavioral expression is concentrated in Public Action (loading = .758), with a negative tendency toward Policy Support (loading = -.442). However, given the low correlation, this Pattern should be interpreted with caution. It suggests that while a "Youth Activist" tendency exists—marked by a preference for outsider tactics over conventional policy support—the relationship is not as robust as the primary Patterns. It likely represents a minority trend or a less cohesive group within the broader Taiwanese context, requiring

doi:10.6342/NTU202600747

further investigation to validate its stability.

Table 8-5

Key Canonical Loadings for the Youth Activist

Variable Set	Variable Name	Loading
Predictors	Age	-.596
	Gender	-.421
	Education	.403
Outcomes	Public Action	.758
	Policy Support	-.442

doi:10.6342/NTU202600747

5. Discussion

This study aims to revise the monolithic concept of "pro-environmental behavior" in the Taiwanese context. By integrating the TPB and VBN frameworks with a data-driven taxonomy, this paper revealed a complex landscape of environmental citizenship that challenges the "one-size-fits-all" approach.

5.1 The Multidimensional Construct of PEB in Taiwan

First, the Exploratory Factor Analysis successfully categorized the vast array of environmental behaviors into five statistically distinct and conceptually coherent constructs: Daily Habits, Policy Support, Willingness to Pay, Community Action, and Public Action.

The literature review highlighted several established theoretical frameworks for classifying PEBs, such as distinguishing between public and private spheres or between low-cost and high-cost behaviors. However, our data-driven approach reveals a more complex landscape. While the results challenge simplistic taxonomies, they show that Taiwanese citizens organize their behavior into logical clusters that mix these features in specific ways.

The Daily Habits factor, which includes actions like avoiding disposable utensils or carrying a shopping bag, aligns well with the classic conception of private-sphere behavior. As discussed by Stern (1992) and Casaló et al. (2019), these are characterized as low-cost, direct, and high-frequency actions embedded in everyday routines.

A significant finding is the clear distinction between Policy Support and Willingness to Pay. Policy Support (e.g., supporting stricter emission standards) represents an endorsement of "command-and-control" regulations, in which the state

doi:10.6342/NTU202600747

imposes rules. In contrast, Willingness to Pay reflects an acceptance of market-based instruments and personal financial sacrifice, such as higher taxes or prices. The fact that these emerged as statistically independent factors implies that the psychological drivers for supporting government rules are not the same as those for accepting costs out of one's own pocket.

Similarly, Community Action and Public Action capture fundamentally different modes of public participation. Community Action—which includes participating in neighborhood cleanups or reporting local pollution—is inherently place-based, collaborative, and hands-on. It reflects engagement with one's immediate physical surroundings, aligning with the "Community PEB" identified by Lu (2022) in Taiwan.

Public Action, conversely, involves donating to environmental NGOs and signing petitions. This form of engagement is more individualistic, less place-bound, and directed at broader national issues. It represents a form of civic participation that requires less direct social interaction than community organizing. It is worth noting that high-cost political actions, such as attending protests, did not cluster into this group, suggesting that this construct represents a more "dutiful" rather than "disruptive" form of engagement.

Overall, the EFA results empirically validate the perspective of scholars like Bain et al. (2015) and Markle (2013) that PEB is inherently multidimensional. This paper has successfully identified a specific PEB taxonomy that reflects Taiwan's unique context.

5.2 Key Drivers in Different Pro-environmental Behaviors

The Correlation and Lasso regression analyses provided a detailed examination of the variables that predict engagement in each of the five PEB domains shown in Table

doi:10.6342/NTU202600747

9. Comparing the Optimal and Reduced models revealed compelling patterns: some factors, like specific risk perceptions, demonstrated broad predictive power across multiple behaviors, while others, particularly trust in government, exhibited paradoxical effects.

The Dominance of Concrete over Abstract Risks

A consistent finding across the Lasso regression models is the superior predictive power of variables related to Daily Habits compared to those related to climate change. Even though Daily Habits (such as reducing plastic) cover only a specific slice of environmental issues, the cognitions associated with them—specifically Habit Consequences and Social Norms—are the most robust predictors across multiple categories. Surprisingly, they even predict behaviors not directly related to waste, such as Policy Support. In contrast, although climate change is a major global issue, Climate Risk proved to be a weak predictor of action in Taiwan.

Why do variables related to daily waste predict behavior better than those related to climate change? This disparity can be explained through the lens of psychological distance (Trope & Liberman, 2010).

The issues underlying Daily Habits, such as plastic pollution, are obvious in everyday life. They imply a short "spatial distance" (litter is visible in one's living space), "temporal distance" (the waste is created now), and "social distance" (it affects the individual and their family directly). Research by McDonald et al. (2015) suggests that low psychological distance leads to a more concrete, emotionally engaging understanding of an issue, which drives action.

Conversely, climate change is often perceived as psychologically distant. Even though our variables include Climate Risk Perception specific to Taiwan, it remains an

doi:10.6342/NTU202600747

Table 9 *Drivers & Factors of each PEB under Lasso Regression*

PEB	Core Drivers	Secondary Factors	Mechanism & Insight
Daily Habits	• Gender (Female) • Age (Older) • Environmental Attention (+) • Habit Consequences (+) • Social Norms (+)	• Outdoor Interest (+) • Education (+) • Personal Env. Impact (+) • Climate Risk (-) • Disaster Experience (-)	Driven by Immediate Reality: Behaviors are motivated by concrete, visible threats (waste) and social pressure. Abstract risks (Climate) or overwhelming trauma (Disaster) are negatively associated, suggesting withdrawal.
Policy Support	• SES (+) • Trust in Government (+) • Habit Consequences (+) • Social Norms (+) • Urban-Rural (Urban)	• Intergenerational Justice (+) • Disaster Experience (+)	The Role of Trust: Unlike daily habits, supporting state regulations requires Trust in Government. It is also strongly linked to urban living (higher exposure to pollution) and SES.
Community Action	• Age (Older) • Environmental Attention (+)	• Trust in Government (-) • Social Norms (-) • Urban-Rural (Rural) • Outdoor Interest (+) • Gender (Male) • Air Quality Perception (+)	The Trust Paradox & Local Focus: Core engagement relies on age and attention. Interestingly, secondary factors reveal that this behavior is associated with low institutional trust and low conventional social norms, representing grassroots self-reliance.
Willingness to Pay	• Habit Consequences (+)	• Gender (Male) • Education (+) • Urban-Rural (Urban) • Trust in Government (+) • Intergenerational Justice (+) • Habit Consequences (+)	Consequence-Driven Sacrifice: The only robust core driver is the concrete awareness of habit consequences. Financial/systemic factors, such as education, trust in the state, and urban residence, act only as secondary enablers.
Public Action	• None	• Education (+) • Age (Younger) • Environmental Attention (+) • Urban-Rural (Urban)	Fluid Engagement: Lacks a single dominant robust driver under strict selection. However, the optimal model highlights a tendency among younger, educated, urban demographics, which contrasts sharply with the older, rural demographic of Community Action.

doi:10.6342/NTU202600747

An issue characterized by high temporal distance (consequences occur in the future) and hypothetical distance (the impact feels uncertain).

The Paradox of Trust in Government

A second major finding concerns the role of Trust in Government. The correlation analysis revealed that this variable is largely isolated from other Environmental Values and beliefs, suggesting it operates on a different psychological plane. The Lasso models confirmed its ambiguous role: Trust in Government is positively associated with support for top-down, state-led interventions (Policy Support, Willingness to Pay), while simultaneously being negatively associated with engagement in bottom-up, grassroots Community Action.

This reveals two distinct, and sometimes oppositional, pathways to environmental citizenship:

The "Dutiful Citizen": Individuals with high Trust in Government are more willing to support complex and costly policies, which aligns with the results of global studies (Hadler et al., 2024). Measures such as emission restrictions or carbon taxes require citizens to make sacrifices for a public good whose benefits are diffuse and long-term. Support for this initiative is predicated on the belief that the government is competent enough to implement the policy and honest enough to use the revenue wisely. As scholars like Kulin and Johansson (2021) argue, political trust acts as a lubricant, reducing the perceived risk of ceding authority to the state.

The "Vigilant Citizen": The significant negative relationship between Trust in Government and Community Action suggests a different motivation. When citizens distrust the state's ability or willingness to protect their local environment, they take matters into their own hands. Research indicates that communities with higher

doi:10.6342/NTU202600747

skepticism of the government often prefer local control and community-led management (Putnam, 2000). This aligns with the history of Taiwan's environmental movement, which largely emerged from grassroots protests against state-backed industrial projects perceived as threatening local health (Ho, 2003).

5.3 The Four Faces of Taiwanese Environmentalism

Last but not least, the Canonical Correlation Analysis (CCA) synthesizes diverse variables to reveal four distinct latent patterns of environmental engagement: the Awakened Citizen, the Community-Centric Actor, the Public-Sphere Mobilizer, and the Youth Activist. The results are shown in Table 10. It is important to note that these typologies do not describe fixed, empirical groups of individuals. Instead, they represent an alignment of variables—a thematic convergence where specific demographics, psychological cognitions, and contextual factors interact to increase the probability of certain behavioral choices. These "faces" illustrate the underlying logic of environmentalism in the Taiwanese context, highlighting how different configurations of predictors foster specific engagement propensities.

Pattern 1: The Awakened Citizen

The first canonical function identifies a thematic convergence in which environmental engagement is driven by a latent pattern of psychological variables rather than by fixed demographic markers. Within this alignment, a high awareness of Habit Consequences, a strong sensitivity to Social Norms, and heightened Environmental Attention interact to significantly increase the probability of a wide-ranging behavioral repertoire. In this configuration, the perceived impact of one’s personal footprint acts as a primary catalyst, fostering a behavioral propensity most pronounced in the formation of Daily Habits. Furthermore, the influence of these

doi:10.6342/NTU202600747

specific predictors extends into the public sphere, increasing the likelihood of Policy Support and a higher Willingness to Pay.

This variable-centric structure reflects the causal chain proposed by the Value-Belief-Norm (VBN) theory, wherein the intersection of threat-related beliefs and social expectations activates a personal norm that drives diverse forms of engagement (Stern, 2000). In this context, the clustering of these psychological factors provides the internal logic necessary to bridge the gap between individual intention and systemic support.

Pattern 2: The Community-Centric Actor

This pattern identifies a thematic shift in which environmental engagement is redirected toward local, autonomous participation, embodying the "Vigilant Citizen" pathway. An alignment of higher age and rural residence with a high degree of Environmental Attention characterizes this configuration. However, the pivot point of this cluster is a profound lack of Trust in Government, which dictates a specific behavioral propensity.

Within this alignment, environmental efforts are channeled almost exclusively into Community Action. The combination of institutional skepticism and localized concern suggests that the propensity for community-level engagement often occurs in place of participation in state-led initiatives, as shown by the negative association with Policy Support. This logic reflects Taiwan’s historically robust tradition of local environmentalism, where grassroots mobilization has served as a critical check on state power and industrial development (Ho, 2003). In this view, when environmental attention is high but institutional trust is low, the resulting engagement prioritizes local agency over national policy frameworks.

doi:10.6342/NTU202600747

Pattern 3: The Public-Sphere Mobilizer

The third pattern identifies a proactive engagement pathway driven by a thematic convergence of high social resources and firsthand experience. This configuration is characterized by the alignment of higher levels of Education, higher SES, and male gender. The critical catalyst within this cluster is a high degree of personal Disaster Experience, which directs the resulting behavioral propensity toward systemic mobilization rather than private coping.

Experiencing extreme environmental disaster or trauma sometimes is associated with a psychological coping mechanism centered on retreat (Cunsolo & Ellis, 2018). However, this high-resource alignment suggests a significant departure from this expected retreat. Rather than intensifying Daily Habits, this pattern is characterized by a withdrawal from the private sphere in favor of a robust commitment to public-facing engagement, including Public Action, Willingness to Pay, and Community Action.

This finding suggests that for individuals with greater socio-economic capacity, disaster experience functions as a catalyst for collective agency rather than a trigger for personal retreat. This aligns with research in the Taiwanese context, indicating that direct Disaster Experience is a strong positive predictor of disaster mitigation and preparation efforts (Yang & Lee, 2021) and that pro-environmental intentions are often a direct response to one's physical environment and tangible threats (Yang, 2013). For this specific configuration, those reactive measures are not limited to the private domain. However, they are channeled into systemic and community-based solutions, reflecting a perception that individual lifestyle changes are insufficient to address macro-level environmental failures.

doi:10.6342/NTU202600747

Pattern 4: The Youth Activist

The fourth pattern identifies a politically distinct pathway of engagement, focusing on high-threshold activism. A thematic convergence of younger age, female gender, and higher levels of Education characterizes this configuration. Within this alignment, the resulting behavioral propensity is overwhelmingly focused on Public Action, such as signing petitions and making donations, while simultaneously showing a significant negative association with Policy Support.

This pattern illustrates an environmental logic rooted in dissent and outsider influence rather than conventional participation. The clustering of high educational resources with a younger demographic suggests a propensity toward skepticism of existing political structures. For this specific configuration, environmental engagement is expressed through "outsider" tactics—aimed at forcing change from the margins—rather than through "dutiful" support for current government policy frameworks. This reflects a broader trend: individuals with high cognitive resources who perceive institutional inertia are more likely to bypass conventional policy channels in favor of disruptive or independent public advocacy.

doi:10.6342/NTU202600747

Table 10

Relationships between Variables & PEBs under Canonical Correlation Analysis

Category	Variables	F1: Awakened Citizen	F2: Community-Centric Actor	F3: Public-Sphere Mobilizer	F4: Youth Activist
Predictors	**Gender (Male)**			+	-
	Age		+		-
	Education			+	+
	SES			+	
	Env. Attention	+	+		
	Habit Consequences	+			
	Social Norms	+			
	Trust in Government		-		
	Residence (Rural)		+		
	Disaster Experience			+	
Actions	**Daily Habits**	+		-	
	Policy Support	+	-		-
	Community Action		+	+	
	Willingness to Pay	+		+	
	Public Action	+		+	

5.4 Limitations and Future Research

While this study offers a robust typology of environmental actors in Taiwan, several limitations regarding data structure and measurement must be acknowledged to guide future scholarship.

First, as this study relied on secondary data from the Taiwan Social Change Survey (TSCS), the operationalization of theoretical constructs was constrained by the

doi:10.6342/NTU202600747

questionnaire items available. A primary limitation is the absence of a direct measure for Perceived Behavioral Control (PBC), a core component of the Theory of Planned Behavior (TPB). Without assessing an individual's perceived capability or ease of performing actions, our model may overestimate the influence of values and norms while underestimating structural barriers, particularly for high-cost behaviors such as policy support.

Second, the specificity of certain variables limits the scope of our analysis. For instance, questions measuring Social Norms were framed specifically around Daily Habits (e.g., plastic reduction). Consequently, we could not empirically test whether social pressure plays a similar role in driving Public Action or Willingness to Pay. Future primary research should develop domain-specific measures to investigate whether peer pressure operates differently across private and public spheres.

Furthermore, the measurement of the dependent variable (PEB) is inherently inconsistent in distinguishing between behavioral intention and actual behavior. Due to the design of the source questionnaire, some constructs were measured by asking about willingness, while others were measured by reporting actual frequency. Although our Factor Analysis confirmed that these items cluster statistically, theoretically, intention is an antecedent to behavior, not the behavior itself. There might be a gap between intention and action, leading to an overestimation of actual environmental engagement.

Third, the cross-sectional design of this study precludes causal inference. While this paper identified distinct Patterns, such as the Youth Activist and the Awakened Citizen, it cannot determine whether these are stable traits or developmental stages. For example, do Youth Activists naturally evolve into Awakened Citizens as they mature and become more willing to support institutional solutions? Or do they become

doi:10.6342/NTU202600747

Community-Centric Actors as they grow disillusioned with national politics? Longitudinal studies are urgently needed to track the life-course evolution of these environmental Patterns.

Fourth, like most large-scale surveys, this study relies on self-reported behaviors. There is a well-documented risk of social desirability bias, where respondents may overreport "virtuous" behaviors, such as daily habits or Willingness to pay. Future studies would benefit from incorporating objective data—such as household energy records or actual donation receipts—to validate the gap between reported intention and actual impact.

Finally, this study is deeply embedded in the Taiwanese context—a society characterized by high collectivism, high disaster experience, and a unique democratic history. The paradox I observed, where low trust in government fuels grassroots community action, may be specific to Taiwan's political landscape. Comparative studies are needed to test whether this "Vigilant Citizen" model is held in Western democracies, where low trust might instead lead to political apathy. Exploring these cross-cultural differences would significantly enrich the global understanding of environmental citizenship.

doi:10.6342/NTU202600747

6. Conclusion

This study confirms that environmentalism in Taiwan is not a uniform construct, but a complex landscape composed of heterogeneous groups. By integrating the TPB-VBN framework with a data-driven taxonomy, this paper successfully deconstructs the monolithic concept of "pro-environmental behavior," offering a more granular understanding of Taiwanese environmental citizenship.

First, this study empirically establishes a multidimensional taxonomy of environmental action. We categorized PEBs into five distinct constructs, ranging from Daily Habits to Public Action. Crucially, this classification advances local literature by disaggregating the "public sphere": we proved that Policy Support and Willingness to Pay are driven by fundamentally different mechanisms. While support for state regulations is heavily dependent on citizens' socio-economic status (SES) and social norms, the willingness to make personal financial sacrifices is uniquely and robustly driven by a deep awareness of tangible environmental impacts (Habit Consequences). This indicates that while regulatory support can be facilitated by social pressure and economic stability, convincing citizens to voluntarily absorb environmental costs requires them to fundamentally internalize the concrete consequences of their daily actions.

Second, analyzing the drivers of these behaviors revealed critical—and sometimes paradoxical—patterns. We found that Psychological Distance plays a decisive role, where concrete, immediate concerns (like waste) are far stronger predictors of action than abstract Climate Risk. Furthermore, we identified a "Trust Paradox" that challenges the assumption that trust is always a prerequisite for engagement. Our results

doi:10.6342/NTU202600747

show that while high trust fosters "Dutiful Citizens" who support state policies, low trust does not lead to apathy but paradoxically fuels "Vigilant Citizens" who engage in grassroots Community Action.

Finally, the central contribution of this research is the transition from variable-based analysis to a holistic typology. Moving beyond isolated predictors such as gender or income, we used Canonical Correlation Analysis to map the "Four Faces of Taiwanese Environmentalism": the Awakened Citizen, the Community-Centric Actor, the Public-Sphere Mobilizer, and the Youth Activist.

For practical implications, this typology signals the end of "one-size-fits-all" campaigns. Effective intervention requires precise targeting: state-centric appeals may alienate Community-Centric Actors who distrust central authority, whereas mobilizing Youth Activists requires channels for disruptive expression. By recognizing these diverse Patterns, policymakers and NGOs can design more effective strategies that resonate with the specific psychological and political realities of different Taiwanese citizens.

doi:10.6342/NTU202600747

References

林宗弘、蕭新煌、許耿銘（2018）。邁向世界風險社會？台灣民眾的社會資本、風險感知與風險因應行為。調查研究-方法與應用，(40)，127-166。https://doi.org/10.7014/SRMA.2018090003

黃毅志（2003）。「臺灣地區新職業聲望與社經地位量表」之建構與評估：社會科學與教育社會學研究本土化。教育研究集刊，(49:4)，1-31。https://doi.org/10.6910/BER.200312_(49-4).0001

吳柏賢（2020）。老舊石化工業設施的風險性與地方感知：以高雄市大社石化工業區為例。〔碩士論文。國立政治大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/gbrafk。

張家芸（2024）。環境風險知覺對環境行為的影響。〔碩士論文。逢甲大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/d5vp58。

李致穎（2022）。臺灣民眾對能源政策偏好因素之探討。〔碩士論文。國立臺北大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/5tv8ka。

呂芯柔（2022）。親自然經驗與利環境行為：城鄉差異〔碩士論文，國立臺灣大學〕。華藝線上圖書館。https://doi.org/1.6342/NTU2230314

施奕任（2012）。全球暖化與台灣的氣候政治-以《溫室氣體減量法》為例。〔博士論文。國立政治大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/r7k683。

楊欣諭（2013）。自我效能在台灣民眾環境關切與環境行為中扮演的角色。〔碩士論文。國立臺灣大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/95wb9f。

郭芝宇（2013）。台灣人民對氣候變遷的認知與反應。〔碩士論文。國立臺灣海洋大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/u7ppt3。

左金蘭（2013）。環境風險認知與環境態度、環境行為之研究—以臺灣成年民眾為例。〔碩士論文。元智大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/43ax4m。

doi:10.6342/NTU202600747

陳郁安、謝雨生（2016）。臺灣民眾社經地位對環境行為的影響。調查研究-方法與應用，(35)，7-45。https://doi.org/1.714/SRMA.20164001

蔣亞庭（2014）。個人環境行為經濟與非經濟因素之分析。〔碩士論文。國立中央大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/j4nv79。

丁太平.（2019）. 环境治理结构与风险认知：两岸民众环保行动的比较。台湾研究集刊，(1)，85-96.

盧宛如（2017）。誰在購買有機蔬果？經濟、文化資本與機會結構。〔碩士論文。國立臺北大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/99e937。

柯文凱（2015）。環境行為的決定因素。〔碩士論文。嶺東科技大學〕臺灣博碩士論文知識加值系統。 https://hdl.handle.net/11296/9y492p。

鄭雅方（2015）。天有不測風雨，誰能自求多福？天然災害風險知覺與防備行為之研究。〔碩士論文。國立臺北大學〕臺灣博碩士論文知識加值系統。https://hdl.handle.net/11296/4mukpm。

黃建勳、黃建勳（2016）。瞭解等於行動？檢驗臺灣民眾環境知識、友善環境價值及節能減碳行為。社會研究學報，2:1 2016.4[民105.4]，59-79。

朱瑞玲、楊淑雯（2013）。臺灣民眾的利環境態度與行為：價值觀與罪感的影響。環境教育研究，9(2)，91-129。https://doi.org/1.6555/JEER.9.2.091

原承君、林翠芳.（2016）. 我國民眾對環境公共財及環境政策偏好之探討。臺北大學財政學系學位論文，1-62。

林宗弘、許耿銘、蕭新煌（2024）。減碳社會學：台灣淨零轉型的民意與挑戰。巨流圖書。

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control: From cognition to behavior* (pp. 11–39). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/1.1007/978-3-642-69746-3_2

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior 1. *Journal of Applied Social Psychology*, *32*(4), 665–683. https://doi.org/1.1111/j.1559-1816.2002.tb00236.x

doi:10.6342/NTU202600747

Bain, P. G., Hornsey, M. J., Bongiorno, R., & Jeffries, C. (2015). Promoting pro-environmental action in climate change deniers. *Nature Climate Change, 5*(10), 891–896.

Baldassare, M., & Katz, C. (1992). The personal threat of environmental problems as predictor of environmental practices. *Environment and behavior*, *24*(5), 62–616. https://doi.org/1.1177/0013916592245002

Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and behavior*, *35*(2), 264–285. https://doi.org/1.1177/0013916502250134

Blake, J. (1999). Overcoming the 'value-action gap'in environmental policy: Tensions between national policy and local experience. *Local environment*, *4*(3), 257–278. https://doi.org/1.1080/13549839908725599

Bord, R. J., O'Connor, R. E., & Fisher, A. (1998). The attitude-behavior relationship: Contributions from environmental psychology. *American Psychologist, 53*(2), 122–13.

Broomell, S. B., Kane, P. B., and Read, D. (2015). What message strategies motivate climate change mitigation? *Judgment and Decision Making, 10*(6), 491–54.

Casaló, L. V., Escario, J. J., & Ibáñez, Z. V. (2019). Analyzing differences between different types of pro-environmental behaviors: Do attitude intensity and type of attitude matter? *Resources, Conservation and Recycling, 149,* 56–64. https://doi.org/1.1016/j.resconrec.2019.05.024

Chen, M. F., & Tung, P. J. (2014). Developing an extended theory of planned behavior model to predict consumers' intention to visit green hotels. *International journal of hospitality management*, *36*, 221–23. https://doi.org/1.1016/j.ijhm.2013.09.006

Curtis, J., McCoy, D., & Aravena, C. (2018). Heating system upgrades: The role of knowledge, socio-demographics, building attributes, and energy infrastructure. *Energy policy*, *120*, 183–196. https://doi.org/1.1016/j.enpol.2018.05.036

Diamantopoulos, A., Schlegelmilch, B. B., Sinkovics, R. R., & Bohlen, G. M. (2003). Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation. *Journal of Business Research*, *56*(6), 465–48. https://doi.org/1.1016/S0148-2963(01)00241-7

doi:10.6342/NTU202600747

Diekmann, A., & Preisendörfer, P. (2003). Green and greenback: The behavioral effects of environmental attitudes in low-cost and high-cost situations. *Rationality and Society, 15*(4), 441–472. https://doi.org/1.1177/1434631315402

Fairbrother, M. (2016). Trust and public support for environmental protection in diverse national contexts. *Sociological Science*, *3*, 359–382. https://doi.org/1.15195/v3.a17

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behavior relationships: A natural experiment with curbside recycling. *Environment and behavior*, *27*(5), 699–718. https://doi.org/1.1177/0013916595275005

Hall, M. P., Lewis Jr, N. A., & Ellsworth, P. C. (2018). Believing in climate change, but not behaving sustainably: Evidence from a one-year longitudinal study. *Journal of Environmental Psychology*, *56*, 55–62. https://doi.org/1.1016/j.jenvp.2018.03.001

Helferich, M., Thøgersen, J., & Bergquist, M. (2023). Direct and mediated impacts of social norms on pro-environmental behavior. *Global Environmental Change*, *80*, 1268. https://doi.org/1.1016/j.gloenvcha.2023.102680

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education, 18*(2), 1–8. https://doi.org/1.1080/00958964.1987.9943482

Hollingshead, A. (1965). Two-factor index of social position.

Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change, 6*(6), 622–626. https://doi.org/1.1038/nclimate2943

Hsu, L. Y. A., & Chang, J. H. (2025). How did pro-environmental attitude, culture, and trust influence climate policy through different actions? In *Proceedings of the International Conference on Environmental Psychology* (*ICEP 2025*)*: Addressing environmental crisis in the face of geopolitical challenges* (pp. xx–xx). Environmental Psychology Research Center, Mykolas Romeris University.

Hungerford, H. R., Peyton, R. B., & Wilke, R. J. (1985). Goals for curriculum development in environmental education. *The Journal of Environmental Education, 17*(3), 1–6. https://doi.org/1.1080/00958964.1983.9942655

doi:10.6342/NTU202600747

Gardner, G. T., & Stern, P. C. (1996). *Environmental problems and human behavior* (pp. 25–252). Boston: Allyn and Bacon.

Gifford, R. (2011). The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, *66*(4), 29. https://doi.org/1.1037/a0023566

Gilligan, C. (1982). The contribution of women's thought to developmental theory: The elimination of sex bias in moral development research and education.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31–36. https://doi.org/1.1007/BF02291575

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2003). Contrasting the theory of planned behavior with the value–belief–norm model in explaining conservation behavior. *Journal of Applied Social Psychology, 35*(10), 2150–217. https://doi.org/1.1111/j.1559-1816.2005.tb02213.x

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior 1. *Journal of Applied Social Psychology*, *35*(10), 215–217. https://doi.org/1.1111/j.1559-1816.2005.tb02213.x

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally, and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–26. https://doi.org/1.1080/1354622214541

Kulin, J., & Johansson Sevä, I. (2021). Whom do you trust? How trust in partial and impartial government institutions influences climate policy attitudes. *Climate Policy*, *21*(1), 33–46. https://doi.org/1.1080/14693062.202.1792822

Lange, F., & Dewitte, S. (2019). Measuring pro-environmental behavior: Review and recommendations. *Journal of Environmental Psychology*, *63*, 92–10. https://doi.org/1.1016/j.jenvp.2019.04.009

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping, Springer Publishing Company.

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C. Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change*, *5*(11), 114–12. https://doi.org/1.1038/nclimate2728

doi:10.6342/NTU202600747

Liberman, N., Trope, Y., & Stephan, E. (2007). Psychological distance. *Social psychology: Handbook of basic principles*, *2*(2), 353–383.

Lin, S. P. (2013). The gap between global issues and personal behaviors: Pro-environmental behaviors of citizens toward climate change in Kaohsiung, Taiwan. *Mitigation and Adaptation Strategies for Global Change, 18,* 773–783. https://doi.org/1.1007/s11027-012-9387-1

Mackay, C. M., & Schmitt, M. T. (2019). Do people who feel connected to nature do more to protect it? A meta-analysis. *Journal of Environmental Psychology*, *65*, 11323. https://doi.org/1.1016/j.jenvp.2019.101323

Markle, G. L. (2013). Pro-environmental behavior: Does it matter how it's measured? Development and validation of the Pro-Environmental Behavior Scale (PEBS). *Human Ecology, 41*(6), 95–914. https://doi.org/1.1007/s10745-013-9614-8

Hadler, M., Fairbrother, M., González, R., Johansson Sevä, I., Liao, P. S., Méndez Lago, M., & Schweighart, M. (2024). Environmentalism around the globe. An introduction to the 2020 ISSP environment module and selected country-level findings. *International Journal of Sociology*, *54*(5-6), 309–333. https://doi.org/10.1080/00207659.2024.2419695

McAdams, D. P. (2013). The positive psychology of adult generativity: Caring for the next generation and constructing a redemptive life. In *Positive psychology* (pp. 191–25). Springer, New York, NY. https://doi.org/1.1007/978-1-4614-7282-7_13

McAndrew, F. T. (1993). *Environmental Psychology*. Thomson Brooks/Cole Publishing Co.

McDonald, R. I., Chai, H. Y., & Newell, B. R. (2015). Personal experience and the 'psychological distance' of climate change: An integrative review. *Journal of Environmental Psychology, 44,* 109–118. https://doi.org/1.1016/j.jenvp.2015.1.003

Meyer, A. (2015). Does education increase pro-environmental behavior? Evidence from Europe. *Ecological economics*, *116*, 108–121. https://doi.org/1.1016/j.ecolecon.2015.04.018

Miller, L. B., & Rice, R. E. (2024). (Mis) matched direct and moderating relationships among pro-environmental attitudes, environmental efficacy, and pro-environmental behaviors across and within 11 countries. *Plos one*, *19*(6), e34945. https://doi.org/1.1371/journal.pone.0304945

doi:10.6342/NTU202600747

Mills, B., & Schleich, J. (2012). Residential energy-efficient technology adoption, energy conservation, knowledge, and attitudes: An analysis of European countries. *Energy Policy, 49,* 616–628. https://doi.org/1.1016/j.enpol.2012.07.008

Minton, A. P., & Rose, R. L. (1997). The effects of environmental concern on environmentally friendly consumer behavior: An exploratory study. *Journal of Business Research*, *40*(1), 37–48. https://doi.org/1.1016/S0148-2963(96)00209-3

Monroe, A. D. (1979). Consistency between public preferences and national policy decisions. *American Politics Quarterly*, *7*(1), 3–19. https://doi.org/1.1177/1532673X7900700101

Sarkis, J., González-Torre, P., & Adenso-Díaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, *28*(2), 163–176. https://doi.org/1.1016/j.jom.2009.1.001

Setiawan, B., Afiff, A. Z., & Heruwasto, I. (2020). Integrating the theory of planned behavior with norm activation in a pro-environmental context. *Social Marketing Quarterly*, *26*(3), 244–258. https://doi.org/1.1177/1524500420949220

Schwartz, S. H. (1977). Normative influences on altruism. In *Advances in experimental social psychology* (Vol. 10, pp. 221–279). Academic Press. https://doi.org/1.1016/S0065-2601(08)60358-5

Stern, P. C. (1992). What psychology knows about energy conservation. *American Psychologist, 47*(10), 1224. https://doi.org/1.137/003-066X.47.1.1224

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407–424. https://doi.org/1.1111/0022-4537.00175

Steg, L. (2018). Limiting climate change requires research on climate action. *Nature Climate Change*, *8*(9), 759–761. https://doi.org/1.1038/s41558-018-0269-8

Steg, L., & Nordlund, A. (2018). Theories to explain environmental behaviour. *Environmental Psychology: an introduction*, 217–227. https://doi.org/1.1002/9781119241072.ch22

doi:10.6342/NTU202600747

Steg, L., Perlaviciute, G., van der Werff, E., & Lurvink, J. (2014). Environmental-Schwartz Value Survey (E-SVS) [Database record]. APA PsycTests. https://doi.org/1.137/t78166-000

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309–317. https://doi.org/1.116/j.jenvp.2008.1.04

Tien, Y., Huang, J. (2023). Gender Differences in Pro-Environmental Behavioral Intentions, Environmental Values, Tolerance of Environmental Protection Cost, and Confidence in Citizen Participation in Environmental Policies During the COVID-19 Pandemic in Taiwan. Polish Journal of Environmental Studies, 32(5), 4813–4823. https://doi.org/1.15244/pjoes/168851

Tobler, C., Visschers, V. H., & Siegrist, M. (2012). Addressing climate change: Determinants of consumers' willingness to act and to support policy measures. *Journal of Environmental Psychology, 32*(3), 197–207. https://doi.org/1.1016/j.jenvp.2012.02.001

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological review*, *117*(2), 44. https://doi.org/1.1037/a0018963

Trotta, G. (2018). Factors affecting energy-saving behaviours and energy efficiency investments in British households. *Energy policy*, *114*, 529–539. https://doi.org/1.1016/j.enpol.2017.12.042

Tsai, C. C., Li, X., & Wu, W. N. (2021). Explaining citizens' pro-environmental behaviours in public and private spheres: The mediating role of willingness to sacrifice for the environment. *Australian Journal of Public Administration, 80*(3), 510–538. https://doi.org/1.1111/1467-850.12504

United Nations Environment Programme. (2024). *Emissions gap report 2024: No more hot air... please!* United Nations Environment Programme. https://www.unep.org/resources/emissions-gap-report-2024

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology, 44*(3), 219–246. https://doi.org/1.1177/0095798418771807

Wiernik, B. M., Dilchert, S., and Ones, D. S. (2016). Age and employee green behaviors: A meta-analysis. *Frontiers in psychology*, *7*, 194. https://doi.org/1.3389/fpsyg.2016.00194

doi:10.6342/NTU202600747

Wu, Chyi-In (2022). 2020 Taiwan Social Change Survey (Round 8, Year 1): Environment (C0369_2) [Data file]. *Survey Research Data Archive, Academia Sinica.* https://doi.org/1.6141/TW-SRDA-C0369_2-2

Yu, T. K., Lavallee, J. P., Di Giusto, B., Chang, I. C., & Yu, T. Y. (2020). Risk Perception and response toward climate change for higher education students in Taiwan. *Environmental Science and Pollution Research, 27,* 24749–24759. https://doi.org/1.1007/s11356-019-07450-7

Zheng, D., Shen, J., Li, R., Jian, B., Zeng, J., Mao, Y., ... and Qu, M. (2022). Understanding the key factors determining rural domestic waste treatment behavior in China: A meta-analysis. *Environmental Science and Pollution Research*, *29*(8), 1076–1109. https://doi.org/1.1007/s11356-021-17999-x

Zulkepeli, L., Fauzi, M. A., Mohd Suki, N., Ahmad, M. H., Wider, W., & Rahamaddulla, S. R. (2024). Pro-environmental behavior and the theory of planned behavior: a state of the art science mapping. *Management of Environmental Quality: An International Journal*, *35*(6), 1415–1433. https://doi.org/1.1108/MEQ-10-2023-0361

doi:10.6342/NTU202600747

Appendix

Table A-1

Pro-Environmental Behavior-related questions

Questions	Scale
Daily Habits	
1. When you get takeout or dine out, are you willing to bring your own tableware (including chopsticks, forks, spoons, etc.)?	(1) Very willing (5) Very unwilling
2. When you drink water outside, how often do you use bottled water or paper cups?	(1) Always (5) Never
3. When you dine out, how often do you use disposable tableware provided by the establishment?	(1) Always (5) Never
4. When you go shopping, are you willing to bring your own shopping bag?	(1) Very willing (5) Very unwilling
5. It is very inconvenient to bring your own tableware, handkerchiefs, etc., when dining out.	(1) Strongly agree (5) Strongly disagree
6. It is easy to reduce the use of single-use items like disposable tableware and paper napkins.	(1) Strongly agree (5) Strongly disagree
Support policy (air pollution)	
7. Phase out old vehicles with a time limit (and subsidize owners for purchasing new vehicles).	(1) Strongly agree (5) Strongly disagree
8. Strictly restrict vehicle pollution emission standards and increase fines.	(1) Strongly agree (5) Strongly disagree
9. Use tax revenue to subsidize the construction and operational losses of the public transportation system.	(1) Strongly agree (5) Strongly disagree
10. Levy a pollution tax on gasoline and diesel to reflect the damage caused by air pollution.	(1) Strongly agree (5) Strongly disagree
11. Levy an energy tax on vehicles to subsidize users of public transportation.	(1) Strongly agree (5) Strongly disagree
Willingness to Pay	
12. And how willing would you be to pay much higher taxes in order to protect the environment?	(1) Very willing (5) Very unwilling
13. How willing would you be to pay much higher prices in order to protect the environment?	(1) Very willing (5) Very unwilling
Community action	
14. How often do you participate in community environmental work (e.g., cleaning drains, community patrols)?	(1) Often (4) Never
15. How often do you report situations in your	(1) Often (4) Never

doi:10.6342/NTU202600747

	community that could be dangerous during a natural disaster (e.g., unsecured signs, clogged drains, or waste soil piled by riverbeds)?	
16.	How often do you report situations that cause environmental pollution in your community (e.g., noise, garbage, wastewater, fume/exhaust emissions)?	(1) Often (4) Never
17.	Are you a member of any group whose main aim is to preserve or protect the environment?	(1) Yes (2) No
Public Action		
18.	Give money to an environmental group?	(1) Yes (2) No
19.	Take part in a protest or demonstration about an environmental issue?	(1) Yes (2) No
Other PEBs		
20.	When you go shopping, how often do you purchase a shopping bag or ask for one?	(1) Always (5) Never
21.	How often do you make a special effort to sort glass, tins, plastic, newspapers, and so on for recycling?	(1) Always (4) Never
22.	And how often do you avoid buying certain products for environmental reasons?	(1) Always (4) Never
23.	And how willing would you be to accept cuts in your standard of living in order to protect the environment?	(1) Very willing (5) Very unwilling
24.	In order to reduce the risks of air pollution and carbon emissions, are you willing to cooperate with an increase in electricity prices to promote the development of renewable energy (solar, wind, etc.)?	(1) Not willing (2) Willing increase <5% (06) Willing increase >21%
25.	How willing would you be to accept a reduction in the size of Taiwan's protected nature areas, in order to open them up for economic development?	(1) Very willing (5) Very unwilling

1. Socio-demographic Factors: Based on the common focus in past research, the socio-demographic factors include Gender (Female = 0, Male = 1), Age (18~19y = 1, 20~29y = 2, 30~39y = 3, 40~49y = 4, 50~59y = 5, 60~69y = 6, 70y~ = 7), Education (How many years in school).

    - Socio-economic Status is calculated by the ”Two-factor index of social position” (Hollingshead, A., 1965). The formula is New Occupational Prestige and Socioeconomic Scores for Taiwan (7* occupational score + 4* education score).
    - Occupational score: Defined by the “New Occupational Prestige and Socioeconomic Scores for Taiwan” (Huang, 2003)
    - Education score: Elementary school = 1, Junior high school = 2, Senior high

doi:10.6342/NTU202600747

school = 3, University & College = 4, Postgraduate = 5

2. Values and Beliefs Oriented Factors: Environmental Value (ESVS), Environmental Attention, Outdoor Interest, Intergenerational Justice, Climate Risk, Habit Consequence, Trust in Government, Personal Environmental Impact

Table A-2

Values and Beliefs Oriented Factors

Questions	Scale
Environmental Value (ESVS)	
26. Being in harmony with nature (fitting into nature)	(0) very unimportant (7) very important
27. Respect for the Earth (harmony with other species)	(0) very unimportant (7) very important
28. Protecting the environment (preserving nature)	(0) very unimportant (7) very important
Environmental Attention	
29. Do you usually pay attention to information about "environmental issues"?	(1) Pay very close attention (4) Pay no attention at all
30. Generally speaking, how concerned are you about environmental issues?	(1) not at all concerned (5) very concerned.
Outdoor Interest	
31. How much, if at all, do you enjoy being outside in nature?	(1) Not at all (5) To a very great extent
32. In the last twelve months, how often, if at all, have you engaged in any leisure activities outside in nature, such as hiking, bird watching, swimming, skiing, other outdoor activities, or just relaxing?	(1) Daily (3) Several times a month (5) Never
Intergenerational Justice	
33. Are you worried about the environmental problems that children today will face in 30 years?	(1) Very worried (5) Not worried at all
34. We must prioritize the development and well-being of our generation; future generations will find their own ways to solve potential environmental problems.	(1) Strongly agree (5) Strongly disagree
35. Our parents' generation and our generation have overused the Earth's natural resources, and future generations may not have natural resources to use.	(1) Strongly agree (5) Strongly disagree
Climate Risk	
36. How bad or good do you think the impacts of	(0) extremely bad (10)

doi:10.6342/NTU202600747

	climate change will be for the world as a whole?	extremely good
37.	How bad or good do you think the impacts of climate change will be for Taiwan?	(0) extremely bad (10) extremely good
	Habit Consequences	
38.	You worry that using plastic bags, disposable tableware, etc., will cause harm to the environment.	(1) Strongly agree (5) Strongly disagree
39.	You worry that using plastic bags, disposable tableware, etc., will harm your own and your family's health.	(1) Strongly agree (5) Strongly disagree
40.	You worry that the pollution caused by plastic bags and disposable tableware will harm the health of the next generation.	(1) Strongly agree (5) Strongly disagree
	Trust in Government	
41.	Your personal level of trust in the Legislative Yuan	(0) completely distrustful (10) entirely trustful
	Personal Environmental Impact	
42.	Environmental problems have a direct effect on my everyday life.	(1) Strongly agree (5) Strongly disagree

3. Norms and Contextual Factors: Social Norms, Urban-Rural Residence, Air Quality Perception, Disaster Experience, Political Affiliation

Table A-3

Norms and Contextual Factors

Questions		Scale
	Social Norms	
43.	When getting takeout food, your family and friends think you should refuse disposable tableware.	(1) Strongly agree (5) Strongly disagree
44.	When you go shopping, your family and friends think you should bring your own shopping bag.	(1) Strongly agree (5) Strongly disagree
45.	The government's plastic reduction policies (banning free plastic bags, banning plastic straws, banning packaged drinking water at gatherings, etc.) help you reduce your use of these single-use items.	(1) Strongly agree (5) Strongly disagree
	Urban-Rural Residence	
46.	Do you consider the place where you currently live to be urban or rural?	(1) Large city (2) Suburb of a large city (3) Small city or town (4) Rural area (5) Isolated farmhouse
	Air Quality Perception	

doi:10.6342/NTU202600747

47.	In the past 12 months, to what extent has air pollution affected your neighborhood?	(1) Not at all (5) To a very great extent
Disaster Experience		
48.	Extreme weather events (such as severe storms, droughts, floods, heat waves, cold snaps, etc.) (To what extent was your neighborhood affected?)	(1) Not at all (5) To a very great extent
Political Affiliation		
49.	Generally speaking, which Political Affiliation do you lean towards?	(0) Other Parties (1) Green Party Taiwan, Pan-Green Coalition, DPP

doi:10.6342/NTU202600747