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Dynamics of environmental communication research in sustainable development: Systematic literature review and bibliometric analysis VOSviewer

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ABSTRACT

This study aims to analyze the dynamics and trends of environmental communication research in sustainable development through the Systematic Literature Review (SLR) approach and bibliometric analysis using VOSviewer. Data were obtained from the Scopus database for the period 2017–2026 and analyzed using the PRISMA framework and the PICO approach to ensure the relevance of the literature. The results of the study show that there has been a significant increase in environmental communication publications in the past decade. The bibliometric analysis identifies four main clusters, namely strategic concepts, policy and impact, behavioral and social, and normative and institutional aspects. The findings also show the fragmentation of knowledge and the dominance of technocratic approaches that position communication as an instrument of behavior change. In addition, the environmental communication paradigm evolved from a linear model to a participatory, digital, and integrative approach. This research emphasizes the importance of developing a more holistic, critical, and multidisciplinary environmental communication model in supporting sustainable development.

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1. INTRODUCTION

Global environmental issues such as climate change, ecosystem degradation, and sustainability crises have evolved into multidimensional challenges that demand a cross-disciplinary approach. Where this multidisciplinary communication approach is able to integrate various fields of knowledge, such as communication, social, political, economic, technological and environmental. In this case, environmental communication emerges as a strategic instrument that not only serves as a means of delivering information, but also as a mechanism that shapes public perception, encourages participation, and influences behavioral changes towards sustainable development (Abdullah, 2023) The role of communication is increasingly important as the complexity of environmental issues increases that require the involvement of various actors. In addition, the development of digital technology has changed the landscape of environmental communication to be more interactive and

participatory, especially through social media that expands the space for public discourse and community involvement in environmental issues (Syakirah et al., 2025)

Along with the increasing attention to sustainability issues, environmental communication research shows a significant growth trend in the past decade. Bibliometric studies reveal that this field is increasingly interdisciplinary, with strong linkages between communication, public policy, and environmental science (Akerlof et al., 2022) However, this growth is also followed by the fragmentation of knowledge. Where various studies develop in separate thematic clusters without adequate conceptual integration (Nithiyanandhan et al., 2025) In addition, there is an imbalance in geographical contribution that shows the dominance of developed countries in knowledge production, while developing countries are still relatively underrepresented (Wahyunengseh & Hastjarjo, 2024) This condition shows the need for a more systematic approach to map the structure and direction of development of environmental communication research comprehensively.

Based on these conditions, this study integrates a systematic literature review (SLR) approach with bibliometric analysis using VOSviewer to examine the dynamics and trends of environmental communication research in sustainable development. The novelty of this research lies in the integration of bibliometric quantitative analysis with a critical interpretation of the evolution of the environmental communication paradigm, as well as the incorporation of communication, sustainability, and digital transformation perspectives in one analytical framework. In line with that, this study aims to answer the following questions: (1) What are the dynamics and trends of environmental communication research publications?; (2) What are the main thematic clusters that are developing? ; (3) How has the environmental communication paradigm evolved in supporting sustainable development?

2. RESEARCH METHOD

This study uses the Systematic Literature Review (SLR) approach combined with bibliometric analysis to examine the dynamics and trends of environmental communication research in sustainable development. To improve accuracy in the formulation of search strategies and literature selection, this study adopted the PICO (Population, Intervention, Comparison, Outcome) framework, which is commonly used in systematic studies to ensure the focus and relevance of the study (Eriksen & Frandsen, 2018) The application of PICO in this study is formulated as follows:

Table 1. PICO framework

Components	Operational Formulation in Research
Population (P)	Scientific literature that discusses environmental communication in the context of sustainable development
Intervention (I)	Environmental communication approaches used in supporting sustainable development
Comparison (C)	Differences in environmental communication paradigms that develop in the literature
Outcome (O)	Patterns, trends, and dynamics of the development of environmental communication research

Source: Article analysis 2026

Based on this framework, data was collected from the Scopus database with a publication time range of 2017–2026 (last 10 years) because it is the most real condition at the moment. The keywords unsed are: “environmental communication”, and “sustainable development”. The inclusion criteria included reputable journal articles (peer-reviewed), topic-relevant, and English-speaking, while proceedings, books, and irrelevant articles were excluded from the analysis.

This study uses secondary data. These data are research findings that have been published online in journals. The data search is done through Scopus. The terms "Environmental Communication" and "Sustainable Development", which are retrieved using boolean operators (ANDs), are combined to perform article searches. The criteria for this study were modified in accordance with the previously established PICO framework with the following additions. The literature criteria consist of inclusion and exclusion criteria.

Table 2. Inclusion criteria and exclusion criteria

Category	Kriteria Inklusi	Exclusion Criteria
Publication Time Range	Year 2017-2026 for current relevance	< 2017 except for the important classic articles
Study	Environment	In addition to the environment
Publication Type	Accredited scientific articles (research articles)	Non-research articles, opinions, editorials, blogs
Topics	Discussing environmental communication and sustainable development	Not addressing environmental communication and sustainable development
Language	English	Languages other than English
Accessibility	Available in full text or open access	Only abstract or not fully accessible

Source: Article analysis 2026

After data collection through Scopus, the researcher used the PRISMA (Preferred Reporting Items for Systematic Review and Meta Analysis) method which consisted of three stages.

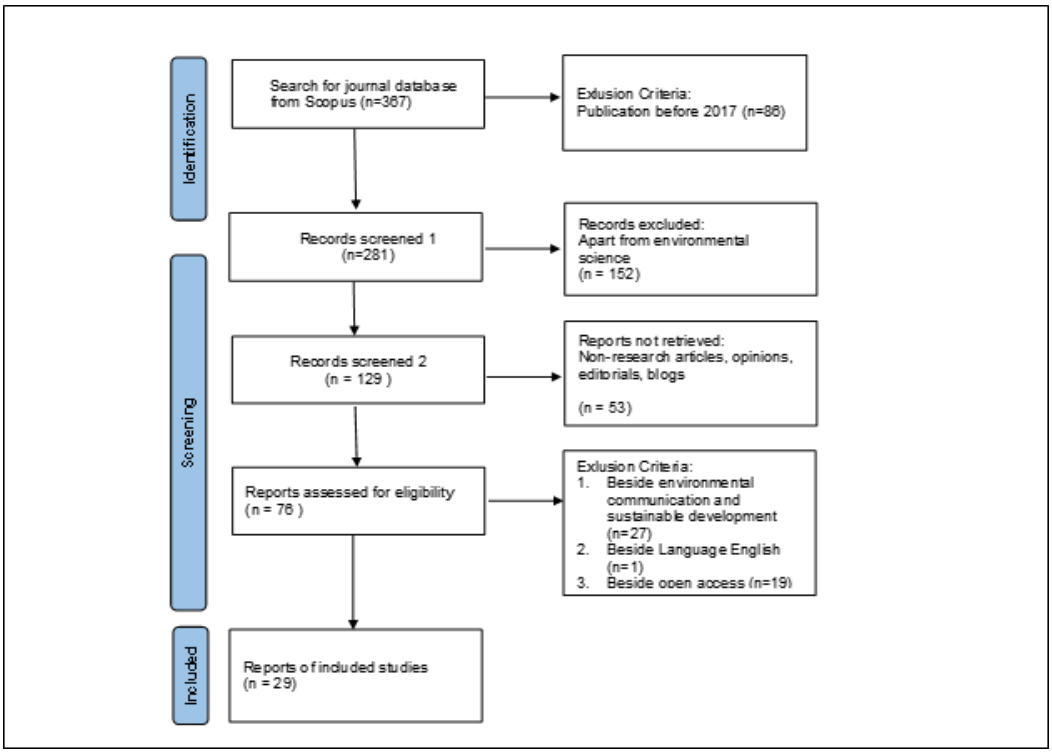

Figure 1. PRISMA flow diagram

Source: (Page et al., 2021)

The literature selection process follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol which includes the identification, screening, feasibility evaluation, and inclusion stages (Page et al., 2021) Articles that passed the selection were then analyzed using VOSviewer software to map bibliographic relationships. The analysis includes co-authorship, co-occurrence, citation, and overlay visualization to identify the knowledge structure and temporal development of the research (Donthu et al., 2021)

The data is exported in RIS format, then the data is cleaned and normalized before being analyzed using VOSviewer. The results of the analysis are visualized in the form of network, overlay, and density to identify research patterns, dynamics, and gaps. This approach allows for a more comprehensive and critical understanding of the development of environmental communication in sustainable development (Passas, 2024)

3. RESULTS AND DISCUSSIONS

Publication Trends and Dynamics of Research Development

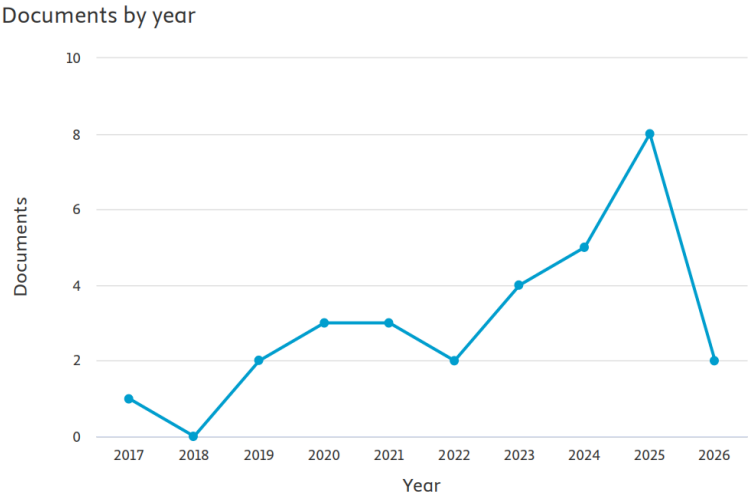

Figure 2. Trend graph based on research year

Source: Scopus Database, 2026

The image above is the result of an analysis that shows that the number of publications is experiencing a fluctuating trend but tends to increase during the 2017–2026 period. In the early phase (2017–2018), publications were still very limited, and there were no publications in 2018, indicating an early stage of research development. Furthermore, the 2019–2021 period showed a relatively stable increase, although there had been a decline in 2022.

A significant increase occurred in the period 2023–2025, with the number of publications reaching its peak in 2025. This shows the acceleration phase and increasing academic attention to environmental communication in sustainable development. Meanwhile, the decline in 2026 is likely due to limited data that has not yet been fully indexed. Thus, it can be concluded that this trend reflects a non-linear growth pattern with an increasing trend, which suggests that this field of research is evolving and increasingly relevant in academic discourse.

Epistemologically, this increase not only reflects the increasing volume of research, but also signals an expansion of the conceptual scope of environmental communication. If in the early phases of research it was more oriented to information delivery (information deficit model), then in the last decade there has been a shift towards a participatory and deliberative approach that emphasizes public involvement and co-creation of knowledge (Wang et al., 2025). Thus, environmental communication is no longer understood as a linear process, but rather as a complex and multidirectional arena of social interaction.

However, this rapid growth also raises the problem of knowledge fragmentation. The literature develops in various subfields such as climate change communication, risk communication, digital communication, and environmental governance, which are often not conceptually integrated. This strengthens the argument that the field of environmental communication is still in a theoretical consolidation phase (Soundarrajan et al., 2025).

Key Thematic Clusters That Develop Through Bibliometric Analysis

Visualization of bibliometric analysis with VOSviewer was carried out to see the relationship between environmental communication discussions and sustainable development. The mapping of 29 articles from Scopus was then included based on the criteria that have been explained in PRISMA. The results of the network visualization from VOSviewer that illustrate the relationship between keywords can be seen in figure 3 below:

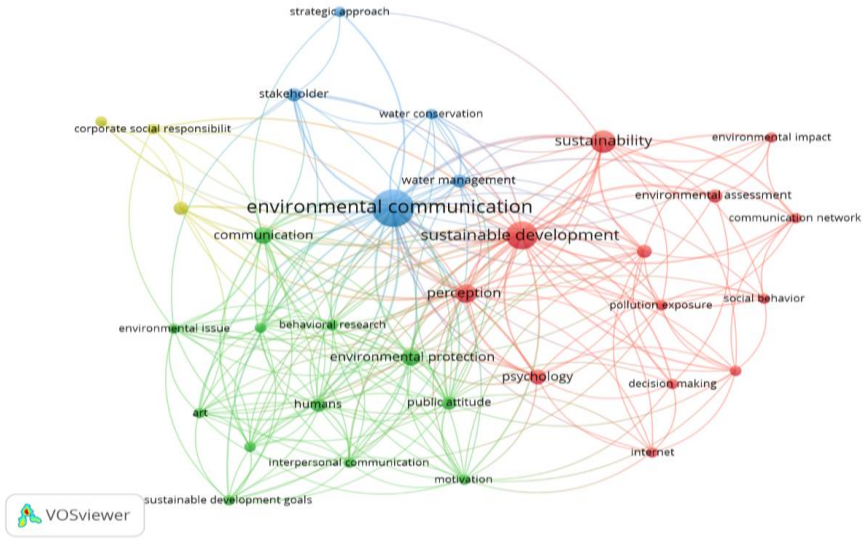

Figure 3. Network visualization map

Source: Output VOSviewer software, 2026

The network visualization mapping yielded 4 different color clusters, with the following keyword count breakdown:

Table 3 Cluster color grouping analysis

Cluster	Color	Identification	Number of Keywords
Cluster 1	Blue	Strategic Concept	5
Cluster 2	Red	Policies and Impacts	13
Cluster 3	Green	Behavior and Social	12
Cluster 4	Yellow	Normative and Institutional	3

Source: Analysis VOSviewer software, 2026

The bibliometric map shows that environmental communication functions as a hegemonic node that integrates the technocratic dimensions (water management), policy (sustainable development), and behavior (public attitude), but that is precisely where the epistemic problem lies: the dominance of connectivity is not balanced by the critical depth of the power relations that shape production and distribution environmental knowledge. The clusters that are formed tend to reflect fragmentation that is methodologically structured but substantively reductionist, where communication is reduced to an instrument of behavior change and policy legitimacy, rather than as an arena for meaning contestation, conflicts of interest, or social resistance. The absence of concepts such as environmental justice, political ecology, or global inequality shows a strong technocratic and normative bias, as if sustainability issues are neutral and universal. Thus, this map not only illustrates the development of research, but also reveals the limitations of the dominant paradigm that tends to depoliticize environmental issues and ignore the structural dimension in communication practices.

The Evolution of the Environmental Communication Paradigm in Supporting Sustainable Development

Table 4. The evolution of the environmental communication paradigm

No	The Evolution of the Environmental Communication Paradigm	References
1	Behavior change through communicative and experiential learning approaches. However, it is still fragmented at the micro level (individuals/small groups). There is no robust theoretical model integration to explain how these changes can be scaled to the broader level of policies or social systems.	(Antonschmidt & Lund-durlacher, 2021)(Ricci et al., 2024)(Asplund et al., 2023)

No	The Evolution of the Environmental Communication Paradigm	References
2	There is a significant gap between the production of technology and communication to the public. Studies are still separated between the technical and communication aspects. Critically, there is no integrative model that explains how communication can increase the adoption of innovation (e.g. through science communication or diffusion of innovation theory).	(Arias et al., 2022)(Osipova et al., 2025)(Karyotakis, 2021)
3	A paradigm shift from top-down to bottom-up communication. However, it is still weak in impact measurement and generalization. Theoretically, it is necessary to strengthen it through the framework of deliberative communication and participatory governance.	(Ofosu et al., 2025)(Asplund et al., 2023)(Bancheva-preslavska & Dallmer, 2020)
4	Weak communication as a factor in policy failure. However, the analysis is still descriptive and does not offer a strategic model. Key gap: lack of integration between policy communication, stakeholder engagement, and local context.	(Kadarisman et al., 2024)(Sunarwibowo et al., 2025) (Alfano & Guarino, 2025)
5	This study is methodologically robust, but still normative and does not consider the role of media/communication in shaping such perceptions. It needs integration with agenda-setting theory and framing to understand the construction of public opinion.	(Savin et al., 2021)(Osipova et al., 2025) (Kirby, 2023)
6	There is a "talk vs walk" phenomenon and the potential for greenwashing. However, it is not enough to explore how the audience responds to the communication. A multidisciplinary approach is needed: legitimacy theory, trust, and digital engagement analytics.	(Taglialatela et al., 2024)(Karyotakis, 2021) (Ignacio et al., 2026)

Source: Article analysis, 2026

The evolution of the environmental communication paradigm shows a significant shift from a linear approach based on information delivery to a more complex, participatory, and integrative approach in supporting sustainable development. A linear approach that oversimplifies the complexity of environmental problems lies in the ability of environmental communication to understand the relationship between social, political, economic and ecological aspects as a whole. The resulting communication strategies and policies tend to be partial, technocratic and less able to answer the real dynamics of sustainable development. This approach can also inhibit public participation, ignore power relations, and weaken social transformation efforts needed to face the environmental crisis more effectively and sustainably.

In its initial phases, environmental communication is understood as a one-way process that assumes that increased knowledge will drive behavior change, but this approach has proven to be limited because it ignores social and psychological factors (Rogers et al., 2019) Furthermore, a behavior-based paradigm that emphasizes contextual and psychological interventions in encouraging environmentally friendly actions is developing, as shown in a study of food waste reduction (Wang & Chen, 2025) Subsequent developments lead to a participatory paradigm that emphasizes co-creation, dialogue, and community engagement in the production of environmental messages and solutions (Asplund et al., 2023) which is then amplified by digital transformation through social media and interactive platforms that expand public reach and engagement (Nithiyanandhan et al., 2025). At the cutting-edge stage, environmental communication is positioned as an integrative element that connects technological innovation, behavior change, and policy implementation, especially in bridging the gap between knowledge and action and between rhetoric and sustainability practices (Kadarisman et al., 2024) Thus, communication is no longer just a tool, but a key factor in ensuring the effectiveness of systemic sustainable development.

Environmental communication contributes to sustainable social transformation by building public awareness, encouraging behavior change, strengthening community participation, and bridging the relationship between knowledge, policy and real action. The development of an increasingly participatory and integrative communication paradigm also enables the creation of collaboration between society, government and various other actors in dealing with environmental problems. So environmental communication not only functions as a means of conveying

information, but also as a mechanism for social transformation that supports the creation of sustainable development in a more inclusive and systemic manner.

Thus, it can be concluded that although the evolution of the environmental communication paradigm shows a progressive shift towards a more complex, participatory, and integrative approach, these developments have not been able to fully address the real complexity of sustainable development. Narratives that tend to be linear simplify empirical dynamics, while the dominance of behavioral approaches is still stuck at the individual level and lacks touch on structural and political dimensions. Moreover, the participatory and digital paradigm, while promising, has not fully guaranteed a fair distribution of power or credible information quality. Therefore, environmental communication needs to be further developed as a truly integrative analytical and practical framework that not only connects technological, behavioral, and policy aspects, but also incorporates dimensions of power, social context, and digital challenges in order to function effectively as a key driver of sustainable development.

4. CONCLUSION

This study shows that environmental communication research in sustainable development has experienced significant growth and is increasingly interdisciplinary namely the development of environmental communication into a more comprehensive field in understanding sustainability issues. However still faces challenges in the form of conceptual fragmentation and the dominance of technocratic approaches. The evolution of the environmental communication paradigm shows a shift from a linear model to a behavioral, participatory, to integrative-based approach. Environmental communication no longer only focuses on conveying information, but also on social transformation that connects technological innovation, policy, behavior change and sustainable public participation to address the complexity of environmental issues. However, these developments have not been able to fully answer the complexity of sustainability issues, especially in integrating structural dimensions, power relations, and the broader social context. Therefore, it is necessary to develop a more comprehensive and critical environmental communication framework, which not only serves as a tool for information delivery or behavior change, but also as a social transformation mechanism capable of connecting technological innovations, policies, and public participation in a sustainable manner.

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