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Bibliometric Analysis of Environmental Strategy Research

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ABSTRACT

This study aims to examine the intellectual structure, development, and emerging trends in environmental strategy research using a bibliometric approach. Data were collected from the Scopus database, covering publications within a defined time span, and analyzed using VOSviewer to visualize relationships among key topics, authors, and research clusters. The findings indicate that environmental strategy research is predominantly centered on sustainable development, which serves as the core theme linking various subdomains such as environmental impact, climate change, and economic and social outcomes. The results also reveal a strong interdisciplinary integration with environmental science, particularly in areas related to remediation, toxicity, and risk assessment, as well as an expanding connection with health-related research. In addition, emerging themes such as artificial intelligence, machine learning, and data-driven decision-making suggest a shift toward more technologically enabled environmental strategies. Overall, the study highlights the evolution of environmental strategy from a compliance-based perspective to a dynamic and capability-oriented field that integrates sustainability, science, and digital innovation. These findings provide valuable insights for researchers and practitioners in identifying research gaps and shaping future directions in environmental strategy.

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1. INTRODUCTION

In recent decades, environmental concerns have become central to global development discourse, driven by escalating challenges such as climate change, biodiversity loss, pollution, and resource depletion. Governments, businesses, and civil society are increasingly expected to adopt sustainable practices that balance economic growth with environmental protection. Within this context, environmental strategy has emerged as a critical field of study, focusing on how organizations and institutions design and implement policies, practices, and innovations to address environmental issues while maintaining competitiveness [1]. The growing urgency of sustainability challenges has significantly expanded the scope and relevance of environmental strategy research across disciplines.

The field of environmental strategy research is inherently interdisciplinary, integrating insights from management, economics, environmental science, and public policy. Scholars have explored a wide range of

themes, including corporate environmental responsibility, green innovation, circular economy, and sustainable supply chains. As the volume of research continues to increase, it becomes increasingly difficult for scholars and practitioners to systematically understand the intellectual structure, key trends, and emerging directions within the field [2]. This rapid expansion highlights the need for comprehensive analytical tools that can synthesize and map the development of knowledge in environmental strategy research.

Bibliometric analysis offers a robust methodological approach to address this need. By quantitatively analyzing patterns in academic literature—such as publication trends, citation networks, authorship, and keyword co-occurrence—bibliometric studies provide valuable insights into the evolution of a research field [3]. Unlike traditional literature reviews, which may be subjective and limited in scope, bibliometric analysis enables a more systematic and objective assessment of large volumes of scholarly work. This approach is particularly useful for identifying influential publications, leading authors, dominant research themes, and collaborative networks within environmental strategy research.

Furthermore, bibliometric analysis can help uncover research gaps and emerging topics that warrant further investigation. As environmental challenges evolve, new concepts such as carbon neutrality, environmental governance, and digital sustainability are gaining prominence. Understanding how these themes are reflected in the academic literature is essential for guiding future research and informing policy decisions [4]. By examining citation patterns and keyword trends over time, researchers can identify shifts in focus and anticipate future directions in environmental strategy research.

Despite the increasing application of bibliometric methods in various fields, there remains a limited number of comprehensive bibliometric studies specifically focused on environmental strategy research. Existing studies often concentrate on narrower topics, such as green innovation or corporate sustainability, without providing a holistic overview of the broader field. This gap underscores the importance of conducting a dedicated bibliometric analysis that captures the full spectrum of environmental strategy research. Such a study can contribute to a deeper understanding of the field's intellectual landscape and support more informed and impactful research efforts moving forward.

Although environmental strategy research has grown substantially in both volume and diversity, there is still a lack of systematic understanding regarding its overall structure, development patterns, and key contributors. The fragmentation of research across multiple disciplines and topics makes it challenging to identify dominant themes, influential works, and emerging trends. Without a comprehensive bibliometric analysis, scholars and practitioners may struggle to navigate the field effectively, leading to potential duplication of efforts and missed opportunities for innovation. Therefore, there is a need to systematically analyze the body of literature on environmental strategy to map its intellectual structure, evaluate its evolution, and identify future research directions. The objective of this study is to conduct a comprehensive bibliometric analysis of environmental strategy research.

2. METHODS

This study employs a bibliometric research design to systematically analyze the development and structure of environmental strategy research. Bibliometric analysis is a quantitative method used to evaluate academic literature through statistical techniques, enabling the identification of patterns, trends, and relationships within a large body of publications. The approach is particularly suitable for this study because it allows for an objective and comprehensive examination of the scholarly output related to environmental strategy. The analysis focuses on key bibliometric indicators, including publication counts, citation analysis,

authorship patterns, and keyword co-occurrence, to provide a holistic understanding of the field's evolution and intellectual structure.

The data for this study are collected from a reputable academic database, such as Scopus or Web of Science, which are widely recognized for their extensive coverage of peer-reviewed literature. A structured search strategy is employed using relevant keywords, including "environmental strategy," "green strategy," "sustainable strategy," and related terms. The search is limited to journal articles and review papers published in English to ensure consistency and quality. After the initial retrieval, the dataset undergoes a screening process to remove duplicates and irrelevant records. Bibliographic information such as authors, titles, abstracts, keywords, citations, and publication years is then extracted for further analysis.

3. RESULTS AND DISCUSSION

3.1 Keyword Co-Occurrence Network

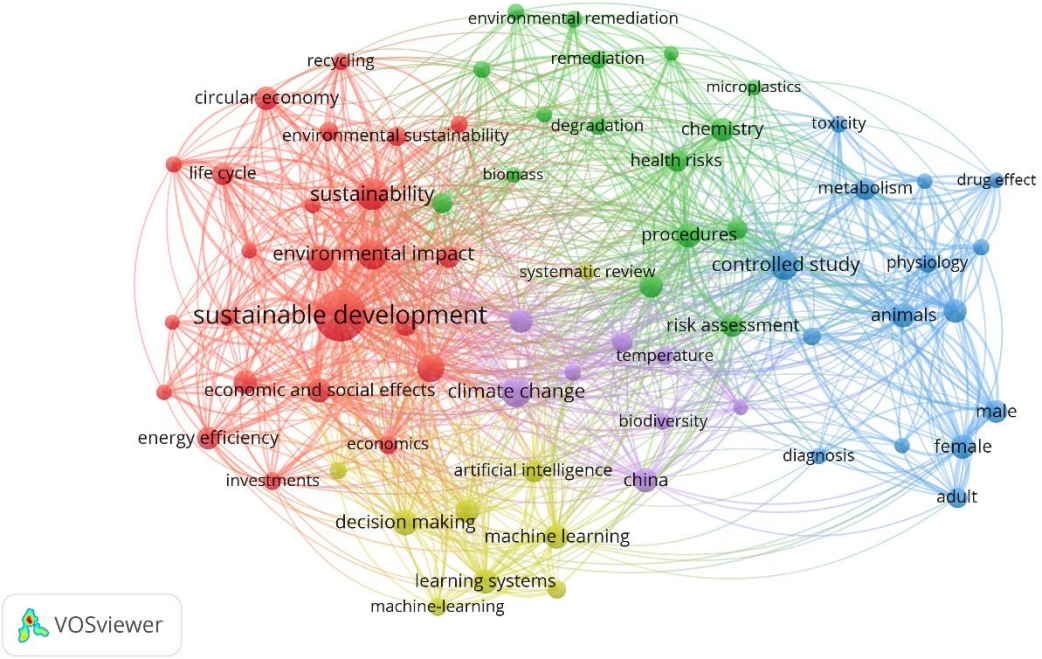

Figure 1. Network Visualization

Source: Data Analysis Result, 2026

Figure 1 reveals a dense and highly interconnected research landscape centered on "sustainable development", which appears as the dominant and most influential node. Its large size and central position indicate that it functions as the intellectual core of environmental strategy research. This suggests that much of the literature is anchored in broad sustainability discourse, where environmental strategy is often embedded within wider discussions of economic, social, and environmental integration rather than treated as a standalone strategic construct.

The red cluster highlights themes closely associated with sustainability and its macro-level implications, including environmental impact, circular economy, energy efficiency, and economic and social effects. This cluster reflects a strategic orientation toward long-term value creation and systemic transformation. The presence of terms such as "life cycle" and "recycling" indicates that research in this area frequently adopts a lifecycle perspective, emphasizing

resource efficiency and sustainable production-consumption systems. This aligns with the evolution of environmental strategy from compliance toward value-driven sustainability initiatives.

The green cluster represents a more technical and scientific dimension, focusing on environmental remediation, chemistry, degradation, and health risks. This indicates that a substantial portion of the literature is rooted in environmental science and engineering domains. The integration of these themes into the broader network suggests that environmental strategy research is not purely managerial but is strongly informed by scientific knowledge related to pollution control, material processes, and environmental restoration. This cluster bridges applied science with strategic considerations, particularly in areas such as remediation technologies and environmental risk mitigation.

The blue cluster introduces a biomedical and toxicological perspective, with keywords such as toxicity, metabolism, drug effect, and physiology. This reflects an interdisciplinary expansion of the field, where environmental issues are increasingly examined through the lens of human health and biological impact. The linkage between this cluster and others implies that environmental strategy is also influenced by concerns about exposure, risk assessment, and health outcomes, reinforcing the idea that sustainability strategies must account for both ecological and human well-being dimensions.

The yellow and purple clusters point to emerging and integrative themes, including artificial intelligence, machine learning, climate change, biodiversity, and decision-making. These clusters suggest a shift toward more data-driven and technologically enabled approaches in environmental strategy research. The inclusion of AI-related terms indicates growing interest in leveraging advanced analytics for environmental monitoring, prediction, and strategic planning. At the same time, the presence of "climate change" and "biodiversity" highlights a transition toward addressing complex global challenges, positioning environmental strategy as a dynamic field that increasingly integrates digital innovation with sustainability imperatives.

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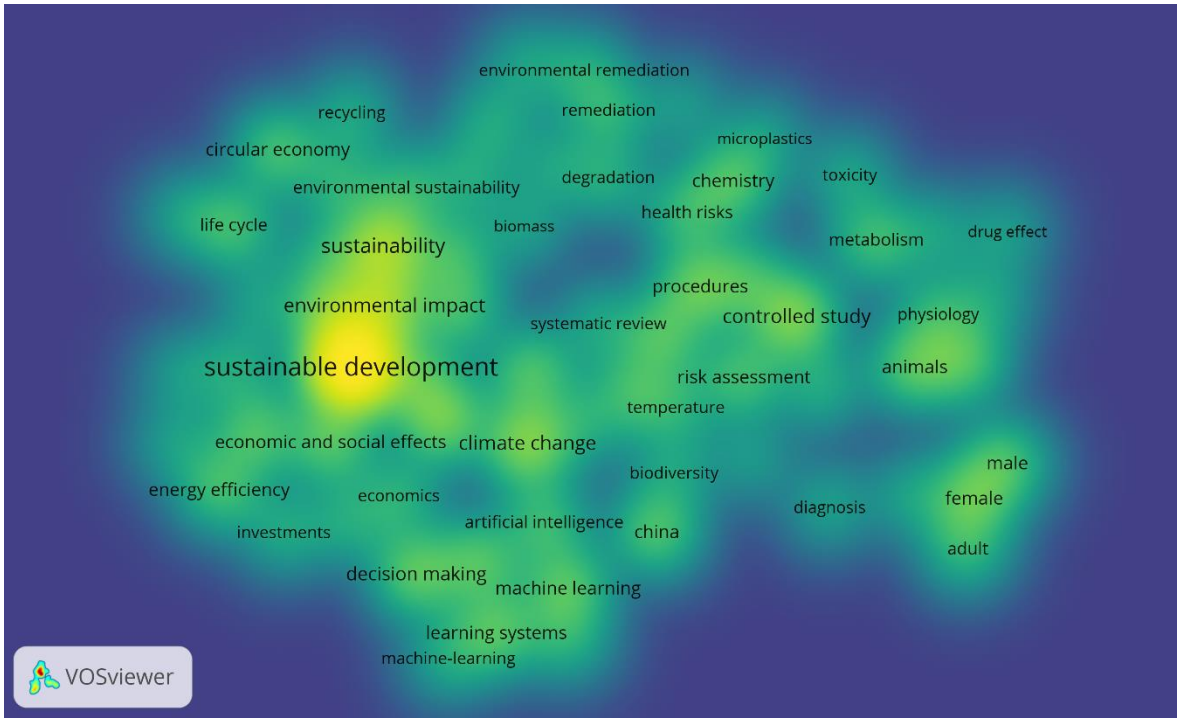

Figure 2. Density Visualization

Source: Data Analysis Result, 2026

Figure 2 clearly identifies "sustainable development" as the most dominant and concentrated research hotspot, surrounded by closely related themes such as sustainability, environmental impact, climate change, and economic and social effects. The bright intensity in this central region indicates a high volume of publications and strong co-occurrence among these keywords, suggesting that environmental strategy research is primarily framed within a broad sustainability paradigm. This concentration reflects a mature core of the field where discussions revolve around balancing environmental, economic, and social dimensions, with increasing attention to energy efficiency, circular economy, and long-term environmental outcomes.

Beyond this core, the density gradually diffuses into adjacent areas that reflect both scientific and emerging strategic directions. Clusters related to environmental remediation, chemistry, toxicity, and risk assessment indicate a strong integration of environmental science and health-related concerns, while areas featuring artificial intelligence, machine learning, and decision-making suggest a growing shift toward data-driven and technologically supported strategies. Although these emerging themes appear less dense compared to the central sustainability cluster, their presence signals an evolving research trajectory in which environmental strategy is increasingly shaped by interdisciplinary approaches, combining sustainability principles with digital innovation and advanced analytical capabilities.

3.3 Citation Analysis

Table 1. Top Cited Research

Citations	Authors and year	Title
25141	[5]	Biodiversity hotspots for conservation priorities
6357	[6]	Effects of biodiversity on ecosystem functioning: A consensus of current knowledge
4937	[7]	From a literature review to a conceptual framework for sustainable supply chain management
3891	[8]	Semiconductor heterojunction photocatalysts: Design, construction, and photocatalytic performances
3832	[9]	New handbook for standardised measurement of plant functional traits worldwide
3819	[10]	Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report.
3800	[11]	The physical impacts of microplastics on marine organisms: a review.
3749	[12]	Chronic inflammation in the etiology of disease across the life span
3635	[13]	Nanomaterials with enzyme-like characteristics (nanozymes): Next-generation artificial enzymes (II)
3171	[14]	Climate change, human impacts, and the resilience of coral reefs

Source: Scopus, 2026

Discussion

The findings of this bibliometric analysis reveal that environmental strategy research is strongly anchored in the broader discourse of sustainable development, which emerges as the most dominant and central theme. This indicates that environmental strategy has evolved beyond a narrow managerial concern into a multidimensional framework that integrates economic, social, and environmental objectives. The prominence of themes such as environmental

impact, climate change, and economic and social effects reflects a shift in scholarly attention toward systemic and long-term sustainability challenges. In this context, environmental strategy is increasingly positioned as a core component of organizational and policy-level decision-making, rather than a peripheral or compliance-driven activity.

At the same time, the results highlight the significant influence of scientific and technical domains within the field. The strong presence of keywords related to remediation, chemistry, toxicity, and risk assessment suggests that environmental strategy research is deeply informed by environmental science and engineering perspectives. This interdisciplinary integration indicates that strategic decisions are often grounded in empirical understanding of environmental processes, pollution control, and health risks. As a result, environmental strategy can be understood not only as a managerial construct but also as a knowledge-intensive domain that requires alignment between scientific evidence and strategic action.

Another important insight is the expanding scope of environmental strategy toward human health and risk-related considerations. The emergence of terms associated with physiology, metabolism, and health risks reflects a growing recognition that environmental issues are closely linked to human well-being. This convergence broadens the relevance of environmental strategy, extending its implications from ecological preservation to public health outcomes. It also suggests that future research may further integrate perspectives from environmental health, thereby strengthening the role of strategy in addressing complex socio-ecological challenges.

The analysis also points to the gradual incorporation of digital technologies into environmental strategy research. Themes such as artificial intelligence, machine learning, and decision-making indicate a transition toward more data-driven and predictive approaches. Although these topics are not yet as dominant as the core sustainability themes, their increasing visibility suggests a shift in how environmental strategies are formulated and implemented. The use of advanced analytics and digital tools has the potential to enhance monitoring, improve decision accuracy, and support adaptive responses to environmental changes.

4. CONCLUSION

This study provides a comprehensive overview of the intellectual structure and evolving trajectory of environmental strategy research through bibliometric analysis. The findings demonstrate that the field is predominantly anchored in sustainable development, with strong integration of environmental science, health-related perspectives, and emerging digital technologies. Over time, environmental strategy has shifted from a compliance-oriented approach toward a more dynamic, interdisciplinary, and capability-driven domain that emphasizes long-term value creation and adaptive decision-making. The growing presence of themes such as artificial intelligence and data-driven strategies further indicates an ongoing transformation in how environmental challenges are addressed.

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