



Environmental Awareness–Action Gap: Explaining Heterogeneity in Sustainable Household Behavior

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ARTICLE INFO

Article History:

Received: August 29, 2026

Revised: September 18, 2026

Accepted: October 05, 2026

Available Online: October 08, 2026

Keywords:

Environmental awareness; sustainable household behaviour; awareness–action gap; household sustainability

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DOI: <https://doi.org/10.59075/tamsaal.v4i10.214>

ABSTRACT

Environmental awareness is often considered essential for sustainable household behavior, although awareness does not always translate into everyday practices. This study examines the relationship between environmental awareness and sustainable household behavior in four districts of Sindh, Pakistan. It assesses whether this relationship persists after accounting for demographic and socioeconomic characteristics. A quantitative cross-sectional survey included 392 respondents from Kambar Shahdadt, Mirpur Khas, Sanghar, and Thatta. Data were analyzed using reliability analysis, correlation, linear regression, district comparisons, and an adjusted general linear model. The findings indicate a positive association between environmental awareness and sustainable household behavior. This relationship remained significant after adjustment for demographic and socioeconomic characteristics. Employment status was the only factor significantly associated with differences in reported behavior, while average awareness and behavior did not differ significantly across the four districts. These results suggest that environmental awareness contributes to sustainable household practices but does not fully explain variations in behavior. Promoting household sustainability therefore requires more than raising environmental awareness; practical support and accessible opportunities may also help households adopt sustainable practices. Given the cross-sectional design and reliance on self-reported data, the findings indicate associations rather than causal relationships.



Introduction

Household sustainability depends not only on individuals' awareness of environmental matters, but also on their ability to convert that awareness into consistent daily practices. Decisions about resource consumption, waste management, and environmental protection shape environmental performance, making household behavior a key component of the sustainability transition. Assuming that greater Environmental awareness automatically produces more sustainable behavior ignores the social, economic, and practical conditions in which households make decisions. To understand the relationship, therefore, it is necessary to move beyond awareness as a personal attribute and examine how environmental understanding translates into actual behavioral participation (Steg & Vlek, 2009; Stern, 2000).

Environmental awareness and sustainable behavior are similar but different dimensions of environmental engagement. Awareness can improve understanding of environmental impacts, but understanding does not necessarily change the routines or consumption priorities people have defined. The theory of planned behavior explains that attitudes, subjective norms, and perceived behavioral control shape behavior, suggesting that favorable attitudes alone cannot guarantee action (Ajzen, 1991). Environmental research on the awareness–action gap also shows that environmental knowledge interacts with personal responsibility, social influences, resources, and external constraints. This relationship indicates that awareness is better understood as a potential contributor to sustainable behavior than as a necessary condition for its attainment (Kollmuss & Agyeman, 2002; Li et al., 2019). Meta-analytic data also indicate that environmental effects of behavior arise from several interrelated psychological factors, including personal norms and behavioral intentions (Bamberg & Möser, 2007).

Empirical research reinforces the need to distinguish environmental understanding from behavioral implementation. Environmental Knowledge and concerns can stimulate conservation, but they may influence behavior in specific ways and include practical requirements. For instance, household energy-saving methods depend not only on environmental awareness but also on household routines, available technological options, and the potential reduction in consumption (Pothitou et al., 2016; Reid et al., 2010). More generally, established habits, experience of inconveniences, and limited options may prevent beneficial environmental attitudes from translating into similar actions (Gifford & Nilsson, 2014). Therefore, researchers empirically assess the relationship between awareness and sustainable behavior rather than assume it, especially when sustainable behavior encompasses various daily household practices.

Household socioeconomic circumstances may further explain why individuals with comparable environmental awareness exhibit different behavioral patterns. Education may improve environmental understanding, while income may affect access to sustainable alternatives, but neither necessarily removes practical constraints. Household size, employment, and living conditions may also affect consumption needs, resources, and conservation possibilities. Prior recycling research indicates that the behavioral environment is linked to demographic and contextual characteristics, challenging explanations based exclusively on individual environmental attitudes (Berger, 1997). These considerations make socioeconomic adjustment essential when investigating the independent association between awareness and behavior. Without household characteristics, the observed relationship may partly reflect differences in circumstances that allow or restrict sustainable practices.

This issue is especially relevant in Pakistan, where understanding household sustainability must reflect different socio-economic conditions and resource-usage patterns. Sustainable household consumption studies in Pakistan considered food, energy, and water practices and highlighted household-relevant characteristics of environmental behavior (Shahbaz et al., 2022). Recent research on the relationship between environmental motivations and specific sustainable practices continues to underscore the importance of examining behavior outcomes rather than relying solely on expressed concerns or intentions (Iqbal et al., 2026). However, evidence linking demographic characteristics to sustainable practices does not, by itself, show whether environmental awareness maintains an independent relationship with behavior after accounting for these features. Similarly, differences in average awareness or behavior across geographic settings do not necessarily imply that the relationship between awareness and behavior varies by these parameters.

An important empirical question is whether environmental awareness remains related to sustainable household behavior after accounting for socio-economic factors and demographic characteristics, and whether average participation rates in awareness and behavior differ across districts. To answer these questions, the study clarifies awareness's explanatory value while recognizing that household sustainability goes beyond understanding the environment. The study examines the awareness-behavior relationship, assesses district-level differences in awareness, reports sustainable practices, and evaluates whether households remain connected after the adjustment. By bringing these questions together, the study contributes to the debate on the limitations of awareness-targeted approaches to sustainability. It helps facilitate a more context-sensitive understanding of sustainable household behavior.

Literature Review

Environmental awareness is widely regarded as a prerequisite for sustainable behavior, but evidence suggests its effects are neither automatic nor consistent. Previous studies showed that environmental knowledge, attitudes, perceived control, and personal responsibility are linked to responsible environmental action, and that behavior is formed by multiple determinants rather than simply knowledge (Hines et al., 1987; Steg et al., 2005). Subsequent theoretical development clarified this distinction: the Theory of Planned Behavior identifies attitudes, subjective norms, and perceived behavioral control as determinants of intention and action, whereas the Value-Belief-Norm framework emphasizes environmental values, awareness of consequences, and personal norms (Ajzen, 1991; Stern, 2000; Yuriev et al., 2020). These are complementary perspectives but not interchangeable. The first stresses the feasibility and social evaluation of behavior and shows how environmental concerns can develop into a moral obligation. Consequently, awareness is best understood as one component of a broader behavioral process.

Empirical literature supports this argument by showing why the relationship between awareness and behavior requires direct testing. The meta-analysis by Bamberg and Möser (2007) showed that environmental awareness affected behavior through moral and social values, guilt, and intentions, not only directly. Similarly, an integrative review of pro-environmental behavior identified psychological, social, and contextual influences as essential for explaining changes in behavior (Chen, 2015; Steg & Vlek, 2009). These findings challenge linear assumptions that increased awareness produces a proportionate improvement in behavior. However, they do not

imply that awareness is unimportant; rather, its explanatory contribution depends on the behavioral outcome and the mechanisms through which awareness translates into action. The difference is empirical because the positive relationship between awareness and behavior does not allow us to determine whether awareness alone explains why some individuals act sustainably while others do not.

Studies of households clearly illustrate this limitation. Pothitou et al. (2016) found positive associations between environmental knowledge, environmental values, and household energy-saving behavior but reported limited relationships between environmental predisposition and device ownership or use. This contrast suggests that Environmental awareness may relate to specific everyday practices rather than choices limited by infrastructure, technology, or the household. Recycling research also shows that environmental measures reflect demographic and contextual features and not just individual attitudes (Berger, 1997; van den Bergh, 2008). Overall, Gifford and Nilsson (2014) suggest that individual, social, and demographic influences interact with the design of environmental concerns and behavior. Together, these studies indicate that sustainable household behavior should not be treated as a uniform outcome: the practical demands and restrictions linked to different practices may alter how people understand and act on the relationship between environmental concerns and behavior.

The behavior gap in the literature also challenges explanations that place responsibility entirely on the individual. Kollmuss and Agyeman (2002) identify psychological, social, and external barriers that can prevent environmental knowledge from translating into action. Recent research on sustainable food consumption reaches a similar conclusion: consumers may not act on sustainable intentions because of factors beyond their control, including product availability and the organization of the shopping environment (Munro et al., 2023; White et al., 2019). Systematic investigations of sustainable consumer theories also show that behavior is more commonly explained by combining internal motivations with social norms, external conditions, and political influences, rather than relying on a single theoretical perspective (Stankuniene et al., 2020; Syed et al., 2024). Although these studies examine different behavioral domains, they share the implication that awareness-based explanations risk overstating individual motivation while underestimating the conditions required for sustainable action.

Socioeconomic characteristics pose an associated but analytically separate question. Education, income, employment, household size, and housing may affect environmental understanding, consumption needs, and access to sustainable alternatives. However, their impact was inconsistent across behaviors and contexts. Broader education can increase environmental knowledge without removing practical barriers, while higher income levels can enable the adoption of better technologies and resource-intensive consumption. A systematic review of green consumption identifies demographic characteristics and geographic context as important dimensions of variation and highlights inconsistencies across existing findings (Megha, 2024). Recent evidence on environmental behavior also reinforces the importance of examining psychological motivations alongside specific behavioral outcomes, rather than assuming that favorable environmental orientations translate uniformly into action (Iqbal et al., 2026). Thus, empirical models include socioeconomic characteristics to determine whether awareness retains an independent statistical connection with behavior, not just because demographic variables are readily available.

This question relates to the household sustainability study on resource constraints in Pakistan. A study on sustainable food, energy, and water consumption examined the relationship between household characteristics and sustainable practices, showing the importance of considering socioeconomic conditions when examining the behavior environment (Shahbaz et al., 2022). However, identifying demographic correlations does not determine whether awareness is related to socioeconomic adjustment in behavior. Similarly, differences in average awareness or sustainable practices between geographical institutions do not necessarily indicate a relationship between awareness and behavior differences between these institutions. These are separate empirical questions and were not brought together. This distinction matters because it can indicate a positive association between awareness and behavior without implying substantial differences between districts or that the association varies across demographic groups.

For this reason, the literature still has a focused empirical question: whether the awareness environment remains linked to reported sustainable household behavior after accounting for relevant socio-economic profiles, and whether the average interaction between awareness and behavior differs across geographic backgrounds. This study examines this problem by analyzing awareness and behavior, assessing district-level differences between the two constructs, and assessing the relationship after adjusting for demographic and socioeconomic characteristics. Their contribution is to examine the gap between awareness and behavior in average outcomes, thereby assessing the explanatory value of awareness without assuming it is sufficient to drive sustainable action.

Methodology

Research Design

This study used a quantitative cross-sectional survey design to investigate the relationship between environmental awareness and sustainable household behavior in Sindh, Pakistan. Four districts-Kambar Shahdadkot, Mirpur Khas, Sanghar, and Thatta - have been carefully chosen to accommodate geographic and socioeconomic differences, including the livelihoods of agriculture, rural living conditions, and coastal and river areas. This selection provided contextual diversity for examining household sustainability without claiming provincial representativeness.

The minimum sample size was calculated using the Cochran formula for a large or unknown population, with a 95% confidence level, a 5% margin of error, and a population share of 0.50, yielding approximately 385 respondents. To support district-level comparisons, the study targeted 430 respondents, spread roughly equally across four districts (107.108 per district). After checking the data for final analysis, we retained 392 valid responses. The sample size calculation provides a conventional benchmark, and representativeness depends on the actual sampling method.

Measures and Variable Construction

We measured environmental awareness using five questionnaires and assessed sustainable household behavior with six items. Both scales used a five-point response scale. We computed separate composite scores by averaging relevant items, with higher scores indicating greater environmental awareness and more common sustainable household practices. Respondent

characteristics include region, sex, age group, education, employment status, monthly income, household size, and housing type. These variables were included in the adjusted analysis to account for potential socio-economic and demographic differences in reported behavior.

Data Collection

The data were based on a structured questionnaire measuring awareness, sustainable household and respondent characteristics, and environmental practices. The same questionnaire structure was used across four districts to maintain measurement consistency and facilitate district-level comparisons. The answers were coded numerically and checked for completeness, a current response range, and consistency before completing the analysis. Cases with unusable data or missing scaling information were handled according to the survey's data-cleaning procedure. To support transparency and replication, provide the Questionnaires and response categories in an annex.

Data Analysis

Statistics were carried out using IBM SPSS Statistics, and descriptive statistics were used to summarize respondent characteristics and composite scores. Internal consistency was assessed using Cronbach's alpha, with .783 for environmental awareness and .725 for sustainable household behavior. We used the Pearson correlation coefficient to assess the direction and strength of the link between the two composite measures. However, the unadjusted association was assessed using simple linear regression between awareness and behavior.

For the overall comparison of awareness and behavior means of four districts, a unilateral analysis of the (ANOVA) differential was used. Homogeneity of variance was assessed using Levene's test. Because this assumption was breached for awareness ($p = .003$), we also used Welch's robust test alongside the conventional ANOVA, with Games-Howell comparisons for pairwise differences. The homogeneity assumption was not met for behavior ($p = .156$), so the conventional ANOVA was not used.

The adjusted general linear model was then assessed to determine whether awareness behavior remained associated after accounting for area, sex, age, education, employment, income, household size, and type of dwelling. This modified specification served as the primary robustness check, assessing whether the relationship remained statistically significant after controlling for observed household characteristics. To assess residual behavior and potential model mis-specification, the authors also examined regression diagnostic techniques. The authors evaluated statistical significance at the 5% level, considering p-values, estimates, and confidence intervals.

Ethical Considerations

The relevant Institutional Review Board (IRB) granted ethical approval before data collection. Participation was voluntary, and respondents were informed of the study's purpose and how their comments were used. We maintained confidentiality in data management and analysis.

Results

Table 1 presents 392 respondents by population and socio-economic characteristics. The sample included four districts and covered age, education, employment, household income, household size, and residence. Village households made up the majority of the sample, while the four districts were represented in approximately equal numbers. This distribution supports studies of the association between environmental awareness and sustainable household behavior, while accounting for household circumstances. However, when interpreting findings for urban households, consider the prevalence of rural respondents.

Table 1. Demographic and socioeconomic characteristics

Characteristic	Category	n	%
District	Kambar Shahdadt	99	25.3
	Mirpur Khas	96	24.5
	Sanghar	100	25.5
	Thatta	97	24.7
Gender	Female	191	48.7
	Male	201	51.3
Age	Under 25	64	16.3
	25–34	116	29.6
	35–44	83	21.2
	45–54	70	17.9
	55 or above	59	15.1
Education	No formal education	71	18.1
	Primary	90	23.0
	Secondary/higher secondary	121	30.9
	Bachelor's degree or above	110	28.1
Employment status	Employed	94	24.0
	Self-employed	86	21.9
	Unemployed	38	9.7
	Student	25	6.4
	Homemaker	100	25.5
	Other	49	12.5
Monthly household income	Below PKR 25,000	115	29.3
	PKR 25,000–49,999	119	30.4
	PKR 50,000–99,999	104	26.5
	PKR 100,000 or above	54	13.8
Household size	1–3 members	59	15.1
	4–6 members	173	44.1
	7–9 members	94	24.0
	10 or more members	66	16.8
Residence	Rural	332	84.7
	Urban	60	15.3

Table 2 provides descriptive statistics and reliability estimates for both indicators. Environmental awareness averages were higher than those for sustainable household behavior. This difference shows that respondents reported greater environmental awareness than participation in sustainable household practices. However, the measures capture different constructs, so interpret the distinction descriptively rather than as a formally established awareness–action gap.

Both scales showed acceptable internal consistency. Although construct reliability alone does not confirm test validity, the reliability estimates support using separate composite measures in the following analysis.

Table 2. Descriptive statistics and reliability

Measure	Items	N	Min	Max	Mean	SD	Cronbach's α
Environmental awareness	5	392	1.00	5.00	3.45	0.74	.783
Sustainable household behavior	6	392	1.17	4.83	2.96	0.68	.725

Note. Composite scores were calculated as the mean of the respective items. Higher scores indicate greater awareness or more frequent sustainable practices.

A correlation analysis identified positive, statistically significant relationships between environmental awareness and sustainable household behavior. This means respondents reporting greater environmental awareness reported more frequent sustainable practices. However, the association was weak, suggesting that awareness explained only a small share of the variation in household behavior.

The simple regression of Table 3 confirmed the relationship. Environmental awareness positively predicted sustainable household behavior, but the model explained only 4.5% of the variation. Although the relationship was statistically significant, its limited explanatory power suggests that other individual, socio-economic, or contextual factors may also influence sustainable household practices.

Table 3. Association between environmental awareness and sustainable household behavior

Predictor/statistic	Model 1: Simple regression
Environmental awareness, B	0.195
Standard error	0.046
Standardised coefficient, β	0.212
95% CI for B	[0.106, 0.285]
t	4.282
p	< .001
Model statistics	
R Squared	0.045
Adjusted R Squared	0.042
$F(1,390)$	18.335
p for model	< .001
N	392

Note. B denotes the unstandardized coefficient; β denotes the standardized coefficient; CI denotes the confidence interval.

Table 4 compares awareness and sustainable household behavior across the four districts. No differences were observed in behavior across the statistically significant districts, and the effect was small. Conventional ANOVA was also not significant for awareness. Because the equal-variance assumption was violated for awareness, the Welch test was considered more appropriate for a robust comparison; it also found no statistically significant differences.

The results indicated that the sample did not provide sufficient evidence that average awareness or sustainable household behavior differed across the four districts. They do not show the districts are identical, nor do they indicate whether the strength of the awareness-behavior relationship differs by district. The latter requires a separate interaction analysis.

Table 4. District comparisons of environmental awareness and sustainable household behavior

District	Awareness mean (SD)	Behavior mean (SD)	n
Kambar Shahdaskot	3.38 (0.75)	2.96 (0.67)	99
Mirpur Khas	3.46 (0.58)	3.01 (0.75)	96
Sanghar	3.58 (0.89)	2.93 (0.62)	100
Thatta	3.36 (0.69)	2.92 (0.71)	97
Overall	3.45 (0.74)	2.96 (0.68)	392

Note. Welch's test is reported for awareness because Levene's test indicated unequal variances.

Adjusted Regression Analysis

The adjusted model investigated whether environmental awareness remained associated with sustainable household behavior after accounting for district, sex, age, education, employment status, monthly household income, household size, and residence type. Although the adjusted explanatory power was moderate, the overall model reported in Table 5 was statistically significant.

Environmental awareness remained positively associated with sustainable household behavior after adjustment ($B = .188, p < .001$). This suggests the reported relationships did not fully account for the demographic and socioeconomic characteristics measured in the model. The awareness coefficient remained positive, and the statistically significant coefficient confirmed the interaction between the unadjusted and adjusted analyses.

Employment status was the only statistically significant categorical control ($p = .019$) in the adjusted model. This suggests that sustainable behavior differed across employment categories, although the overall test does not indicate which categories differed or the direction of these differences. The remaining categorical controls were not statistically significant at the 5% level.

Table 5. Adjusted general linear model predicting sustainable household behavior

Predictor	df	F	p	Partial n^2
District	3	0.301	.825	.002
Gender	1	0.043	.836	.000
Age group	4	0.608	.657	.007
Education	3	0.491	.689	.004

Employment status	5	2.741	.019	.036
Monthly household income	3	1.084	.356	.009
Household size	3	0.920	.431	.007
Residence type	1	0.030	.862	.000
Environmental awareness	1	14.612	< .001	.038
Overall model	24, 367	1.814	.012	—

Model summary: $N = 392$; $R^2 = .106$; adjusted $R^2 = .048$.

Note. B = unstandardized coefficient; SE = standard error; partial β = partial eta squared.

Overall, the findings suggest that awareness has a positive environmental association with sustainable household behavior, but its explanatory contribution is limited. The absence of statistically significant regional differences and the persistence of the awareness association after adjustment indicate that the relationship between awareness and household behavior reflects awareness rather than geographical differences. Because the data are cross-sectional, these results reflect statistical associations rather than causal effects.

Discussion

The findings provide qualified support for the proposition that environmental awareness is associated with sustainable household behavior, while challenging the assumption that awareness alone adequately explains behavioral engagement. The positive association observed in this study, despite its modest contribution, remained statistically significant after adjustments for population and socioeconomic characteristics. This distinction matters: environmental awareness appears relevant to household sustainability, but its relationship is insufficient to explain differences in respondents' reported practices. In other words, the results support interpreting awareness as part of sustainable behavior, rather than as a comprehensive explanation.

The positive association aligns with Pothitou et al. (2016) identified relationships between environmental knowledge, value, and household energy-saving behavior. The weak association in this study suggests that if sustainable behavior includes several household practices, the awareness-to-action gap may be less significant. The findings showed that pro-environmental behavior reflects several interrelated factors, including personal standards, perceived responsibility, and behavioral intention (Bamberg & Möser, 2007; Piao & Managi, 2024). It also strengthens Kollmuss and Agyeman (2002) argument that environmental knowledge cannot necessarily overcome the psychological and external barriers that separate concern from action. These findings support this argument by showing that awareness remains positively associated with reported household practice, although the association is weaker.

Adjusted regression helps clarify the interrelationship. Environmental awareness remained statistically significant after accounting for district, gender, age, education, employment, income, household size, and type of place of residence. The coefficient was somewhat smaller than in the unadjusted model; the association remained. This suggests that the measured household characteristics do not fully capture the relationship between awareness and behavior. Nevertheless, the adjusted model explained a modest proportion of behavioral variation. This result aligns with broader reports on environmentally friendly behavior, which highlight the combined influence of individual motivations, established habits, social circumstances, and

practical options (Gifford & Nilsson, 2014; Steg & Vlek, 2009). The findings do not indicate that socio-economic conditions are unimportant. Yet, they do indicate that the characteristics included in this model provide only partial explanations of the reported sustainable practice.

Employment status was the only adjusted model of statistically significant categorical control. This finding shows that other behavior variables differed in at least certain employment categories. After accounting for these factors, the differences were not explained by the categories that differed, or by why. Employment can be linked to differences in household routines, responsibilities, or access to resources, though these potential mechanisms have not been investigated directly (Bülbül et al., 2023; Vrselja et al., 2024). Shahbaz et al. (2022) found a similar pattern, but their study focused on Pakistan and examined the interrelationship between sustainable household consumption and several demographic characteristics. These differences underline the importance of considering the behavior measure, sample composition, and model specification when comparing each study's socio-economic findings. Consequently, the employment result was treated as a specific finding that requires further investigation, rather than proof that employment status systematically defines sustainable behavior.

The absence of statistically significant district differences adds further qualifications. Average awareness and sustainable household behavior did not differ significantly across the four districts. This result contrasts with explanations that assume a geographical context necessarily produces significant variation in environmental practices, awareness, or household behavior. The nonsignificant comparisons do not demonstrate equivalence across districts. Differences may go unnoticed, and comparing district-level average points does not confirm geographic differences in the awareness-behavior ratio. We ran direct interaction tests to assess this variation. Therefore, current findings support the link between awareness and behavior in the pooled sample, but do not establish district-level heterogeneity in that association.

Together, these findings have implications for designing household sustainability interventions. Awareness-raising remains important, but information-based programs alone may fail to account for the conditions needed to build a realistic understanding of environmental issues. The previous study also emphasizes that sustainable behavior depends on the interaction between personal motivations and the practical conditions of decision-making (Berger, 1997; Lye et al., 2024; Steg & Vlek, 2009). The present study adds specific contextual data showing that an awareness-behavior association persists after adjustment, while its limited explanatory power suggests that additional determinants warrant investigation. A combination of environmental communication, support, and the capacity to act sustainably can therefore benefit interventions. However, these observations cannot establish the effectiveness of specific activities.

Several limitations were acknowledged. The cross-sectional design does not determine the order of time or causality. Self-reported practice can introduce reporting or social desirability bias. Additionally, the lack of a statistically significant difference between counties should not be interpreted as evidence of equivalence, and the study does not directly test the interaction between awareness and household. Future research could examine specific behavioral barriers, use longitudinal or intervention-based designs, and test whether the awareness-behavior relationship varies across socioeconomic groups. Such approaches would help to clarify when the awareness environment process is put into action, and the context for this process is facilitated.

Conclusion

This study investigated the relationship between environmental awareness and sustainable household behavior in four districts of Sindh, Pakistan. The findings show that awareness is positively linked to sustainable environmental practices and that this relationship remained significant after controlling for demographic and socio-economic characteristics. However, the association was weak, suggesting that awareness alone offers a limited explanation for differences in household behavior. Across the four districts, we observed no statistically significant differences between awareness and behavior on average.

These findings underline the limitations of relying exclusively on awareness elevation to promote household sustainability. Environmental communication must be complemented by practical measures that support sustainable decision-making and remove implementation barriers. The study provides context-specific evidence of the relationship between environmental awareness and reported household practices. Yet, it also shows how important it is to distinguish statistical significance from explanatory strength. Given the cross-sectional design and self-reported behavior, do not interpret the results causally. Future research should investigate specific behavioral constraints and examine whether the awareness–behavior relationship varies across socioeconomic groups and contexts.

References

1. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
2. Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14–25. <https://doi.org/10.1016/j.jenvp.2006.12.002>
3. Berger, I. E. (1997). The Demographics of Recycling and the Structure of Environmental Behavior. *Environment and Behavior*, 29(4), 515–531. <https://doi.org/10.1177/001391659702900404>
4. Bülbül, H., Topal, A., Özoğlu, B., & Büyükkelik, A. (2023). Assessment of determinants for households' pro-environmental behaviours and direct emissions. *Journal of Cleaner Production*, 415, 137892. <https://doi.org/10.1016/j.jclepro.2023.137892>
5. Chen, M. (2015). An examination of the value-belief-norm theory model in predicting pro-environmental behaviour in Taiwan. *Asian Journal of Social Psychology*, 18(2), 145–151. <https://doi.org/10.1111/ajsp.12096>
6. Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology*, n/a-n/a. <https://doi.org/10.1002/ijop.12034>
7. 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/10.1080/00958964.1987.9943482>
8. Iqbal, Z., Youjin, L., Imtiaz, H., & Ahmad, N. (2026). Do pro-environmental factors influence sustainable behavior? The moderating role of climate change concern in China and Pakistan. *Frontiers in Psychology*, 17. <https://doi.org/10.3389/fpsyg.2026.1704513>

9. 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), 239–260. <https://doi.org/10.1080/13504620220145401>
10. Li, D., Zhao, L., Ma, S., Shao, S., & Zhang, L. (2019). What influences an individual's pro-environmental behavior? A literature review. *Resources, Conservation and Recycling*, 146, 28–34. <https://doi.org/10.1016/j.resconrec.2019.03.024>
11. Lye, C.-T., Ng, T.-H., & Law, J.-W. (2024). The role of general and specific pro-environmental education in household waste management in Malaysia: Evidence from quantile regression. *Environmental Challenges*, 15, 100933. <https://doi.org/10.1016/j.envc.2024.100933>
12. Megha. (2024). Determinants of green consumption: a systematic literature review using the TCCM approach. *Frontiers in Sustainability*, 5. <https://doi.org/10.3389/frsus.2024.1428764>
13. Munro, P., Kapitan, S., & Wooliscroft, B. (2023). The sustainable attitude-behavior gap dynamic when shopping at the supermarket: A systematic literature review and framework for future research. *Journal of Cleaner Production*, 426, 138740. <https://doi.org/10.1016/j.jclepro.2023.138740>
14. Piao, X., & Managi, S. (2024). Determinants of pro-environmental behaviour: effects of socioeconomic, subjective, and psychological well-being factors from 37 countries. *Humanities and Social Sciences Communications*, 11(1), 1293. <https://doi.org/10.1057/s41599-024-03790-z>
15. Pothitou, M., Hanna, R. F., & Chalvatzis, K. J. (2016). Environmental knowledge, pro-environmental behaviour and energy savings in households: An empirical study. *Applied Energy*, 184, 1217–1229. <https://doi.org/10.1016/j.apenergy.2016.06.017>
16. Reid, L., Sutton, P., & Hunter, C. (2010). Theorizing the meso level: the household as a crucible of pro-environmental behaviour. *Progress in Human Geography*, 34(3), 309–327. <https://doi.org/10.1177/0309132509346994>
17. Shahbaz, P., ul Haq, S., Abbas, A., Samie, A., Boz, I., Bagadeem, S., Yu, Z., & Li, Z. (2022). Food, Energy, and Water Nexus at Household Level: Do Sustainable Household Consumption Practices Promote Cleaner Environment? *International Journal of Environmental Research and Public Health*, 19(19), 12945. <https://doi.org/10.3390/ijerph191912945>
18. Stankuniene, G., Streimikiene, D., & Kyriakopoulos, G. L. (2020). Systematic Literature Review on Behavioral Barriers of Climate Change Mitigation in Households. *Sustainability*, 12(18), 7369. <https://doi.org/10.3390/su12187369>
19. Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology*, 25(4), 415–425. <https://doi.org/10.1016/j.jenvp.2005.08.003>
20. 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/10.1016/j.jenvp.2008.10.004>
21. 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/10.1111/0022-4537.00175>
22. Syed, S., Acquaye, A., Khalfan, M. M., Obuobisa-Darko, T., & Yamoah, F. A. (2024). Decoding sustainable consumption behavior: A systematic review of theories and models

- and provision of a guidance framework. *Resources, Conservation & Recycling Advances*, 23, 200232. <https://doi.org/10.1016/j.rcradv.2024.200232>
23. van den Bergh, J. C. J. M. (2008). Environmental regulation of households: An empirical review of economic and psychological factors. *Ecological Economics*, 66(4), 559–574. <https://doi.org/10.1016/j.ecolecon.2008.04.007>
 24. Vrselja, I., Batinić, L., & Pandžić, M. (2024). Relationship between Socioeconomic Status and Pro-Environmental Behavior: The Role of Efficacy Beliefs. *Social Sciences*, 13(5), 273. <https://doi.org/10.3390/socsci13050273>
 25. White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT Consumer Behaviors to be More Sustainable: A Literature Review and Guiding Framework. *Journal of Marketing*, 83(3), 22–49. <https://doi.org/10.1177/0022242919825649>
 26. Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, 155, 104660. <https://doi.org/10.1016/j.resconrec.2019.104660>