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Editorial

Enabling Strategies and Policies Toward a Sustainable Environment

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This Topic, Enabling Strategies and Policies toward a Sustainable Environment, addresses the gaps in the literature by synthesizing pioneering research on the mechanisms driving sustainable transitions. The contributions span four thematic pillars: (1) circular economy innovations, (2) green financial architectures, (3) decarbonization pathways in energy systems, and (4) polycentric governance models. Methodologically, this Topic breaks new ground by applying computational econometrics, agent-based modeling, and participatory action research, offering granular insights into structural inertia and leverage points within socio-technical systems. By framing sustainability as a "wicked problem" [1] characterized by competing priorities and irreducible uncertainties, this collection advances a critical epistemology that rejects technocratic reductionism in favor of adaptive, justice-centered solutions.

A salient cross-cutting theme is the dialectic between globalization and hyper-localized sustainability challenges. For instance, some studies dissect how urban agglomeration economies exacerbate resource depletion in the Global South [2], while others interrogate the gender-disaggregated impacts of climate policies in agrarian communities [3]. Such analyses reveal the inadequacy of universalist frameworks, underscoring the need for spatially and culturally attuned governance. However, critical asymmetries persist. While energy transitions dominate scholarly discourse, under-researched intersections, such as the health–environment–poverty triad, remain marginalized [4]. Similarly, circular economy paradigms often falter in resource-constrained regions because of institutional voids, necessitating context-specific innovation ecosystems [5].

Future research should prioritize two topics: technological integration and contextual scalability. Emerging technologies, such as blockchain-enabled supply chain traceability and AI-driven climate modeling, promise to optimize resource flows and enhance governance transparency [6]. Concurrently, comparative studies across the Global South—examining, for example, solar microgrid adoption in sub-Saharan Africa versus Southeast Asia—could illuminate scalable models for equitable technology diffusion [7]. Such endeavors must be coupled with epistemic pluralism by integrating Indigenous knowledge systems and grassroot innovations into the mainstream sustainability discourse. By convening this Topic, we aim to galvanize a transdisciplinary praxis that bridges the theory–policy–action chasm. The existential stakes of ecological collapse demand nothing less than a radical reimagining of collaboration that transcends disciplinary boundaries, centers marginalized voices, and prioritizes intergenerational equity.

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The first study (Paper 1) in this Topic examines Slovakia's municipal solid waste (MSW) management challenges, critiques its landfill dependency, and advocates for circular economy transitions. This study identifies socio-technical barriers (e.g., public awareness gaps) and stresses the importance of stakeholder engagement through behavioral nudges (e.g., pay-as-you-throw schemes). The second study (Paper 2) analyzes the industrialization–environment nexus in the South African Customs Union (SACU) using quantile regression (2007–2021), revealing an Environmental Kuznets Curve (EKC): industrial expansion initially worsens ecological degradation (e.g., air pollution, biodiversity loss) but reverses after economic thresholds. In alignment with SDGs 9 and 13, this study advocates for decoupling industrial growth from resource depletion by redefining economic complexity to integrate ecological resilience. Another study (Paper 3) investigates the COVID-19 pandemic's disruption of Brazil's poultry supply chain, a critical node in global agri-food systems. The authors advocate for structural resilience through supply chain diversification, enhanced biosecurity protocols, and adaptive production models to mitigate future shocks.

The next study (Paper 4) investigates the heterogeneous relationship between green patenting activity and financial performance across firm-size cohorts in the US and EU (2010–2022). This study contributes to the ecological modernization theory by quantifying how firm-specific capacities mediate green innovation–performance linkages and advocates granular policy frameworks to accelerate low-carbon transitions without compromising competitiveness. The following study (Paper 5) investigates Polish households' adaptive strategies to rising energy costs under economic and climate policy shifts by employing a multivariate regression analysis of survey data (2020–2023). This study underscores the necessity of coupling market-based incentives with equity-oriented governance to ensure inclusive climate resilience. The systematic review of this Topic (Paper 6) synthesizes 138 studies to evaluate conceptual and methodological advancements in energy literacy research, defined as individuals' capacity to comprehend energy systems, environmental externalities, and sustainable decision-making. This synthesis advances strategies for democratizing energy knowledge and accelerating equitable low-carbon transitions by aligning energy literacy initiatives with transition principles.

The following study (Paper 7) quantified the ecological and economic value of Wuhan's urban lake wetlands by employing multidisciplinary valuation frameworks, including contingent valuation surveys, shadow pricing, and hedonic analysis, to assess ecosystem services (ES). This study advocates for a holistic valuation framework that integrates the Total Economic Value (TEV) model into municipal land-use policies, emphasizing adaptive governance to balance urbanization with socio-ecological resilience. Another study (Paper 8) investigates the spatial agglomeration of pollution-intensive industries (PIIs) in Hebei Province, China, using spatial econometric analysis (Moran's I and geographically weighted regression) to assess industrial clustering patterns and environmental externalities. The authors advocate embedding socio-ecological equity into regional planning, ensuring that industrial redistribution aligns with the "Dual Carbon" targets. The next study (Paper 9) evaluates Thailand's transport decarbonization strategies by analyzing the efficacy of electric vehicle (EV) incentives and public transit expansion in reducing sectoral emissions. Utilizing a hybrid methodology—integrating traffic simulation (VISUM), life cycle emissions modeling, and policy gap analysis—the research projects a 28% reduction in CO_2-equivalent emissions by 2030 under full policy implementation.

The following study (Paper 10) investigates the strategic interdependencies between power producers and policymakers in biomass-coal energy transitions by employing evolutionary game theory and system dynamics simulations. This study advocates for hybrid policy frameworks that combine performance-based subsidies, real-time carbon markets, and regulatory sandboxes to accommodate sectoral heterogeneities. The next study (Paper

11) investigates the innovation dynamics in the wind energy sector through the lens of competitor-weighted centrality. This network metric quantifies firms' strategic influence based on their position within competitive ecosystems. By embedding competitive centrality into industrial policy, stakeholders can harness network dynamics to meet the global renewable energy targets of the Paris Agreement, fostering resilience in decarbonization pathways. Another study (Paper 12) explored the relationship between corporate environmental responsibility and firms' involvement in green innovation networks. The authors suggest that firms actively participate in green innovation networks to enhance their environmental performance while fostering a corporate culture that values sustainability and ethical practice.

The next study (Paper 13) investigates the effects of water resource taxation on conservation behaviors in Hubei Province, China, employing a dynamic stochastic general equilibrium (DSGE) model to evaluate the long-term policy impacts. The analysis underscores the necessity of water-pricing frameworks that internalize environmental and social externalities and align economic signals with sustainability objectives. The following study (Paper 14) examines the socio-psychological determinants of sustainable water consumption among Generation Z tourists in Quintana Roo, Mexico, employing a quantitative survey methodology to assess attitudes, subjective norms, and perceived behavioral control. This research contributes to the discourse on youth-centric sustainability strategies in high-traffic destinations, emphasizing actionable frameworks for mitigating resource depletion amid escalating tourism-driven environmental pressures. Another study (Paper 15) explored the transformative role of digital technologies in national audits and their impacts on regional sustainable development. The findings reveal that digital transformation enhances the government's capacity to monitor environmental governance and corporate green innovation, leading to better alignment with sustainable development goals.

The next study (Paper 16) examines divergent marine spatial planning (MSP) paradigms—"soft" sustainability, prioritizing adaptive governance and stakeholder collaboration, and "hard" sustainability, emphasizing regulatory stringency and conservation targets—through a cross-national comparative analysis of seven early adopting nations. The findings reveal systemic challenges, including institutional fragmentation, uneven stakeholder inclusion, and tensions between ecological preservation and maritime economic development. The following paper (Paper 17) examines the health benefits of "blue spaces" such as rivers, lakes, and wetlands, emphasizing their potential to improve mental and physical well-being. The findings show that blue spaces offer unique benefits, such as stress reduction, improved mood, and enhanced physical activity, particularly for vulnerable populations, such as older people and children. The next study (Paper 18) constructs a composite Urban Energy Transition Index (UETI) to evaluate low-carbon progress in Turin, Italy, by integrating environmental, economic, and social metrics. The results reveal marked advancements in environmental performance, notably renewable energy adoption, and efficiency gains, but lagging socioeconomic equity outcomes, underscoring disparities in transition inclusivity.

Another study (Paper 19) addressed the growing number of doctor–patient disputes in China, which are exacerbated by information asymmetry and unequal access to medical resources. This study proposes a multistakeholder governance framework involving doctors, patients, government agencies, and third-party mediators to resolve disputes more effectively. The following study (Paper 20) assesses the efficacy of China's innovative city pilot policies in driving regional innovation through a quasi-experimental difference-in-differences (DID) analysis of the 2003–2016 panel data. This research advances the theoretical and practical discourse on spatial equity in national innovation strategies by elucidating the interplay between policy design, regional heterogeneity, and innovation

ecosystems. The last study (Paper 21) explored innovative methods for reducing Cd contamination in soils using thermally activated nanomaterials combined with potassium dihydrogen phosphate (KH_2PO_3). These findings contribute to the growing knowledge of sustainable soil management and offer practical solutions for mitigating the environmental and health impacts of heavy metal pollution.

This Topic, Enabling Strategies and Policies for a Sustainable Environment, has brought together a diverse collection of studies that collectively address some of the most pressing challenges in sustainability. These 21 papers span a range of topics from waste management and industrialization to green innovation and water conservation, offering novel insights and practical recommendations for policymakers, businesses, and researchers. Together, these studies highlight the interconnectedness of environmental, economic, and social systems and the complexity of transitioning to a more sustainable future for the planet. This Topic underscores the critical need for a systemic approach to achieve sustainability. For instance, the emphasis on transitioning from landfills to a circular economy (Paper 1) reflects the broader challenge of reducing waste and resource inefficiencies. Similarly, the nuanced findings on industrialization in SACU countries (Paper 2) remind us that economic growth can only be sustainable if green technologies and policies accompany it. Other studies, such as those on green patents (Paper 4) and innovation networks (Paper 12), have demonstrated the power of technological advancement and collaboration to drive sustainability.

These studies also highlight the importance of integrating environmental considerations into everyday decision-making at various levels of governance and society. The behavioral adaptations of Polish households to rising energy costs (Paper 5), health benefits of blue spaces (Paper 17), and sustainable water consumption practices among Generation Z tourists (Paper 14) illustrate how individual and collective behaviors can shape environmental outcomes. Simultaneously, the role of governance and institutions is apparent in studies on water resource taxes (Paper 13), digital audits (Paper 15), and marine spatial planning (Paper 16), which show how effective policies and frameworks can incentivize sustainable practices and improve resource management. While these studies provide valuable insights, they highlight persistent gaps and challenges in achieving sustainability. Many studies have called for stronger collaboration between stakeholders, whether in managing doctor–patient disputes (Paper 19), reducing motor vehicle emissions in Thailand (Paper 9), or implementing innovative city pilot policies in China (Paper 20). Additionally, the findings emphasize the need for context-specific solutions that consider regional disparities, as seen in the uneven effects of industrialization in SACU countries and the varied progress of urban energy transitions (Paper 18).

This Topic highlights the exciting opportunities for future research. Emerging technologies like artificial intelligence, blockchain, and advanced materials like nano-serpentine (Paper 21) have immense potential for addressing long-standing environmental challenges. However, realizing this potential requires interdisciplinary research that bridges the technical, economic, and social perspectives. Moreover, as papers such as those on Wuhan's wetlands (Paper 7) demonstrate, the valuation and preservation of natural resources must remain central to sustainability efforts, especially in urban areas, where ecological services are often undervalued. In conclusion, this Topic provides a comprehensive and multidimensional view of the strategies and policies required to achieve a sustainable environment. These findings provide a foundation for future research, emphasizing the importance of innovation, collaboration, and tailored approaches to address environmental challenges. By engaging with these studies, we hope readers will gain new perspectives and be inspired to contribute to the ongoing global efforts to build a sustainable, equitable, and resilient future.

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