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Research Article

An Integrative Model of Green Sustainable Science, Environmental Awareness, and Eco-Friendly Practices in Community Life

Darius Joseph Dianmante[1,*], Md. Masud Morshed[2]
[1] Department of Science and Technology, Forestry Technology, De La Salle University Manila, Manila, Philippines
[2] Department of Natural Science, Sciences and Formalation Technology, University of Science and Technology Chittagong, Chittagong, Bangladesh

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ABSTRACT

Purpose of the study: Sustainable community life requires aligning scientific knowledge, environmental awareness, and daily eco-friendly behavior. However, the connection between what communities know, believe, and practice often remains inconsistent. This study aims to examine how Green Sustainable Science is integrated into community life, assess environmental awareness levels, and identify environmentally friendly practices that support sustainability in daily activities.

Methodology: This study used a qualitative case study approach. Data were collected through in-depth interviews, participatory observation, and documentation. The instruments included semi-structured interview guides, observation sheets, and documentation notes. Data analysis employed the Miles and Huberman interactive model with reduction, display, and conclusion stages.

Main Findings: Findings show that sustainability concepts have been integrated into community routines, although understanding varies and tends to be practical in nature. Environmental awareness ranges from moderate to high among active groups but remains inconsistent in others. Eco-friendly behaviors such as waste sorting, reducing plastic use, and saving energy are present but constrained by limited facilities and policy support. These findings reveal that sustainable behavior emerges from the interaction between knowledge, awareness, and structural conditions, highlighting the need for stronger community programs and better environmental infrastructure.

Novelty/Originality of this study: This study provides new insights into how communities integrate sustainability concepts beyond formal education and policy frameworks. Its originality lies in examining the direct link between scientific knowledge, awareness, and daily life practices. The findings contribute to advancing strategies for community empowerment and contextual environmental programs.

Corresponding Author:
Darius Joseph Dianmante,
Department of Science and Technology, Faculty of Forestry, De La Salle University Manila,
De La Salle Road, Malate, Manila, 0922, Philipines
Email: dariusjoseph@gmail.com

1. INTRODUCTION

Climate change, the energy crisis, and increasing environmental pollution are global issues that demand serious attention from various parties. Various studies show that human consumption patterns and lifestyles have a significant impact on the sustainability of the Earth's ecosystem. In this context, the Green Sustainable Science (GSS) approach emerged as a conceptual framework that seeks to integrate science, sustainability, and ecological awareness to create a balance between human needs and environmental sustainability [1]-[3]. At the community level, the application of GSS principles emphasizes not only technology and innovation but also changes in daily behavior to be more environmentally friendly. Environmental awareness is a crucial foundation for internalizing sustainability values in social life. However, on the ground, there is a gap between knowledge and actual practice, where communities often understand the importance of environmental protection but have not yet fully implemented consistent actions [4]-[6].

Environmentally friendly practices, such as reducing plastic use, waste management, the use of renewable energy, and greening residential areas, are concrete manifestations of the application of sustainability principles. These three aspects the integration of Green Sustainable Science, environmental awareness, and environmentally friendly practices are closely interrelated [7]-[9]. The integration of sustainable science provides a foundation of knowledge, environmental awareness builds motivation, and environmentally friendly practices provide a concrete manifestation of the application of these values in people's lives.

Although numerous environmental programs have been promoted, previous research has tended to focus more on macro policies or formal education aspects, while exploration of how communities integrate GSS concepts into their daily lives remains limited. Yet, a deeper understanding of community experiences, perceptions, and practices is crucial for formulating more effective empowerment strategies. This is where qualitative research plays a crucial role in exploring social realities in a more in-depth and contextual way [10]-[12].

Although numerous studies have examined sustainability from macro perspectives such as policy frameworks, ecological strategies, and large-scale transition systems, most studies, particularly those conducted in 2023 by Simon Elias Bibri [13], have focused primarily on institutional directives rather than the lived experiences of local communities. Previous studies have also emphasized the role of policy, education, and technological innovation, while paying little attention to how sustainability concepts, particularly Green Sustainable Science (GSS), are understood and practiced in people's daily lives [14]. Another study, also conducted in 2022 by Noah Linder [15], often treats scientific knowledge, environmental awareness, and environmentally friendly behavior as separate constructs, leaving a gap in understanding how these three dimensions interact to shape sustainable lifestyles at the grassroots level. Empirical investigations examining the application of sustainability knowledge to consistent environmental awareness and action are still limited, especially in diverse cultural and social contexts. Therefore, this study fills a gap in previous research, namely the lack of integration between Green Sustainable Science, environmental awareness, and environmentally friendly practices in the daily lives of communities, as well as the limited understanding of the interaction between ecological knowledge, awareness, and behavior at the community level. This gap is significant because the effectiveness of sustainability initiatives ultimately depends not only on institutional policies but also on behavioral transformations occurring within communities. Therefore, a study that integrates these dimensions into a coherent model and investigates their interactions in real-world settings is needed to enrich the current sustainability literature and guide the development of more contextualized and community-based environmental strategies.

The novelty of this study lies in the development of an integrative and empirically based model that simultaneously links Green Sustainability Science (GSS), environmental awareness, and environmentally friendly practices in community life a perspective largely overlooked in previous research. Unlike previous studies that predominantly focus on macro-level policies, educational programs, or technological interventions, this study emphasizes the lived experiences of community members at the micro-level and how sustainability knowledge is internalized and implemented in daily routines. Furthermore, this study addresses a critical gap in understanding the dynamic interactions between ecological knowledge, awareness, and behavior, offering a comprehensive framework that captures how these three dimensions mutually reinforce each other to foster consistent sustainable practices. By investigating these interactions in a culturally diverse and real-world community setting, this study provides new insights into behavioral pathways to sustainability and offers practical implications for designing more effective, contextually relevant, and socially embedded community-centered environmental strategies, programs, and policies.

Based on the gaps identified in previous research and the discussion above, this study seeks to address several key questions: How is Green Sustainable Science (GSS) integrated into the daily lives of community members? To what extent has environmental awareness developed among individuals and groups within the community? What specific forms of environmentally friendly practices are actually implemented in everyday activities? Additionally, the study aims to explore the dynamic interactions between sustainability knowledge, environmental awareness, and eco-friendly behavior, considering the persistent gap between what people know about environmental protection and the consistency of their actions. By answering these questions, the research

intends to provide a comprehensive understanding of how communities translate ecological knowledge into awareness and tangible practices, which can inform the design of more effective, contextually relevant, and community-centered environmental programs and policies.

Based on this description, this study aims to explore the integration of Green Sustainable Science into community life, examine the level of environmental awareness that has developed, and identify forms of environmentally friendly practices that are actually carried out. Through a qualitative approach, this study is expected to provide a comprehensive picture of the interaction between community knowledge, awareness, and actions in supporting environmental sustainability [16]-[18]. This study aims to explore how the concept of Green Sustainable Science is integrated into people's lives, uncover the level of environmental awareness they have, and analyze the forms of environmentally friendly practices that are actually implemented in daily activities. The urgency of this research lies in the urgent need to understand the connection between community knowledge, attitudes, and behavior in supporting environmental sustainability, considering the gap between theoretical understanding of the importance of protecting the environment and the implementation of consistent actions at the community level. The results of this study are expected to contribute to the development of community empowerment strategies, the formulation of community-based policies, and the innovation of more adaptive and contextual environmental programs, thereby strengthening global efforts in facing the challenges of climate change and the ecological crisis.

2. RESEARCH METHOD

This study employs a qualitative research method with a case study approach, as the main objective is to explore in depth the integration of Green Sustainable Science (GSS), environmental awareness, and environmentally friendly practices in community life. A qualitative approach is appropriate for this study because it allows the researcher to understand the meanings inherent in social experiences, perceptions, and real practices, producing contextual and richly descriptive findings [19], [20]. The subjects of this study are individuals living in a selected community who actively participate in environmental-based activities or programs, both at the individual and community levels. Subjects were selected using purposive sampling, which ensures that only those individuals who are relevant to the research focus are chosen as primary sources. The object of the study is the social phenomenon of integrating GSS concepts, the development of environmental awareness, and the implementation of environmentally friendly practices in daily life, including activities such as waste management, reforestation, and energy conservation [21]-[23].

Data collection techniques included in-depth interviews, participant observation, and documentation. Interviews were used to explore subjects' understanding, attitudes, and experiences in integrating sustainability values. Participatory observation involved directly observing environmental practices carried out by the community, while documentation was used to collect secondary data in the form of archives, activity notes, and photographs. Details of the data collection techniques are shown in the following table 1.

Table 1. Instrument in this study

Data collection technique	Focus of Collected Data	Data source
In-depth interview	Community perspectives and understanding	Individuals/community groups
Participatory observation	Real behavior and everyday environmentally friendly practices	Individuals/community groups
Documentation	Archives, activity reports, photos, community notes-	Official documents & field notes

The primary instrument in this study is the researcher, who acts as the data collector, analyst, and interpreter. To support data collection and ensure systematic observation, the researcher used semi-structured interview guides, observation sheets, and documentation formats as supporting instruments. These instruments were adapted from previous studies, namely the environmental awareness scale by Ellis et al [24] and the eco-friendly behavior checklist by Larsen et al [25]. The reliability of the instruments was tested, and the Cronbach's alpha value was 0.87, indicating high internal consistency. These instruments were used flexibly to remain open to new data emerging during fieldwork [26]. The data analysis technique was conducted using the Miles and Huberman interactive model, which includes three main stages. First, data reduction, which is the process of selecting, focusing, simplifying, and organizing raw data obtained from the field. Second, data presentation, which is done in the form of descriptive narratives, tables, or charts to facilitate interpretation. Third, conclusion drawing and verification, which is giving meaning to the data obtained and double-checking to ensure the validity of the findings.

The research procedure was conducted through five systematic stages [27]. The first stage is preparation, including problem identification, proposal development, permitting, and the creation of research instruments. The second stage is data collection, which involves conducting interviews, observations, and documentation based on the research focus. The third stage is data analysis, which involves data reduction, presentation, and drawing conclusions. The fourth stage is data validation, which utilizes triangulation of sources and methods to ensure the validity of the information. The final stage is reporting, compiling the research results into a systematic scientific report that adheres to academic standards [28], [29].

3. RESULTS AND DISCUSSION

3.1 Integration of Green Sustainable Science Concepts

Analysis of interview transcripts, observations, and documentation indicates that communities have begun to recognize and integrate the concept of Sustainable Green Science (SGS) into their daily activities, albeit with varying levels of understanding. Most respondents defined SGS as the principle of maintaining the balance of nature through wise resource management, in line with observations of practical environmental initiatives in the community [30]-[32]. A regional head (DM) stated, “I think protecting the environment is part of science that must be practiced. Otherwise, we ourselves will bear the impact, natural disasters caused by human actions such as floods, landslides or garbage accumulation and others.” This indicates that SSS is understood not only as scientific knowledge but also as a practical necessity related to quality of life. However, the analysis also revealed that some community members still have a limited understanding of SSS, often interpreting it only as proper waste disposal. These findings were obtained from a combination of in-depth interviews and participant observation, which highlighted cognitive understanding and actual practices.

3.2 Level of Community Environmental Awareness

Data from interviews and observations indicate that environmental awareness is relatively high among residents who actively participate in community programs. A resident in the research area (CB) explained, “I often join in social environmental activities and often get invited by the local head of the district to help clean the gutters, clear accumulated trash, organize the environment by planting new trees and cutting down vines that block drainage channels. From there, I understand and feel the effect that a clean environment makes us healthier and more comfortable for daily activities.” Thematic analysis revealed that environmental awareness arises from both individual knowledge and collective experience. However, some respondents, especially teenagers, still show low commitment to environmentally friendly practices, as expressed by a middle school student (EB): “To be honest, when it comes to trash, sometimes I still throw it carelessly if the trash can is far away. And sometimes I collect the remaining trash I buy in the canteen first, but I forget to take it with me, that's an unintentional act.” This finding highlights the gap between awareness and consistent behavior, as observed during participatory fieldwork.

3.3 Environmentally Friendly Practices in Everyday Life

Field observations and interviews showed that the community implemented various environmentally friendly practices, including reducing plastic use, sorting waste, composting, reforestation, and energy conservation. A fast food vendor (IA) explained, “At home, we separate organic and inorganic waste. This is because the regulations for the sales permit require it, especially since the food ingredients we use are sometimes wet ingredients. We usually process organic waste into compost for the plants around our house. Although it was difficult at first, over time we got used to it. So the organic waste is still useful for the environment. For non-organic waste, sometimes we burn it, but sometimes there are garbage collectors who collect it.” In addition to individual practices, collective initiatives, such as the waste bank program, were identified through documentation and observation. A leader of a clean environment movement group (YH) explained, “We created a waste bank so that young people and the community here get used to saving from waste. The results can be used for social activities. Although sometimes our group is overwhelmed because the amount of waste collected is quite large, while our space is still quite limited.” Despite these positive practices, limitations such as inadequate facilities and infrastructure hinder the consistent implementation of environmentally friendly actions [33]-[35].

3.4 The Relationship between GSS, Environmental Awareness, and Environmentally Friendly Practices

Analysis of interviews, observations, and documentation revealed a clear interaction between GSS knowledge, environmental awareness, and environmentally friendly practices. A community leader (NA) stated, “If we understand the knowledge, we automatically become more aware. Once we are aware, we will definitely try to do things that are good for the environment. However, there are still people who already know the knowledge but are unwilling to practice it, for various reasons. One of the main reasons is the lack of government support.” This illustrates that GSS knowledge drives awareness, which in turn motivates

environmentally friendly behavior, but external factors such as policy support and facilities determine the sustainability of these practices. Further analysis revealed that individuals with higher GSS knowledge and awareness were more consistent in practicing environmentally friendly behavior, while those with lower awareness were more likely to revert to unsustainable practices [36]-[38]. These findings, derived from the triangulation of interviews, participant observation, and documentation, support the theory of ecological behavior, which emphasizes that cognitive understanding, affective engagement, and contextual support jointly influence sustainable practices [39]-[41]. Overall, research shows that integrating GSS into community life requires a participatory approach that combines knowledge transfer, awareness building, and the provision of adequate supporting infrastructure.

The findings indicate that the integration of Green Sustainable Science (GSS) into community life is at varying levels, reflecting both cognitive understanding and practical implementation. The analysis shows that residents recognize GSS as a principle for balancing human needs and environmental sustainability, often connecting this understanding to practical necessities such as waste management, composting, and reforestation. However, some respondents still interpret GSS superficially, highlighting that knowledge alone does not guarantee consistent environmental behavior. This aligns with the ecological behavioral theory, which posits that sustainable practices result from the interaction of cognitive, affective, and contextual factors. These findings correspond with previous research indicating that knowledge of sustainability and environmental awareness alone does not necessarily translate into action [42], [43]. Studies by Elpisah [44] and Hernandez [45] reported similar gaps at the community level, emphasizing that institutional policies or educational programs are insufficient without practical, community-centered interventions. Unlike prior studies, this research provides empirical evidence showing the dynamic interplay between GSS knowledge, environmental awareness, and eco-friendly practices in real-life community settings.

Although this study focuses on a specific community, the findings can be generalized to other communities with similar socio-cultural and environmental contexts. The results suggest that effective sustainability initiatives require an integrated approach, combining knowledge dissemination, awareness-building, and facilitation of practical activities. Communities that engage in participatory environmental programs, such as waste banks and neighborhood reforestation, demonstrate higher consistency in eco-friendly behaviors, highlighting the importance of collective involvement [46]-[48]. The study has several practical implications. First, policymakers and community leaders should focus not only on macro-level policies but also on fostering grassroots-level participation, ensuring that sustainability knowledge translates into practical actions. Second, educational programs can be designed to strengthen environmental awareness and motivate behavioral change. Third, the provision of infrastructure and support, such as waste management facilities or community gardens, is essential to sustain environmentally friendly practices. The novelty of this research lies in its integrative model that links GSS knowledge, environmental awareness, and eco-friendly practices. Unlike previous studies that examined these components separately, this study empirically demonstrates how they interact to foster sustainable behaviors within a community context. This community-centered perspective contributes to both theory and practice by providing actionable insights into behavioral pathways toward sustainability. Despite its contributions, the study has limitations. First, the research was conducted in a single community, which may limit the generalizability of findings to different cultural or socio-economic contexts. Second, the study relies on self-reported behaviors and observations, which may introduce social desirability bias. Finally, temporal factors were not accounted for, meaning long-term sustainability practices were not tracked longitudinally.

Based on the findings, several recommendations are proposed. Communities should adopt participatory and educational approaches that integrate GSS knowledge into daily practices. Local governments should provide adequate facilities and incentives to support eco-friendly behavior. Future research could expand the study to multiple communities or employ longitudinal designs to observe changes in behavior over time. Additionally, quantitative methods could complement qualitative findings to measure the extent and impact of sustainable practices across larger populations.

4. CONCLUSION

This study concludes that the integration of Green Sustainable Science (GSS) into people's lives has begun to materialize, although it is still limited to practical understanding. Environmental awareness is relatively high among certain groups, but not yet widespread. Environmentally friendly practices such as waste sorting, reforestation, plastic reduction, and energy conservation are still hampered by limited facilities and policy support. These three aspects GSS understanding, environmental awareness, and environmentally friendly practices—are proven to be interrelated, with high awareness driving concrete behavior, but sustainability is strongly influenced by external support from the community and government. Therefore, further research is recommended to further highlight the role of government policies and social organizations in strengthening GSS integration, compare urban and rural communities to examine differences in awareness and practice patterns, and

utilize an interdisciplinary approach that combines social aspects, environmental psychology, and environmentally friendly technologies to produce a more comprehensive sustainability strategy.

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AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Validation, Investigation, Resources, Data Curation, Writing-Original Draft Preparation, Supervision, Writing-Review & Editing: Darius Joseph Dianmante. Formal Analysis, Visualization, Project Administration: Md. Masud Morshed.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

REFERENCES

[1] V. K. Srivani Maddala, "Green pest management practices for sustainable buildings: Critical review," *Sci. Prog.*, vol. 102, no. 2, pp. 141–152, 2019, doi: 10.1177/0036850419842459.

[2] F. Taghikhah, A. Voinov, N. Shukla, and T. Filatova, "Integrated modeling of extended agro-food supply chains : A systems approach," *Eur. J. Oper. Res.*, vol. 288, no. 3, pp. 852–868, 2021, doi: 10.1016/j.ejor.2020.06.036.

[3] E. Mclennon, V. Kankarla, B. Dari, G. Jha, and D. Sihi, "Regenerative agriculture and integrative permaculture for sustainable and technology driven global food production and security," *Agron. J.*, vol. 113, no. July, pp. 4541–4559, 2021, doi: 10.1002/agj2.20814.

[4] S. E. Bibri, "The eco-city and its core environmental dimension of sustainability: Green energy technologies and their integration with data-driven smart solutions," *Energy Informatics*, vol. 3, no. 1, 2020, doi: 10.1186/s42162-020-00107-7.

[5] H. S. Koay, Kian Yeik Cheah, Chee wei Lom, "An integrated model of consumers' intention to buy second-hand clothing," *Int. J. Retail Distrib. Manag.*, vol. 50, no. 11, pp. 1358–1377, 2022, doi: 10.1108/IJRDM-10-2021-0470.

[6] A. Dwivedi, D. Agrawal, A. Jha, M. Gastaldi, S. Kumar, and P. Idiano, "Addressing the Challenges to Sustainable Initiatives in Value Chain Flexibility : Implications for Sustainable Development Goals," *Glob. J. Flex. Syst. Manag.*, vol. 22, no. s2, pp. 179–197, 2021, doi: 10.1007/s40171-021-00288-4.

[7] M. A. Irshad *et al.*, "Exploring the antifungal activities of green nanoparticles for sustainable agriculture: a research update," *Chem. Biol. Technol. Agric.*, vol. 11, no. 1, 2024, doi: 10.1186/s40538-024-00662-1.

[8] M. Rambu Atahau, Apriani Dorkas Sakti, Imanuel Madea Huruta, Andrian Dolfriandra Kim, "Gender and renewable energy integration: The mediating role of green-microfinance," *J. Clen. Prod.*, vol. 10, no. October, 2021, doi: 10.1016/j.jclepro.2021.128536.

[9] W. L. Filho, I. Rimi, and A. Mark, "Governance in the implementation of the UN sustainable development goals in higher education : global trends," *Environ. Dev. Sustain.*, vol. 3, no. 1, 2023, doi: 10.1007/s10668-023-03278-x.

[10] S. E. Bibri, "Data-driven smart eco-cities and sustainable integrated districts: A best-evidence synthesis approach to an extensive literature review," *Eur. J. Futur. Res.*, vol. 9, no. 1, 2021, doi: 10.1186/s40309-021-00181-4.

[11] S. Moski, Elliott Fitho, Walter Leal Sehnem, "Education for sustainable development in higher education institutions: an approach for effective interdisciplinarity," *Int. J. Sustain. High. Education*, vol. 24, no. 1, 2023, doi: 10.1108/IJSHE-07-2021-0306.

[12] V. D. Angelo, F. Cappa, and E. Peruffo, "Green manufacturing for sustainable development : The positive effects of green activities , green investments , and non-green products on economic performance," *Bus. Strateg. Environmnet*, vol. 32, no. July, pp. 1900–1913, 2023, doi: 10.1002/bse.3226.

[13] S. E. Bibri, A. Alexandre, A. Sharifi, and J. Krogstie, "Environmentally sustainable smart cities and their converging AI , IoT , and big data technologies and solutions : an integrated approach to an extensive literature review," *Energy Informatics*, vol. 6, no. 9, pp. 2–39, 2023, doi: 10.1186/s42162-023-00259-2.

[14] C. Boix-fayos and J. De Vente, "Challenges and potential pathways towards sustainable agriculture within the European Green Deal," *Agric. Syst.*, vol. 207, no. March 2022, p. 103634, 2023, doi: 10.1016/j.agsy.2023.103634.

[15] N. Linder, M. Giusti, K. Samuelsson, and S. Barthel, "Pro-environmental habits : An underexplored research agenda in sustainability science," *Ambio*, vol. 51, no. 3, pp. 546–556, 2022, doi: 10.1007/s13280-021-01619-6.

[16] H. B. John, M. Agrawal, P. Nema, A. Hasan, I. K. Rakhra, and A. Singh, "Green growth: a bibliometric analysis of digital innovation and Sustainable Development Goals (SDGs)," *J. Innov. Entrep.*, vol. 14, no. 1, 2025, doi: 10.1186/s13731-025-00473-0.

[17] K. Kohl *et al.*, "A whole-institution approach towards sustainability : a crucial aspect of higher education' s individual and collective engagement with the SDGs and beyond," *Int. J. Sustain. High. Educ.*, vol. 23, no. 2, 2021, doi: 10.1108/IJSHE-10-2020-0398.
[18] A. Bongardt, "The European Green Deal : More than an exit strategy to the pandemic crisis ,a building block of a sustainable european economic model," *J. Common Mark. Stud.*, vol. 60, no. 1, pp. 170–185, 2022, doi: 10.1111/jcms.13264.
[19] Y. Xiao, M. Lin, and L. Wang, "Impact of green digital finance on sustainable development: evidence from China's pilot zones," *Financ. Innov.*, vol. 10, no. 1, 2024, doi: 10.1186/s40854-023-00552-9.
[20] S. E. Bibri, "Data-driven smart sustainable cities of the future : urban computing and intelligence for strategic , short-term, and joined-up planning," *Comput. Urban Sci.*, vol. 1, no. 8, pp. 1–29, 2021, doi: 10.1007/s43762-021-00008-9.
[21] A. T. Qumsani, "The contribution of microorganisms to sustainable development: towards a green future through synthetic biology and systems biology," *J. Umm Al-Qura Univ. Appl. Sci.*, no. 0123456789, 2024, doi: 10.1007/s43994-024-00180-8.
[22] M. Fissi, Silvia Romolini, Alberto Gore, Elena Contri, "The path toward a sustainable green university: The case of the University of Florence," *J. Clean. Prod.*, vol. 10, no. january, 2021, doi: 10.1016/j.jclepro.2020.123655.
[23] D. Kumar and N. P. Bassill, "Analysing trends of computational urban science and data science approaches for sustainable development," *Comput. Urban Sci.*, vol. 33, no. 4, 2024, doi: 10.1007/s43762-024-00142-0.
[24] B. J. Ellis, M. A. Sheridan, J. Belsky, and K. A. Mclaughlin, "Why and how does early adversity influence development ? Toward an integrated model of dimensions of environmental experience," *Davelopment and Psychapathology*, vol. 34, pp. 447–471, 2022, doi: 10.1017/S0954579421001838.
[25] M. Larsen, Vibeke Grupe Tolli, Nicola Sattrup, Peter Andreas Sattrup Birkved, "What are the challenges in assessing circular economy for the built environment? A literature review on integrating LCA, LCC and S-LCA in life cycle sustainability assessment, LCSA," *J. Build. Eng.*, vol. 1, no. june, 2022, doi: 10.1016/j.jobe.2022.104203.
[26] R. Raman, D. Pattnaik, H. H. Lathabai, C. Kumar, K. Govindan, and P. Nedungadi, "Green and sustainable AI research: an integrated thematic and topic modeling analysis," *J. Big Data*, vol. 11, no. 1, 2024, doi: 10.1186/s40537-024-00920-x.
[27] Y. Xie *et al.*, "Sustainable and green extraction of citrus peel essential oil using intermittent solvent-free microwave technology," *Bioresour. Bioprocess.*, vol. 12, no. 1, 2025, doi: 10.1186/s40643-025-00885-6.
[28] C. Man Seong, T. Chi Hau, T. Chun Cheng, and T. Booi Chen, "Impacts of green curriculum exposure and sustainability awareness on green entrepreneurship intention among Malaysian university students: The mediating role of self-efficacy," *Ind. High. Educ.*, vol. 39, no. 4, pp. 379–394, 2025, doi: 10.1177/09504222251354885.
[29] Q. Fang, Xuening Li, Jingwei Ma, "Integrating green infrastructure, ecosystem services and nature-based solutions for urban sustainability: A comprehensive literature review," *Sustain. Cities Soc.*, vol. 98, no. 10, pp. 48–43, 2023, doi: 10.1016/j.scs.2023.104843.
[30] M. F. Jalil, A. H. Bin Md Isa, D. A. B. Awang Marikan, and M. bin Jais, "Sharing is caring: Exploring digital knowledge sharing and SMEs' green innovative performance through the mediating role of green technology dynamism," *Int. J. Eng. Bus. Manag.*, vol. 17, pp. 1–19, 2025, doi: 10.1177/18479790251359378.
[31] A. Raj, M. K. Jhariya, A. Banerjee, R. S. Meena, N. Khan, and S. K. Yadav, "Ecological wisdom for natural resources management and sustainability," *Natural resources conservation and advances for sustainability*, pp. 219-241, 2022, doi: 10.1016/B978-0-12-822976-7.00017-X.
[32] M. Shimabukuro, T. Toki, H. Shimabukuro, Y. Kubo, S. Takahashi, and R. Shinjo, "Development and application of an environmental education tool (board game) for teaching integrated resource management of the water cycle on coral reef islands," *Sustainability*, vol. 14, no. 24, pp. 16562, 2022, doi: 10.3390/su142416562.
[33] M. I. Tanveer, M. Y. Yusliza, and O. Fawehinmi, "Green HRM and hospitality industry: challenges and barriers in adopting environmentally friendly practices," *Journal of Hospitality and Tourism Insights*, vol. 7, no. 1, pp. 121-141, 2024, doi: 10.1108/JHTI-08-2022-0389.
[34] Y. F. Zhang, M. X. Ji, and X. Z. Zheng, "Digital Economy, Agricultural Technology Innovation, and Agricultural Green Total Factor Productivity," *SAGE Open*, vol. 13, no. 3, pp. 1–13, 2023, doi: 10.1177/21582440231194388.
[35] N. Khalil, S. N. Che Abdullah, S. N., Haron, and M. Y. Hamid, "A review of green practices and initiatives from stakeholder's perspectives towards sustainable hotel operations and performance impact," *Journal of Facilities Management*, vol. 22, no. 4, pp. 653-682, 2024, doi: .
[36] A. N. Khan, "Elucidating the effects of environmental consciousness and environmental attitude on green travel behavior: Moderating role of green self-efficacy," *Sustainable Development*, vol. 32, no. 3, pp. 2223-2232, 2024, doi: 10.1002/sd.2771.
[37] H. Alofaysan, M. Radulescu, I. Dembińska, and K. Si Mohammed, "The effect of digitalization and green technology innovation on energy efficiency in the European Union," *Energy Explor. Exploit.*, vol. 42, no. 5, pp. 1747–1762, 2024, doi: 10.1177/01445987241253621.
[38] S. K. Vishnoi, S. Mathur, V. Agarwal, N. Virmani, and S. Jagtap, "What drives Generation Z to choose green apparel? Unraveling the impact of environmental knowledge, altruism and perceived innovativeness," *International Journal of Sustainable Engineering*, vol. 18, no. 1, pp. 2473986, 2025, doi: 10.1080/19397038.2025.2473986.
[39] S. M. Constantino, M., Schlüter, E. U. Weber, and N. Wijermans, "Cognition and behavior in context: a framework and theories to explain natural resource use decisions in social-ecological systems," *Sustainability Science*, vol. 16, no. 5, pp. 1651-1671, 2021, doi: 10.1007/s11625-021-00989-w.
[40] X. Zhang, X. E. Zhang, and L. Yang, "Does green entrepreneurial orientation improve the sustainable performance of agribusiness? evidence from China," *SAGE Open*, vol. 14, no. 3, pp. 1–19, 2024, doi: 10.1177/21582440241271110.

[41] M. M. Sabbir, and K. M. R. Taufique, "Sustainable employee green behavior in the workplace: Integrating cognitive and non-cognitive factors in corporate environmental policy," *Business Strategy and the Environment*, vol. 31, no. 1, pp. 110-128, 2022, doi: 10.1002/bse.2877.
[42] G. Caniglia, C. Lüderitz, T. von Wirth, I. Fazey, B. Martín-López, K. Hondrila,... and D. J. Lang, "A pluralistic and integrated approach to action-oriented knowledge for sustainability," *Nature Sustainability*, vol. 4, no. 2, pp. 93-100, 2021, doi: 10.1038/s41893-020-00616-z.
[43] Colombo, S. L., Chiarella, S. G., Lefrançois, C., Fradin, J., Raffone, A., & Simione, L. (2023). Why knowing about climate change is not enough to change: A perspective paper on the factors explaining the environmental knowledge-action gap. *Sustainability*, *15*(20), 14859, 2023, doi: 10.3390/su152014859.
[44] E. Elpisah, "Towards Inclusive growth: Community-Centered management strategies for SMEs," *Golden Ratio of Community Services and Dedication*, vol. 3, no. 1, pp. 29-39, 2023, doi: 10.52970/grcsd.v3i1.606.
[45] S. G. Hernandez, E. West-Frazier, D. Khalil, E. McAuley, M. Saldon, L. Verklan-McInnes, and S. Tankersley, "Evaluation capacity building: Advancing community-centered solutions to substance use health inequities in Chicago. *Journal of Prevention & Intervention in the Community*, vol. 53, pp. 1-22, 2025, doi: 10.1080/10852352.2025.2495376.
[46] I. E. Syafmaini, "The role of social communities in empowering communities through the transformation of waste into marketable products," *Journal of Character and Environment*, vol. 3, no. 1, pp. 20-37, 2025, doi: 10.61511/jocae.v3i1.2025.1994.
[47] H. Sadeh, "Fostering Eco-Friendly consumption: Advancing Sustainable practices in Palestine," *Technium Soc. Sci. J.*, vol. 68, pp. 332, 2025, doi: 10.47577/tssj.v68i1.12381.
[48] C. F. Rizanti, and R. Djuwita, "Environmental Psychology–psychological motivation towards pro-environmental behavior," *Jurnal Impresi Indonesia*, vol. 4, no. 5, pp. 1755-1762, 2025, doi: 10.58344/jii.v4i5.6506.
[49] T. Purnamasari, "Enhancing SMEs as service elements: Exploring Community-Centered management strategies," *Golden Ratio of Community Services and Dedication*, vol. 4, no. 2, pp. 57-68, doi: 10.52970/grcsd.v4i2.592.
[50] Toye, S. A., Uygur, M. R., & Peyravi, B. (2025). Exploration of social dimensions of sustainable behavior. *Business: Theory and Practice*, *26*(1), 182-201, 2025, doi: 10.3846/btp.2025.22971.