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Editorial Note

South Asian Journal of Management Research (SAJMR), is a scholarly journal that publishes scientific research on the theory and practice of management. All management, computer science, environmental science related issues relating to strategy, entrepreneurship, innovation, technology, and organizations are covered by the journal, along with all business-related functional areas like accounting, finance, information systems, marketing, and operations. The research presented in these articles contributes to our understanding of critical issues and offers valuable insights for policymakers, practitioners, and researchers. Authors are invited to publish novel, original, empirical, and high quality research work pertaining to the recent developments & practices in all areas and disciplined.

Cross-functional, multidisciplinary research that reflects the diversity of the management science professions is also encouraged, the articles are generally based on the core disciplines of computer science, economics, environmental science, mathematics, psychology, sociology, and statistics. The journal's focus includes managerial issues in a variety of organizational contexts, including for profit and nonprofit businesses, organizations from the public and private sectors, and formal and informal networks of people. Theoretical, experimental (in the field or the lab), and empirical contributions are all welcome. The journal will continue to disseminate knowledge and publish high-quality research so that we may all benefit from it.

Dr. Pooja M. Patil
Editor

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C O N T E N T S

From Recycling to Renewable Energy: A SEM-Based Study of Social Norms, Personal Values, and Environmental Knowledge as Drivers of Pro-Environmental Behavior Influencing Positive Spillover Effects

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Abstract

This study delves into the pivotal role of pro-environmental behaviors (PEBs) in addressing pressing environmental concerns and fostering a culture of sustainability. By examining the concept of spillover effects, where the adoption of one eco-friendly action leads to additional sustainable practices, the research highlights the transformative potential of initial pro-environmental actions. The paper underscores the importance of environmental education in cultivating a deep understanding of the interdependence between human actions and natural systems, thereby promoting behaviors that minimize ecological degradation. This research investigates the determinants of pro-environmental behavior (PEB) and the factors contributing to positive spillover effects in sustainable practices. Despite increased environmental awareness, a gap persists between pro-environmental behavior in controlled settings and its translation to uncontrolled environments. Addressing this discrepancy, the study identifies key drivers of PEB, including environmental knowledge (EK), economic benefits (EB), personal values (PV), and social norms (SN), with PEB acting as a mediating variable. Employing a quantitative research approach, data were collected via a structured survey encompassing diverse demographic groups. The research employs a quantitative approach using Structural Equation Modelling (SEM) and Confirmatory Factor Analysis (CFA) to analyze the relationships among the latent constructs such as social norms, economic benefits, environmental knowledge, and personal values, analyzing factor loadings, t-values, and p-values to test the hypotheses. The findings highlight that all examined variables significantly influence PEB and positive spillover effects, with EK and SN exerting the most substantial impact. These results underscore the importance of fostering environmental knowledge dissemination and leveraging social norms to promote widespread sustainable behavior. By identifying critical factors influencing PEB, this research provides valuable insights for policymakers and educators seeking to design targeted interventions that bridge the gap between environmental consciousness and actionable sustainability. The study offers a foundation for future research into behavioral strategies and policy frameworks aimed at cultivating a culture of sustainability through enhanced positive spillover effects. Future research avenues include exploring the link between PEBs and policy support, as well as the effectiveness of various nudging techniques in promoting sustainable behavior change.

Keywords: Pro-Environmental Behavior, Spillover Effects, Sustainability, Social Norms, Environmental Knowledge.

Introduction to Pro-Environmental Behaviors

The intensifying necessity to address environmental concerns has led to a greater focus on pro-environmental behaviors, acknowledging the crucial importance of collective effort to reduce ecological degradation. Pro-environmental behavior, a fundamental aspect of environmental education, pertains to deliberate efforts taken to minimize one's detrimental effects on the environment (Sam C. Staddon, 2016). These behaviors span a broad spectrum of actions, ranging from common routines like recycling and saving water to more substantial commitments such as embracing renewable energy sources and advocating for sustainable laws. Environmental education aims to cultivate and enhance the profound comprehension of the interdependence between natural systems and human actions, thus underscoring the need to adopt these behaviors as crucial measures in attaining long-term sustainability (Nicole M. Ardoin, 2020). Educational programs seek to empower individuals and communities by cultivating pro-environmental beliefs and behaviors, fostering a culture of sustainability, enabling people to take responsibility for their environmental impact, and effectively solving the pressing environmental issues of today's times (Boeve-de Pauw, 2015). The fundamental concept of Pro-environmental conduct is to reduce adverse effects on the environment and actively promote its well-being and long-term viability (Boiral, 2015). Furthermore, the notion of spillover effects in relation to pro-environmental behavior emphasizes how the adoption of one environmentally conscious activity can stimulate the adoption of additional sustainable behaviors (Thøgersen J. &., 2003).

Explaining the Spillover Effect

The spillover effect of pro-environmental behaviors is an intriguing and intricate phenomenon, in which the adoption of one eco-friendly activity frequently leads to the adoption of further sustainable actions (Elise A. Margetts, 2017). Envision a person who begins their commute by riding to work, therefore minimizing their carbon footprint. By taking this initial step, individuals can trigger a cascade of beneficial consequences, prompting them to adopt more environmentally friendly practices such as composting, minimizing plastic consumption, or endorsing local organic agriculture. Every time that person adopts a new practice, it strengthens their dedication to sustainability, resulting in a combined effect that magnifies their total environmental influence. Spillover happens when changes in how we feel about the environment lead to changes in our behavior. If someone has a strong positive attitude toward the environment, they are more likely to take eco-friendly actions, especially when those actions are somewhat challenging but not too difficult. In other words, when people start caring more about the environment, they're likely to do more things to help it, especially those actions that are a little hard but not impossible (Henn, 2020).

Nevertheless, the spillover effect is not solely beneficial it has both positive and negative aspects (Truelove H. B., 2014). The opposite effect, termed negative spillover, can also occur, where adopting one PEB reduces the likelihood of adopting additional eco-friendly behaviors (Maki, 2019). Occasionally, when individuals carry out a single environmentally friendly behavior they may develop a feeling of complacency, mistakenly thinking that they have fulfilled their responsibility, and as a result, they may disregard additional sustainable behaviors (Nilsson, 2017). For example adopting a single environmentally friendly habit, like recycling at home, can have negative spillover effects, such as encouraging more shopping patterns and lowering the likelihood of adopting more sustainable practices (Karmarkar, 2015). The occurrence of negative spillover effects has the potential to compromise the overall benefits of these endeavors, thereby hindering broader environmental initiatives (Carrico, 2021). Many studies have shown that people are more likely to experience positive spillover effects and less likely to have negative spillover effects when caring about the environment as an important part of their identity (Carfora, 2017). Additionally, only those people with a weaker connection to environmentalism are more likely to experience negative spillover effects (Meijers, 2019). Thus, policymakers can exploit the benefits of positive spillover by creating interventions that promote first pro-environmental activities, recognizing that these actions can trigger a series of subsequent green behaviors (Marius Alt, 2024). By understanding and managing the complex consequences of spillover effects, we may promote a stronger and long-lasting dedication to environmental conservation efforts (Thøgersen J. &., 2009).

Recycling Behavior Leading to Energy Conservation

Encouraging recycling activity can have a substantial impact in promoting other sustainable habits, showcasing the influential role of social norms and spillover effects (Christine Thomas, 2013). Engaging in recycling may enhance one's feeling of environmental responsibility, which in turn can lead to greater involvement in other sustainable activities, such as waste reduction and energy conservation (Geng, 2016). The study by (Ha, 2016) revealed that consumer recycling behavior extends to purchasing green apparel, which is driven by a heightened environmental concern and belief in sustainable practices. Another study by (Ertz M. K., 2016) suggests that feeling a sense of power or control directly influences whether someone will engage in pro-environmental behaviors, like recycling, especially when these actions are done privately. Educating the public about changes in local recycling rules is essential because once recycling becomes a habit, it not only sustains future recycling efforts but also sets a powerful example for adopting other environmentally friendly behaviors within the community (Liu, 2022). Further recycling intention is directly influenced by personal norms and behavioral skills, and indirectly shaped by personal motivation, social motivation, and ascription of responsibility (Liu, 2022). Personal norms related to recycling and packaging waste prevention are deeply intertwined, both stemming from the same broader internalized values, with research confirming a positive spillover effect from recycling to packaging waste prevention (Thøgersen J. , 1999).

Literature Review

The examination of spillover effects in pro-environmental behaviors reveals a complex interplay of positive and negative outcomes, highlighting the multifaceted nature of environmental engagement. Positive spillover, where one pro-environmental action catalyzes additional eco-friendly behaviors, is a promising phenomenon (Clot, 2022). However, challenges such as moral licensing, where individuals feel justified in neglecting subsequent green behaviors after engaging in an initial pro-environmental act, can undermine overall environmental benefits (Mazar, 2010). Empirical studies offer a nuanced view, with (Margetts, 2017) finding that environmental cues can increase initial pro-environmental behaviors but may also lead to moral licensing and negative spillovers. Conversely, cognitive accessibility nudges have shown potential in sustaining pro-environmental behaviors without triggering these negative effects, emphasizing the importance of thoughtful intervention design and implementation. The complexity of spillover effects is further amplified by the motivations driving these

behaviors. (De Dominicis, 2017) argues that pro-environmental programs and policies must address both egoistic and altruistic motivations. Self-interested individuals are more likely to engage in sustainable behaviors when personal benefits are emphasized, whereas altruistic individuals respond to both environmental and personal gains. This underscores the need for tailored approaches in policy-making. Additionally, (Margetts, 2017) suggests that positive spillover is more likely when behaviors require similar resources and when chronic environmental motivations are present. However, the impact of goal priming remains inconclusive, pointing to the need for further research. (White, 2019) discussed the SHIFT framework—highlighting Social influence, Habit formation, Individual self, Feelings and cognition, and Tangibility—offers a strategic approach to fostering sustained pro-environmental engagement by leveraging psychological and contextual factors. Understanding these dynamics is crucial for designing policies and programs that encourage both initial behavior changes and their long-term sustainability. While adopting new pro-environmental behaviors can enhance individuals' sense of environmental responsibility and even encourage political engagement, (Lacasse, 2019) notes that the overall impact on broader pro-environmental behaviors and policy support remains modest. Research has shown that employees' pro-environmental behaviors can create a "win-win" situation by protecting the natural environment while also enhancing environmental performance, leader effectiveness, and employee job satisfaction (Robertson, 2013).

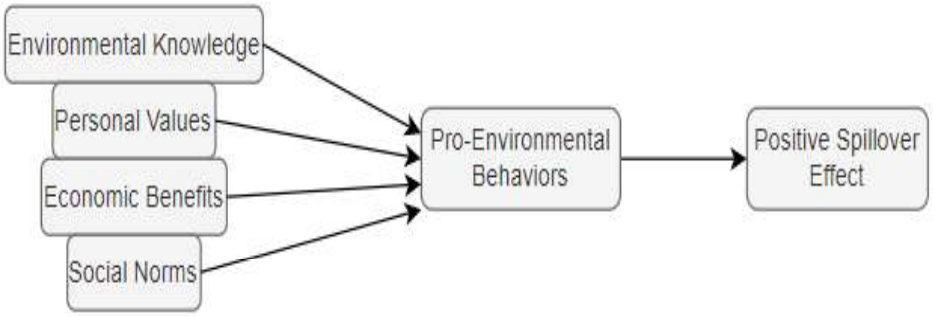

Figure 1: Conceptual Framework (Author Developed)

Personal Values

Individual views and values have a significant impact on the incidence and extent of spillover effects in pro-environmental behavior (Arias, 2020). Individuals who possess robust intrinsic beliefs pertaining to environmental stewardship are more inclined to expand their eco-friendly acts beyond the first conduct (Bennett, 2018). For example, an individual deeply committed to protecting marine life may start by reducing plastic use and then progressively take up beach clean-up initiatives, advocate for policies against ocean pollution, and support sustainable seafood practices (Nithin, 2023). Personal values serve as a compass, directing individuals toward a wider range of sustainable actions (Frank, 2024). In many studies conducted the multigroup SEM analyses revealed that respondents who prioritize the value domain are marginally but significantly more likely to experience spillover (Thøgersen J. &., 2003).

Social Norms

The inclination of individuals to participate in various environmentally friendly actions is greatly influenced by societal standards and social norms (Cialdini, 2021).When eco-friendly habits become commonplace within a community or social group, individuals are more inclined to embrace and sustain these behaviors because they want social acceptability and togetherness (White, 2019). For example, in a neighborhood where residents collectively participate in a community garden and composting program, it sets a benchmark that motivates individuals to engage in these activities and potentially extend their efforts to other sustainable practices, such as installing solar panels or using rain barrels for water conservation (Corkery, 2004). Social norms provide a conducive atmosphere for the proliferation and growth of sustainable behaviors (Yamin, 2019).

Environmental Knowledge

Environmental literacy plays a vital role in the spillover effect since knowledgeable persons are more capable of comprehending the wider consequences of their activities (Nyika, 2021). Individuals who possess a greater understanding of environmental concerns and the interdependence of ecosystems are more inclined to acknowledge the advantages of embracing further sustainable practices (Zsóka, 2013). For example, learning about the benefits of water conservation might inspire an individual to install rainwater harvesting systems at home, participate in local watershed protection programs, and advocate for stricter water usage regulations, thereby amplifying their overall impact on environmental sustainability (Tsai, 2011).

Economic Benefits

Economic considerations, such as cost-benefit analyses, financial incentives, and environmental policies, are critical in shaping pro-environmental behavior (Pham, 2024). People frequently evaluate the financial consequences of their choices, taking into account the current expenses compared to the long-term advantages (Lusardi, 2014). Monetary rewards, such as refunds for energy-efficient appliances or tax deductions for solar panel installations, may greatly encourage consumers to embrace sustainable practices by reducing initial expenses (Kowalska-Pyzalska, 2018). In addition, carefully designed environmental regulations that offer economic incentives for environmentally responsible actions can encourage wider adoption (Zhou, 2023). For instance, subsidies allocated to electric vehicles can enhance their accessibility, therefore promoting a transition away from transportation reliant on fossil fuels (Chaturvedi, 2022). Policymakers may promote sustainable behaviors on a broader scale by connecting economic incentives with environmental goals, thereby assuring that eco-friendly choices are both ethically acceptable and financially possible (Placet, 2005).

Research Methodology

A quantitative research design is employed to examine the impact of pro-environmental behaviors on positive spillover effects. The research investigates how social norms, economic incentives, environmental knowledge, and personal values—considered as independent variables—affect pro-environmental behavior, which serves as a mediating variable in its relationship with positive spillover, the dependent variable. Structural Equation Modelling (SEM) is utilized to explore the complex interactions between latent and observable variables within the conceptual framework proposed. The data collection focused on individuals with a well-established understanding of environmental issues. A nonprobability convenience sampling method was used to achieve a representative and diverse demographic sample. Data were gathered using a structured questionnaire with a Likert scale to evaluate each variable. The questionnaire items were adapted from validated scales used in prior research, ensuring the reliability and accuracy of the measurements. This methodological approach enabled a thorough analysis and understanding of the study's core variables and their interrelationships. All empirical analyses, including the development of the conceptual framework, path modeling, and confirmatory factor analysis (CFA), were conducted using SmartPLS 4.0. Accordingly, all figures and tables presented in this study are based on the authors' own computation and model outputs derived from SmartPLS..

Findings and Analysis

The Structural Equation Model (SEM) analysis offers valuable insights into the relationships between key variables influencing Pro-environmental Behavior (PEB) and its ripple effects on Positive Spillover (PS) behaviors. The analysis shows that Environmental Knowledge (EK), Personal Values (PV), and Social Norms (SN) play a significant role in shaping Pro-environmental Behavior, collectively explaining 78.7% of its variance.

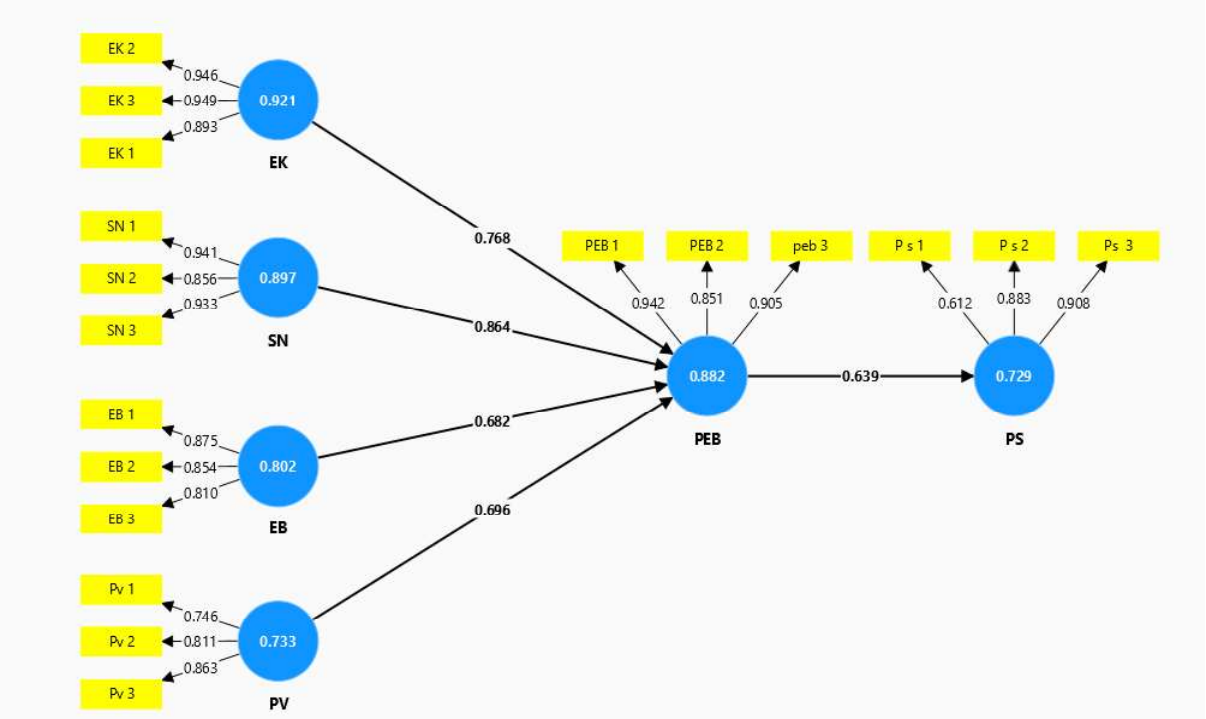

Figure 2: Path Coefficient Insights: Exploring Relationships through PLS-SEM Analysis

Table 1: Path Coefficient Matrix

Path	Coefficient	Interpretation
EB → PEB	**-0.017**	The path coefficient between Economic Benefits (EB) and Pro-environmental Behavior (PEB) is weak and negative (-0.017), indicating that economic incentives or considerations do not significantly contribute to or motivate pro-environmental actions. This suggests that external rewards, such as financial gains, may not be sufficient to drive environmentally conscious behaviors.
EK → PEB	**0.196**	The positive coefficient between Environmental Knowledge (EK) and Pro-environmental Behavior (PEB) (0.196) shows that increased environmental awareness and understanding positively influence pro-environmental actions. Though the relationship is not very strong, it indicates that educating individuals on environmental issues can moderately enhance their likelihood of engaging in sustainable behavior.
PEB → PS	**0.642**	The relationship between Pro-environmental Behavior (PEB) and Positive Spillover (PS) is strong and positive (0.642). This means that individuals who engage in pro-environmental actions are likely to exhibit similar positive behaviors in other aspects of their lives, fostering a broader impact on society. This finding highlights the idea of behavioral spillover, where acting sustainably in one domain encourages socially responsible actions in other areas.
PV → PEB	**0.184**	The path between Personal Values (PV) and Pro-environmental Behavior (PEB) shows a positive coefficient (0.184), indicating that individuals' deeply held ethical beliefs and personal values significantly contribute to their likelihood of adopting pro-environmental behaviors. Although the strength of this relationship is moderate, it underscores the importance of value-driven motivations in sustainable practices.
SN → PEB	**0.603**	The coefficient between Social Norms (SN) and Pro-environmental Behavior (PEB) is quite strong (0.603), revealing that societal expectations and perceived social pressure play a crucial role in encouraging pro-environmental actions. This suggests that when individuals perceive that pro-environmental behaviors are supported and expected by their social group, they are more likely to engage in such actions.

Interpretation: The analysis identifies Social Norms (SN) as the strongest predictor of Pro-environmental Behavior (PEB), highlighting the significant role of societal expectations in driving sustainable actions. Environmental Knowledge (EK) and Personal Values (PV) also positively influence PEB, underscoring the importance of awareness and ethical principles, while Economic Benefits (EB) have a negligible and negative effect, showing limited impact of monetary incentives. PEB strongly influences Positive Spillover (PS), explaining 64.2% of its variance, demonstrating how environmentally conscious actions foster broader pro-social behaviors. These findings emphasize the primacy of social and intrinsic motivators over economic factors in promoting sustainability and societal well-being.

Table 2: Construct Reliability and Validity

Construct Reliability and Validity	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
EK	0.921	0.936	0.95	0.864
SN	0.897	0.92	0.936	0.83
PEB	0.882	0.887	0.928	0.81
EB	0.802	0.803	0.884	0.717
PV	0.733	0.74	0.849	0.653
PS	0.729	0.776	0.85	0.66

Interpretation: The construct reliability and validity analysis confirms the robustness of the measurement model. Environmental Knowledge (EK) stands out with a high Cronbach's alpha (0.921) and AVE (0.864), reflecting strong internal consistency and convergent validity. Subjective Norms (SN) and Pro-environmental Behavior (PEB) also demonstrate excellent reliability, with composite reliability values of 0.936 and 0.928, respectively. While Economic Benefits (EB) and Personal Values (PV) have slightly lower Cronbach's alphas (0.802 and 0.733), they meet acceptable thresholds. AVE values above 0.65 for PV and Positive Spillover (PS) confirm sufficient convergent validity, supporting the model's reliability and construct clarity.

Table 3: Correlation Matrix

Latent Variables - Correlation	EB	EK	PEB	PS	PV	SN
EB	1	0.679	0.682	0.519	0.704	0.725
EK	0.679	1	0.768	0.562	0.647	0.77
PEB	0.682	0.768	1	0.642	0.697	0.863
PS	0.519	0.562	0.642	1	0.755	0.549
PV	0.704	0.647	0.697	0.755	1	0.66
SN	0.725	0.77	0.863	0.549	0.66	1

Interpretation: The correlation matrix highlights the interplay of societal, personal, and economic factors in shaping Pro-environmental Behavior (PEB). Strong correlations are observed between Subjective Norms (SN) and PEB (0.863) and Environmental Knowledge (EK) and PEB (0.768), emphasizing the influence of societal expectations and awareness on sustainable actions. Personal Values (PV) strongly correlate with Positive Spillover (PS) (0.755), showing how values drive extended pro-environmental behaviors. Economic Benefits (EB) notably correlate with SN (0.725), reflecting the combined impact of incentives and social norms. Moderate correlations between PS and EK (0.562) and EB (0.519) highlight weaker but relevant links.

Table 4: Heterotrait-Monotrait Ratio (HTMT) Matrix

HTMT Matrix	EB	EK	PEB	PS	PV
EK	0.786				
PEB	0.81	0.844			
PS	0.68	0.701	0.796		
PV	0.922	0.778	0.861	1.012	
SN	0.849	0.826	0.956	0.672	0.814

Interpretation: The analysis using the Heterotrait-Monotrait Ratio (HTMT) highlights issues with discriminant validity, as HTMT values for Subjective Norms (SN) and Pro-environmental Behavior (PEB) (0.956), Economic Benefits (EB) and Personal Values (PV) (0.922), and Positive Spillover (PS) and PV (1.012) exceed the acceptable threshold of 0.85, indicating significant overlap. This suggests strong interconnections among societal norms, economic perceptions, and personal values in shaping pro-environmental behaviors. However, Environmental Knowledge (EK) demonstrates acceptable discriminant validity, with HTMT values below 0.85, confirming its distinctiveness in the model. The results suggest the need to refine overlapping constructs.

Table 5: Fornell -Larcker Criterion

Fornell - Larcker Criterion	EB	EK	PEB	PS	PV	SN
EB	0.847					
EK	0.679	0.93				
PEB	0.682	0.768	0.9			
PS	0.519	0.562	0.642	0.812		
PV	0.704	0.647	0.697	0.755	0.808	
SN	0.725	0.77	0.863	0.549	0.66	0.911

Interpretation: The Fornell-Larcker Criterion confirms acceptable discriminant validity among the constructs. Subjective Norms (SN) and Pro-environmental Behavior (PEB) show a strong relationship, but their diagonal

values indicate they are distinct constructs. Economic Benefits (EB) and Personal Values (PV) are closely related yet separate, as EB's diagonal value exceeds its correlation with PV. Positive Spillover (PS) and Environmental Knowledge (EK) demonstrate strong discriminant validity, with diagonal values exceeding correlations with other constructs, affirming their distinctiveness. The analysis highlights the nuanced interrelations, especially between SN and PEB, in shaping environmental behaviors while confirming the validity of the constructs.

Table 6: Cross Loadings

Cross Loadings	EB	EK	PEB	PS	PV	SN
EB 1	0.875	0.641	0.591	0.404	0.583	0.635
EB 2	0.854	0.597	0.578	0.43	0.49	0.612
EB 3	0.81	0.485	0.564	0.488	0.72	0.593
EK 2	0.653	0.946	0.733	0.448	0.576	0.748
EK 3	0.659	0.948	0.782	0.547	0.624	0.815
PS 1	0.335	0.433	0.399	0.612	0.453	0.329
PS 2	0.459	0.492	0.566	0.883	0.666	0.506
PEB 1	0.663	0.725	0.941	0.558	0.672	0.893
PEB 2	0.598	0.662	0.855	0.707	0.61	0.63
PS 3	0.46	0.452	0.579	0.908	0.693	0.483
PV 1	0.742	0.504	0.554	0.47	0.746	0.583
PV 2	0.462	0.396	0.506	0.552	0.811	0.521
P3	0.503	0.644	0.619	0.783	0.863	0.502
SN 1	0.654	0.754	0.869	0.545	0.617	0.941
SN 2	0.568	0.582	0.639	0.473	0.538	0.856
SN 3	0.746	0.747	0.823	0.479	0.641	0.933
PEB 3	0.576	0.684	0.903	0.464	0.595	0.8
EK 1	0.574	0.893	0.609	0.584	0.609	0.556

Interpretation: The Cross Loadings analysis confirms strong discriminant validity for most constructs. Subjective Norms (SN) and Pro-environmental Behavior (PEB) show high loadings on their respective constructs, with moderate cross-loadings indicating a strong relationship between societal norms and environmental behaviors. Economic Benefits (EB) and Personal Values (PV) demonstrate distinctiveness, although moderate correlations with other constructs suggest some interaction. Environmental Knowledge (EK) also maintains strong validity, with moderate cross-loadings with SN and PEB, highlighting its influence on environmental actions. Overall, the analysis supports the conceptual distinctiveness of each construct while acknowledging key interrelationships, especially between SN and PEB.

Table 7: R-Square Values for PEB and PS

R - Square	R-square	R-square adjusted
PEB	0.787	0.778
PS	0.412	0.406

Interpretation: The regression analysis shows that the independent variables significantly explain the variance in the dependent variables. For Pro-environmental Behavior (PEB), the model explains 78.7% of the variance, with strong contributions from Subjective Norms, Economic Benefits, Personal Values, and Environmental Knowledge. The adjusted R-square of 0.778 confirms the model's robustness. In contrast, Positive Spillover (PS) explains 41.2% of the variance, with a moderate explanatory power (adjusted R-square = 0.406), suggesting other factors may also influence spillover behaviors. Overall, the model demonstrates a stronger fit for PEB, highlighting the significant role of societal norms and environmental knowledge in shaping environmental actions.

Table 8: F-Square Values for Relationships among Constructs

Path	F-Square	Interpretation
EB → PEB	0.001	The effect of Economic Benefits (EB) on Pro-environmental Behavior (PEB) is negligible, indicating that EB has minimal influence on PEB in this model.
EK → PEB	0.066	Environmental Knowledge (EK) has a small effect on Pro-environmental Behavior (PEB), suggesting a limited positive influence on individuals' pro-environmental actions.
PEB → PS	0.7	The strong effect of Pro-environmental Behavior (PEB) on Positive Spillover (PS) indicates that engaging in pro-environmental behaviors significantly enhances the likelihood of spillover effects to other behaviors.
PV → PEB	0.07	Personal Values (PV) have a small effect on Pro-environmental Behavior (PEB), suggesting that while personal values do influence pro-environmental actions, the impact is relatively modest.
SN → PEB	0.551	Subjective Norms (SN) have a strong effect on Pro-environmental Behavior (PEB), indicating that societal expectations and norms significantly drive individuals' pro-environmental actions.

Table 9: Outer Model Descriptives Analysis

Latent Variable	Standard Deviation	Interpretation
PS 1	0.791	Positive Spillover (PS) indicator 1 shows the highest variability, indicating that respondents have diverse views on spillover effects in environmental behaviors.
PV 1	0.666	Personal Values (PV) indicator 1 has moderate variability, suggesting moderate differences in personal values among respondents.
EB 3	0.587	Economic Benefits (EB) indicator 3 has moderate variability, showing that perceptions of economic benefits are somewhat consistent among respondents.
PV 2	0.585	Personal Values (PV) indicator 2 shows similar variability as PV 1, indicating moderate differences in personal values.
EB 2	0.52	Economic Benefits (EB) indicator 2 exhibits moderate variability, showing some differences in perceived economic benefits.
PEB 2	0.518	Pro-environmental Behavior (PEB) indicator 2 has moderate variability, indicating differences in pro-environmental behaviors among respondents.
SN 2	0.517	Subjective Norms (SN) indicator 2 shows moderate variability, suggesting that social norms vary somewhat across respondents.
PV 3	0.506	Personal Values (PV) indicator 3 has lower variability, indicating relatively consistent personal values among respondents.
EB 1	0.483	Economic Benefits (EB) indicator 1 shows relatively low variability, indicating that most respondents perceive economic benefits similarly.
PS 2	0.469	Positive Spillover (PS) indicator 2 shows lower variability, indicating more consistency in how respondents view spillover effects.
EK 1	0.45	Environmental Knowledge (EK) indicator 1 shows relatively low variability, indicating consistent levels of environmental knowledge across respondents.
PEB 3	0.43	Pro-environmental Behavior (PEB) indicator 3 has low variability, suggesting that respondents behave similarly in their pro-environmental actions.
PS 3	0.418	Positive Spillover (PS) indicator 3 shows low variability, indicating consistent views on spillover effects.
SN 3	0.359	Subjective Norms (SN) indicator 3 has low variability, suggesting that social norms are consistent among respondents.
PEB 1	0.339	Pro-environmental Behavior (PEB) indicator 1 shows very low variability, indicating very consistent behaviors among respondents.
SN 1	0.339	Subjective Norms (SN) indicator 1 shows very low variability, suggesting consistent social norms.
EK 2	0.324	Environmental Knowledge (EK) indicator 2 shows very low variability, indicating that environmental knowledge is quite consistent.
EK 3	0.317	Environmental Knowledge (EK) indicator 3 has the lowest variability, indicating highly consistent levels of environmental knowledge among respondents.

Table 10: Total Effects Analysis

Total Effects	Total Effect Value	Interpretation
EB -> PEB	-0.017	Economic Benefits (EB) has a negligible and slightly negative effect on Pro-environmental Behavior (PEB), indicating that individuals' perception of economic benefits does not strongly influence their pro-environmental actions.
EB -> PS	-0.011	Economic Benefits (EB) has an almost neutral and slightly negative effect on Positive Spillover (PS), showing that economic considerations have minimal impact on engaging in additional pro-environmental behaviors.
EK -> PEB	0.196	Environmental Knowledge (EK) has a positive effect on Pro-environmental Behavior (PEB), suggesting that higher environmental knowledge moderately encourages individuals to engage in pro-environmental activities.
EK -> PS	0.126	Environmental Knowledge (EK) has a positive but modest effect on Positive Spillover (PS), indicating that knowledge about the environment promotes additional pro-environmental behaviors, although the influence is not strong.
PEB -> PS	0.642	Pro-environmental Behavior (PEB) has a significant positive effect on Positive Spillover (PS), implying that engaging in one pro-environmental action strongly encourages further environmental behaviors.
PV -> PEB	0.184	Personal Values (PV) positively influence Pro-environmental Behavior (PEB), indicating that personal values play a moderate role in shaping individuals' pro-environmental actions.
PV -> PS	0.118	Personal Values (PV) have a modest positive effect on Positive Spillover (PS), suggesting that personal values slightly contribute to additional pro-environmental behaviors.
SN -> PEB	0.603	Subjective Norms (SN) have a strong positive effect on Pro-environmental Behavior (PEB), highlighting the significant role of societal norms in driving individuals' pro-environmental actions.
SN -> PS	0.387	Subjective Norms (SN) positively affect Positive Spillover (PS), indicating that social norms encourage further pro-environmental behaviors, though the effect is moderate.

Table 11: Cramér-von Mises Test

Latent Variables	Cramér-von Mises Test Statistic	Cramér-von Mises p-value	Interpretation
EB (Economic Benefits)	0.08	0.206	The p-value indicates that there is no significant difference between the model and the observed data for Economic Benefits, suggesting that the model represents EB well.
EK (Environmental Knowledge)	0.498	0	The low p-value shows a significant difference between the model and the observed data for Environmental Knowledge, suggesting a misfit in capturing the construct effectively.
PEB (Pro-environmental Behavior)	0.291	0	Similar to EK, the significant p-value points to a mismatch between the model and the data, implying that the construct PEB is not being well-represented.
PS (Positive Spillover)	0.257	0.001	The significant p-value indicates a poor model fit for Positive Spillover, requiring further refinement in how this construct is measured.
PV (Personal Values)	0.245	0.001	The significant p-value for Personal Values suggests that the model is not accurately capturing this construct, requiring adjustments to better reflect its influence.
SN (Subjective Norms)	0.12	0.059	The p-value is close to significance, indicating a moderate fit for Subjective Norms, but further refinement could improve the accuracy of the model.

Table 12: Collinearity Statistics (VIF)

Collinearity Statistics	VIF	Interpretation
EB 1	1.993	Acceptable collinearity as the VIF is below 5, indicating that EB 1 does not significantly correlate with other variables.
EB 2	1.857	Acceptable collinearity with a VIF under 5, suggesting no multicollinearity issue for EB 2.
EB 3	1.533	Low VIF value indicates no concerns about collinearity for EB 3.
EK 2	4.32	High VIF value, but still under 5, indicating some level of multicollinearity between EK 2 and other constructs.
EK 3	4.268	Similar to EK 2, this high VIF suggests moderate collinearity with other variables.
PS 1	1.155	Very low VIF, indicating no significant multicollinearity for Positive Spillover 1.
PS 2	2.348	Acceptable VIF value, showing moderate collinearity for P s 2 but nothing critical.
PEB 1	3.977	Higher VIF value but still under the threshold, indicating moderate collinearity for PEB 1.
PEB 2	1.951	Acceptable level of collinearity, suggesting no issues with PEB 2.
PS 3	2.475	Moderately acceptable VIF value, indicating manageable collinearity for Positive Spillover 3.
PV 1	1.26	Low VIF value suggests no collinearity issues with Personal Values 1.
PV 2	1.67	Collinearity is low for Personal Values 2, indicating no multicollinearity concerns.
PV 3	1.752	Acceptable VIF, showing no major collinearity problems for Personal Values 3.
SN 1	3.641	Higher VIF but still within acceptable limits, indicating moderate collinearity for Subjective Norms 1.
SN 2	2.159	Low to moderate collinearity with acceptable VIF, suggesting no concerns for Subjective Norms 2.
SN 3	3.511	Higher VIF but below 5, meaning moderate multicollinearity for Subjective Norms 3.
PEB 3	3.292	Acceptable VIF value indicating moderate collinearity for Pro-environmental Behavior 3.
EK 1	2.693	VIF value is within acceptable limits, suggesting moderate collinearity for Environmental Knowledge 1.

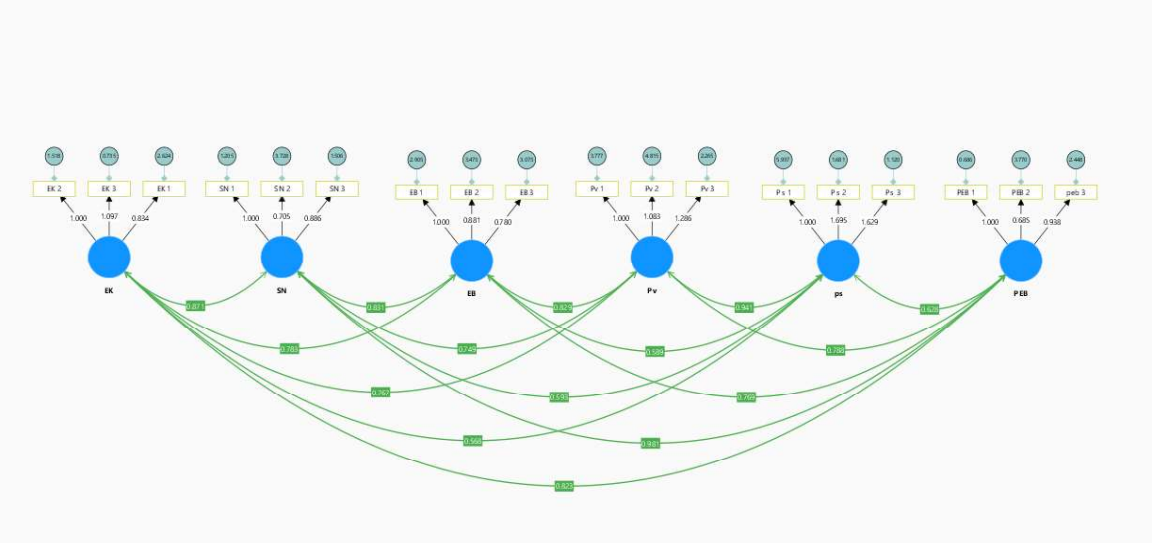

Figure 3: Validation of Latent Constructs through CFA in the SEM Framework

Interpretation: The CFA diagram validates the measurement model by confirming the reliability and validity of latent constructs (e.g., EK, SN, EB) through strong factor loadings (mostly >0.7) on their observed variables. Positive correlations between constructs (e.g., 0.831, 0.757) indicate their interconnectedness, aligning with theoretical expectations. The model demonstrates good construct validity, highlighting both convergent and discriminant validity. This analysis is significant for ensuring that the constructs and their relationships are robust and suitable for further hypothesis testing. Additionally, it provides a foundation for understanding the influence of these constructs, such as their potential impact on behavior or decision-making.

Table 13: Covariance Matrix of Latent Constructs

Factors Covariances	EB	EK	PEB	PV	SN	PS
EB	5.638	4.842	5.317	3.219	5.785	1.679
EK	4.842	6.78	6.242	3.266	6.65	1.778
PEB	5.317	6.242	8.487	3.754	8.376	2.199
PV	3.219	3.266	3.754	2.676	3.592	1.849
SN	5.785	6.65	8.376	3.592	8.591	2.089
PS	1.679	1.778	2.199	1.849	2.089	1.443

Interpretation: The covariance matrix highlights the relationships between latent constructs such as EB, EK, PEB, PV, SN, and PS. High covariance values (e.g., SN and PEB: 8.376, EK and SN: 6.65) suggest strong interdependence between these constructs, indicating that they share common underlying influences or are highly related in the theoretical framework. Lower values (e.g., ps and PV: 1.849, PS and EB: 1.679) denote weaker relationships, suggesting limited overlap between certain constructs. This analysis is significant because it demonstrates the interconnectedness of constructs in the model, offering insights into how different factors interact. For instance, strong covariance between SN and PEB implies that social norms may significantly impact pro-environmental behavior. The matrix also helps verify discriminant validity, ensuring constructs are sufficiently distinct while exhibiting meaningful correlations, thereby supporting the theoretical model's robustness and its ability to explain the studied phenomena effectively.

Table 14: Correlation Matrix of Latent Constructs

Factors Correlation	EB	EK	PEB	PV	SN	PS
EB	1	0.783	0.769	0.829	0.831	0.589
EK	0.783	1	0.823	0.767	0.871	0.568
PEB	0.769	0.823	1	0.788	0.981	0.628
PV	0.829	0.767	0.788	1	0.749	0.941
SN	0.831	0.871	0.981	0.749	1	0.593
PS	0.589	0.568	0.628	0.941	0.593	1

Interpretation: The correlation matrix reveals the relationships among latent constructs (EB, EK, PEB, PV, SN, PS). Strong correlations, such as between PEB and SN (0.981) and EK and SN (0.871), suggest that these constructs are highly related. Moderate correlations, like EB and PEB (0.769) and PV and PEB (0.788), reflect meaningful connections, while weaker correlations, such as PS with EB (0.589), indicate less overlap. These findings validate the model's convergent and discriminant validity, ensuring that closely related constructs align theoretically, while distinct constructs maintain their uniqueness, providing a solid basis for further analysis.

Table 15: Parameter Estimates, Standard Errors, T-values, and P-values for Relationships

Factors Estimated Parametre	Parameter estimates	Standard errors	T values	P values
EB	5.638	1.238	4.555	0
EK	6.78	1.177	5.763	0
PEB	8.487	1.309	6.482	0
PV	2.676	0.842	3.177	0.002

SN	8.591	1.387	6.193	0
PS	1.443	0.663	2.177	0.032
EK <-> EB	4.842	0.945	5.122	0
PEB <-> EB	5.317	1.006	5.283	0
PEB <-> EK	6.242	1.056	5.91	0
PV <-> EB	3.219	0.885	3.638	0
PV <-> EK	3.266	0.786	4.157	0
PV <-> PEB	3.754	0.915	4.105	0
SN <-> EB	5.785	1.057	5.473	0
SN <-> EK	6.65	1.103	6.031	0
SN <-> PEB	8.376	1.266	6.618	0
SN <-> PV	3.592	0.921	3.899	0
PS<-> EB	1.679	0.54	3.107	0.002
PS <-> EK	1.778	0.566	3.143	0.002
PS <-> PEB	2.199	0.662	3.322	0.001

Interpretation: The results demonstrate strong, statistically significant relationships between key factors, with all p-values below 0.05. The relationship between Environmental Knowledge (EK) and Economic Benefits (EB) (estimate: 6.78, t-value: 5.763) highlights a robust link. Similarly, Pro-environmental Behavior (PEB) has a strong influence on EB (estimate: 8.487, t-value: 6.482). Social Norms (SN) also significantly impact EB (estimate: 5.785, t-value: 5.473). Furthermore, Positive Spillover shows a meaningful effect on EB and EK (estimates: 1.443 and 1.778). These findings underscore the importance of knowledge, behavior, and social influences in fostering sustainable actions.

Conclusion

The study concludes the significant positive effect of PEBs on positive spillover, suggesting that fostering initial eco-friendly actions can lead to broader societal benefits. By promoting initial pro-environmental behaviors through education and community engagement, it is possible to create a ripple effect of sustainable actions, ultimately contributing to global sustainability goals. Utilizing the influence of spillover effects in behavior modification projects can initiate a chain reaction of transformation, converting individual acts into a widespread commitment to environmental stewardship (Elf, 2019). Envision a society where recycling is not only an isolated action but rather the pathway to adopting a more environmentally friendly way of living. By establishing a clear and inherent link between composting and recycling, practitioners encourage recyclers to adopt composting practices, resulting in a stronger dedication to reducing waste (Sayara, 2020). Encouraging public transport passengers to carpool or bike enhances their environmentally favorable habits, creating a network of sustainable behaviors (Esztergár-Kiss, 2021). Thus, through the careful and precise implementation of these interventions, professionals may effectively and smoothly lead individuals from one environmentally friendly behavior to another, thus establishing a growing network of people dedicated to protecting the environment (Stapleton, 2022). In conclusion, this study offers valuable insights into the intricate relationship between pro-environmental behaviors and spillover effects. Through an extensive examination of factors such as environmental knowledge, personal values, social norms, and economic incentives, the findings highlight the transformative potential of initial eco-friendly actions in fostering a broader culture of sustainability. The research underscores that while environmental knowledge and personal values are critical in shaping individual behaviors, social norms serve as a powerful catalyst in driving collective environmental action. Additionally, the analysis reveals that economic benefits, though less influential, still play a role in certain contexts. The positive spillover effect of pro-environmental behavior into other socially responsible actions demonstrates that fostering sustainable practices is not only beneficial for the environment but also for societal well-being. Encouraging individual responsibility through education and community engagement can lead to a ripple effect of sustainable actions, ultimately contributing to the global sustainability agenda. This study thus provides a comprehensive framework for policymakers, educators, and community leaders to harness the power of behavioral spillover to achieve broader environmental and societal goals, fostering a more resilient and sustainable future.

Policy and Practice Suggestions

Based on the findings, several practical recommendations can be made:

- **Community-driven campaigns**: Utilize social norms to design neighborhood sustainability programs that promote visible green behaviors.
- **Curriculum Integration**: Strengthen environmental knowledge through school and university-level courses with experiential learning.
- **Incentive Realignment**: While economic benefits had limited direct impact, aligning incentives with social identity (e.g., eco-badges, community recognition) may be more effective.

- **Digital Nudging Platforms**: Use behavioral nudges via apps to promote PEBs and track spillover progress.
- **Policy Design**: Encourage spillover-aware policy frameworks that recognize how one sustainable action can trigger others.

Future Research Avenues

While the intentional adoption of pro-environmental behaviors can enhance individuals' engagement with climate issues and foster a sense of responsibility, its overall impact on broader behavioral changes and policy support appears limited, underscoring the need for more comprehensive strategies to promote sustainable practices (Lacasse, 2019). Furthermore, there is limited research examining the extent to which engaging in one pro-environmental behavior influences support for pro-environmental policies, as well as the mechanisms driving these spillover effects (Truelove H. B., 2016). Another study by (Wee, 2021) opens up opportunities for future research to conduct experimental studies that further investigate the effectiveness of different nudging techniques in promoting pro-environmental behavior change. Future research should also explore how various factors influence the connection between pro-environmental intentions and behaviors within the context of the Theory of Planned Behavior, and how these influences differ across various cultures (Ertz M. H., 2017).

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