Review

Media and energy research: a bibliometric analysis

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Abstract
This study's significance is rooted in the media's pivotal role in shaping public discourse on energy issues, influencing public perception, and potentially impacting political agendas. Through a comprehensive analysis of 3498 studies indexed in the Web of Science (WoS) database from 1948 to 2024, this research sought to ascertain the bibliometric indicators within the domain of media and energy literature. The primary objective was to investigate the potential of these indicators to inform and guide the formulation of a prospective research agenda within this interdisciplinary field. The analysis reveals a surge in scholarly interest in the field, particularly over the past decade. The United States emerged as the leading contributor, followed by China, the United Kingdom, Spain, and Germany. However, the contribution of Arab countries remains relatively modest. The study identifies three primary research directions: communication studies, policy studies, and economic studies. Within these areas, research has focused on a range of topics, including public perception, media framing, energy policy, and climate change. To bridge existing research gaps and inform future research agendas, the study recommends further longitudinal and comparative analyses of public opinion trends, the impact of media on energy policy, and the interplay between energy, climate, and environmental issues.

Keywords Media · Energy · Communication studies · Bibliometric analysis

1 Introduction

Energy policies are influenced by a diverse array of factors, including public discourse and media representation. These elements have become focal points of scholarly inquiry within the social sciences and humanities, notably in the disciplines of economics, political science, and media studies. The imperative to investigate this topic stems from the pivotal role of both traditional and digital media in shaping the discourse surrounding energy issues. Media outlets exert considerable influence, both positively and negatively, on public perception, policy formation. They often serve as a catalyst for public awareness, influencing public opinion and political agendas. Moreover, Media often serve as a source of evidence for substantiating academic and policy claims, and they frequently precede scientific research in opening new avenues of awareness regarding energy issues. Media coverage can affirm, expand, or challenge existing policies as well as the understanding of scientists and the general public on energy matters [42].

This study also derives its importance from the role of media and communication in raising awareness of energy issues, whether in terms of opportunities or risks, evaluating the media's role in this domain, or identifying suitable communication strategies. It aims to present a comprehensive overview of studies and research published globally in the field of energy media over 76 years, based on data from the Web of Science (WoS) using bibliometric analysis. This technique

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provides a micro-level examination of the existing literature [23]:284). The main question is: What are the bibliometric indicators in the literature on media and energy, and how can they be utilized in developing a future research agenda?

The study establishes a foundational framework for future research endeavors in this field, asserting that the precise scientific identification of research problems worthy of investigation in any domain must be grounded in an understanding of the research landscape developed over past decades and building upon it.

2 Previous studies

Research has analyzed media coverage of energy issues from various perspectives. Examples include comparing trends in renewable energy production and media coverage [24], television news coverage of wind energy [9], newspaper coverage of biogas production in Finland (Lyytimäki, 16, and analysis of German media coverage of energy system services [31]. Several studies have focused on how media frame energy issues, such as the framing of biofuel issues and public attitudes [6], the framing of nuclear energy in Spanish journalism from environmental and climate perspectives [21, 22], and the framing of wind energy in press coverage [46].

Other studies have examined social media analysis, including emotional discourse on social media regarding sustainable energy in the U.S. [5], sentiment analysis of energy and climate change issues on social media in the U.K. and Spain [14], the challenges and opportunities of social media for understanding public perceptions of energy issues [15], thematic analysis of renewable energy technologies on Instagram [39], expressions of public anger on social media during the Texas energy crisis [27], and discussions of Australian energy issues on social media [2]. Further studies have explored the political dimensions affecting media coverage of energy issues, including the impact of partisanship and media on energy transitions [19], the role of media and policies in U.S. wind energy legislation [34], comparative studies on media coverage of wind energy issues across U.S. states [36], the discourse of right-wing populist media in Poland on energy transition and climate change [45], civic and media activism against nuclear energy in China [7], and media discourse opposing sustainable energy technologies [32].

Extensive research has been conducted on energy research within scientific journals, as evidenced by numerous bibliometric and review studies [1, 3, 4, 8, 11, 13, 17, 20, 26], Reyes-Belmonte [28, 37, 43]. Nevertheless, a comprehensive examination of energy issues within media research over an extended timeframe remains relatively unexplored.

This subset of studies includes reviews of the scientific literature on topics such as the characteristics of media coverage and public perceptions of nuclear energy and its risks [10, 12], reviews of media coverage of hydraulic fracturing [18], reviews of public perceptions of emerging low-carbon energy technologies [25], thematic analyses of media coverage on energy insecurity over time [42], and literature reviews on media coverage of scientific issues [30].

3 Research gap

Previous reviews, while significant, have either adopted a broad scope encompassing diverse fields like media coverage of science [30], or a narrow focus on specific energy-related issues which is the dominant theoretical framework in the analysis of media and energy relations such as nuclear energy, energy conservation behavior, hydraulic fracturing, energy insecurity, or low-carbon energy [10, 12, 18, 25, 42]. Moreover, these studies have not extensively utilized bibliometric analysis, a powerful tool for identifying key trends and patterns within a large body of literature.

This study seeks to fill this research gap by conducting a bibliometric analysis of media and energy research over an extended time period (1948–2024) using data from the Web of Science database. The goal is to assess the level of international scholarly interest in this field, highlight key contributions and research trends, and identify research areas warranting further investigation in the future.

The study specifically aims to examine the level of both Arab and international scholarly engagement in media and energy studies, and to uncover the most notable research contributions and trends within this domain over the 1948–2024 timeframe. By doing so, it seeks to identify promising research directions and areas deserving of further exploration.

4 Research questions

This study investigates the key bibliometric indicators within media and energy literature indexed in the Web of Science. The primary objective is to understand how these indicators can be leveraged to inform and guide future research directions within the field.

sub-questions

1. What are the primary thematic areas of research within the intersection of media and energy, as categorized by the Web of Science, over the past seven decades?
2. How has the distribution of scholarly publications within this field evolved over time?
3. What are the relative contributions of Arab and non-Arab nations to the body of knowledge in media and energy studies?
4. What emerging research trends can be discerned from a bibliometric co-occurrence analysis of keywords within this field?
5. What temporal patterns and trends can be identified in scientific publishing within the field of media and energy?
6. Based on the findings of the bibliometric analysis, what research gaps and promising avenues for future investigation can be delineated?

4.1 Methodology

Bibliometric analysis is a crucial technique that provides a microscopic view of previous literature [23], p. 284). It is a scientifically recognized methodology for exploring and analyzing vast amounts of academic data to determine the formal characteristics of a research field, track changes and growth, identify current research trends, and guide future studies [33, 38, 40]. Bibliometric metrics are valuable scientific tools widely employed across disciplines to serve as a foundation for future research, reveal scientific development trends across fields, and identify research gaps [29, 40, 44].

4.2 Analysis framework and tools

This study leverages the Web of Science (WoS) database, a longstanding repository of scholarly literature curated by Clarivate Analytics. WoS, established by the Institute for Scientific Information (ISI), indexes high-quality publications from top-tier journals and international conferences, ensuring the inclusion of rigorously peer-reviewed research. To conduct the bibliometric analysis, the study utilizes VOSviewer (version 1.6.20), a powerful software tool for scientific visualization and bibliometric mapping. VOSviewer is widely recognized for its ability to construct and analyze complex networks of scientific publications, revealing patterns of co-occurrence, citation, and collaboration among authors, institutions, and countries. This tool is particularly well-suited for identifying emerging trends, key research themes, and influential scholars within a specific field [41].

4.3 Inclusion and exclusion criteria.

The selection process for literature included in this analysis (Fig. 1) reveals that most energy-related studies indexed in WoS are concentrated in engineering and scientific fields, accounting for 98.6% (254,719 of 258,217) of publications. Conversely, publications on energy and media in social sciences and humanities represent only 1.35% (3498 of 258,217).
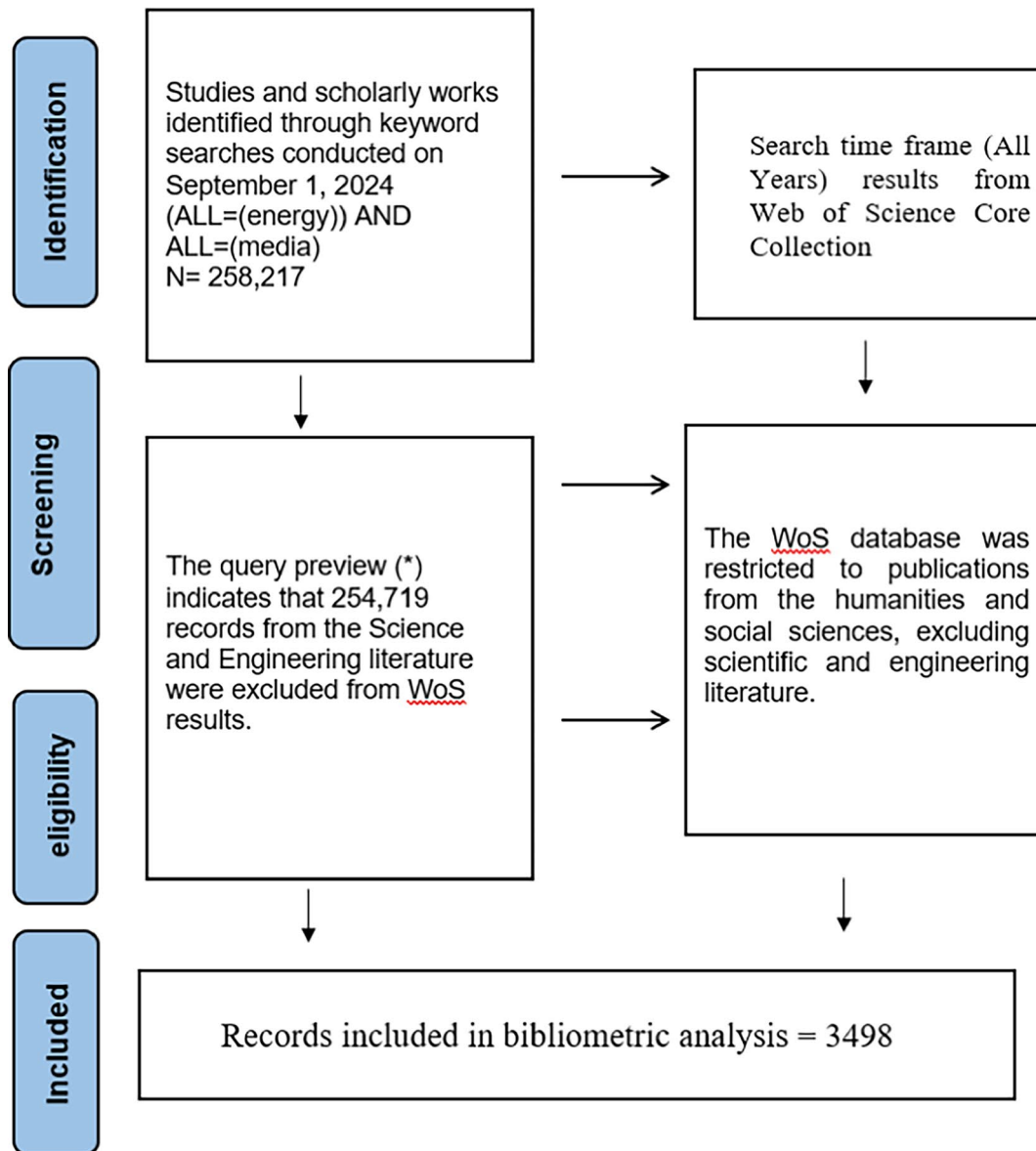
Fig. 1 Framework for literature inclusion in bibliometric research. Refine results for (TS = (media)) AND TS = (energy) Business or Education Educational Research or Communication or Operations Research Management Science or Social Science Other Topics or Public Administration or Urban Studies or Government Law or Arts and Humanities Other Topics or development Studies or International Relations or Sociology or Art or Cultural Studies or Linguistics or Psychology or Area Studies History or Mathematical Methods In Social Science or Social Issues or Film Radio Television or Philosophy or Asian Studies or Religion or Women S Studies or Health Care Science Service or Literature or Social Work or Music or Family Studies or Biomedical Social Sciences or Dance (Research Areas) Timespan: All Years Date Run: Sun Sep1, 2024 Results: 3498 from Web of Science Core Collection Query link: http://www.webofscience.com/wos/woscc/summary/0c5dcc63-bbfc-4c25-8fde-94368ec52167-0100853c8b/relevance/1

5 Results

A comprehensive analysis of 3498 studies pertaining to media and energy was conducted, drawing data from the Web of Science (WoS) database. The analysis period spanned from 1948 to 2024, with data retrieval on September 1, 2024.

Table 1 Research areas of the target literature (Media and energy research)

	Web of science categories	Record count	% of 3498
1	Economics	943	26.958
2	Environmental Studies	609	17.410
3	Management	389	11.121
4	Environmental Sciences	355	10.149
5	Operations Research Management Science	338	9.663
6	Energy Fuels	333	9.520
7	Business	326	9.320
8	Communication	289	8.262
9	Education Educational Research	226	6.461
10	Regional Urban Planning	196	5.603
11	Education Scientific Disciplines	193	5.517
12	Social Sciences Interdisciplinary	190	5.432
13	Political Science	144	4.117
14	Urban Studies	137	3.917
15	Business Finance	130	3.716
16	Humanities Multidisciplinary	99	2.830
17	Engineering Electrical Electronic	98	2.802
18	Public Administration	96	2.744
19	International Relations	94	2.687
20	Computer Science Interdisciplinary Applications	88	2.516
21	Engineering Industrial	88	2.516
22	Green Sustainable Science Technology	88	2.516
23	Development Studies	79	2.258
24	Art	72	2.058
25	Physics Multidisciplinary	71	2.030
26	Sociology	70	2.001
27	Computer Science Information Systems	65	1.858
28	Hospitality Leisure Sport Tourism	64	1.830
29	Geography	57	1.630

The inclusion and exclusion criteria detailed in the methodological procedures (Fig. 1) guided the selection of studies.

5.1 Research areas in media and energy studies.

Table 1 presents a categorization of the research domains encompassed by the sampled literature, as classified by the Web of Science (WoS) categories. The table emphasizes fields with a publication count exceeding 50 studies or articles within the specified timeframe. Economics and environmental studies emerged as the dominant domains, each constituting approximately 27% of the total research output. Management studies followed, succeeded by communication and media studies, which accounted for 8.3% of the total.

5.2 Distribution of publications by year

The results (Table 2) indicate that the last decade (2014–2024) accounted for nearly 70% of the scholarly output in this domain (2,439 studies out of 3,498). Before 2007, the annual publication rate was below 50 studies. Starting in 2017, the publication rate more than quadrupled annually, peaking in 2023 with 326 studies published in a single year.

Table 2 Distribution of literature by publication year

Final publication year	Record count	% of 3498
2024	202	5.775
2023	326	9.320
2022	281	8.033
2021	247	7.061
2020	233	6.661
2019	247	7.061
2018	200	5.718
2017	215	6.146
2016	188	5.374
2015	156	4.460
2014	144	4.117
2013	160	4.574
2012	144	4.117
2011	110	3.145
2010	111	3.173
2009	73	2.087
2008	66	1.887
2007	47	1.344
2006	38	1.086
2005	31	0.886
2004	29	0.829
2003	14	0.400
2002	13	0.372
2001	10	0.286
2000	15	0.429
1999	7	0.200
1998	13	0.372
1997	8	0.229
1996	10	0.286
1995	4	0.114
1994	5	0.143
1993	5	0.143
1992	8	0.229
1991	3	0.086
1989	1	0.029
1988	1	0.029
1987	1	0.029
1983	1	0.029
1981	1	0.029
1980	1	0.029
1979	3	0.086
1978	1	0.029
1977	1	0.029
1976	1	0.029
1975	1	0.029
1974	1	0.029
1973	1	0.029
1967	1	0.029
1949	3	0.086
1948	1	0.029

115 record(s) (3.288%) do not contain data in the field being analyzed

Table 3 Distribution of literature by Countries/Regions

Countries/Regions	Record count	% of 3498
USA	682	19.497
Peoples R China	484	13.836
England	315	9.005
Germany	193	5.517
Spain	171	4.889
Australia	164	4.688
Italy	161	4.603
Arab countries	130	3.72
India	121	3.459
Canada	114	3.259
France	114	3.259
Russia	104	2.973
Netherlands	94	2.687
Brazil	75	2.144
Romania	73	2.087
Indonesia	68	1.944
Switzerland	61	1.744
Malaysia	59	1.687
Turkey	57	1.630
Poland	56	1.601
Portugal	56	1.601
Norway	55	1.572
Sweden	54	1.544
Austria	52	1.487

5.3 Geographical distribution of scientific output

Table 3 ranks countries based on their scientific contributions to the field, focusing on those with over 50 publications. The United States led with 19.5%, followed by China at 13.8%, and then England, Spain, and Germany.

Collectively, Arab countries ranked eighth, contributing 3.7% of the total, positioned after Italy and ahead of India. Among Arab nations, 14 countries contributed to the field, with the United Arab Emirates, Saudi Arabia, Egypt, Tunisia, and Lebanon leading. However, no Arab country exceeded 1% of the global scientific output, as detailed in Table 4.

Figure 2 illustrates the collaborative network among participating nations, revealing four distinct clusters centered around the United States, China, the United Kingdom, and Germany. A temporal analysis, indicated by the color yellow, suggests that countries such as Turkey, Pakistan, and Lebanon have emerged as more recent contributors to the field, following Egypt and Saudi Arabia. Moreover, the figure emphasizes nations whose collaborative efforts were primarily confined to the United States or the United Kingdom, including Costa Rica, Israel, Estonia, and Northern Ireland.

5.4 Research trends: a bibliometric analysis of keyword co-occurrence

A network analysis of co-occurring keywords (Fig. 3) identifies three primary research clusters within the field:

- Society, Communication, and Knowledge (red cluster)
- Policies (green cluster)
- Economics (blue cluster)

Table 4 Distribution of literature by Countries/ Regions (Arab Countries)

Arab countrieS	Record count	% of 3498
U Arab Emirates	24	0.686
Saudi Arabia	20	0.572
Egypt	17	0.486
Tunisia	16	0.457
Lebanon	14	0.400
Jordan	11	0.314
Qatar	8	0.229
Iraq	4	0.114
Morocco	4	0.114
Oman	4	0.114
Bahrain	3	0.086
Algeria	2	0.057
Palestine	2	0.057
Kuwait	1	0.029
Total	130	3.72

A detailed analysis using VOSviewer (Fig. 4) reveals the distribution of the most frequently occurring terms across these clusters, encompassing a total of 162 keywords. The prominent clusters are:

- Society, Communication, and Knowledge (Cluster 1)
- Policy Studies (Cluster 2)
- Economics (Cluster 3)

The most frequently recurring keywords: "policies" (574 times), "economics" (429 times), "society" (237 times), and "communication" (222 times). The Total Link Strength metric, indicative of the strength of co-authorship ties among researchers, follows the same order for these terms.

5.5 Temporal trends in scholarly publishing

Figure 5, an overlay visualization, demonstrates the temporal evolution of scholarly publishing on media and energy over the last decade (2014–2024). The three primary research clusters—policy, economics, and communication—have generally progressed in parallel, with a few notable exceptions. For example:

- COVID-19-related studies
- Research on China and Ukraine
- Studies addressing the role of social media platforms
- Clean energy and carbon emission topics

These research areas are relatively recent compared to other subjects of interest.

6 Discussion and conclusion

Findings indicate a substantial increase in scientific publications within the domain of media and energy research over the past decade (2014–2024). A fourfold annual growth rate, commencing in 2017, culminated in a peak output in 2023. Western nations and China emerged as the primary contributors to this global scientific discourse. Collectively, Arab countries secured the eighth position, accounting for a mere 3.7% of the total output, lagging behind Italy but surpassing India. Notably, no individual Arab country exceeded the 1% threshold. This disparity can be attributed, in part, to the dominance of English as the primary language of publication in Web of Science-indexed journals. This factor may also explain the relatively modest ranking of France at 3.3%. Previous research corroborates
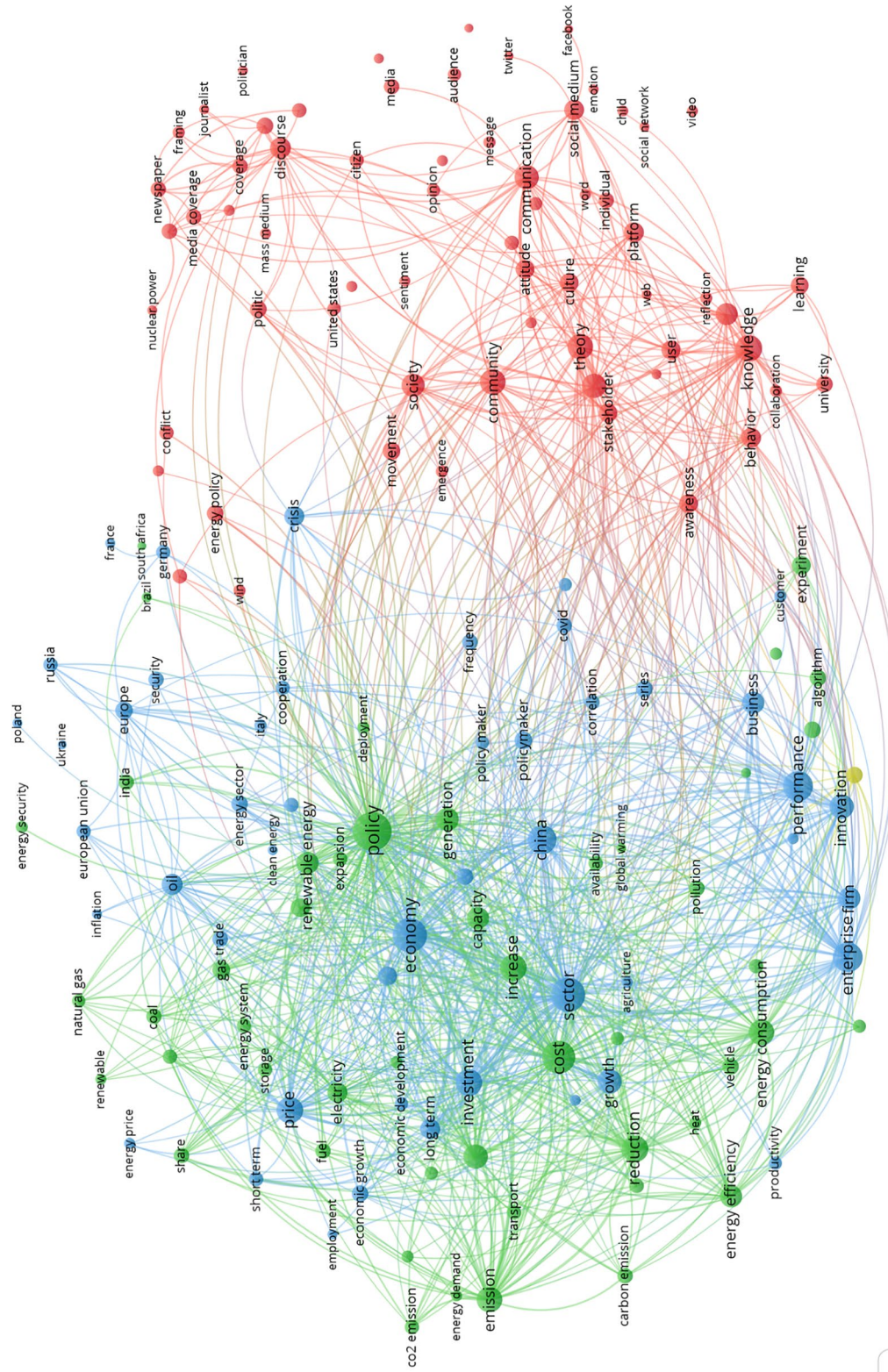
Fig. 2 The overlay visualization, Distribution of literature by Countries (N =3498)

Fig. 3 A network analysis of keyword co-occurrence in WoS literature on media, and energy literacies (N = 3498)
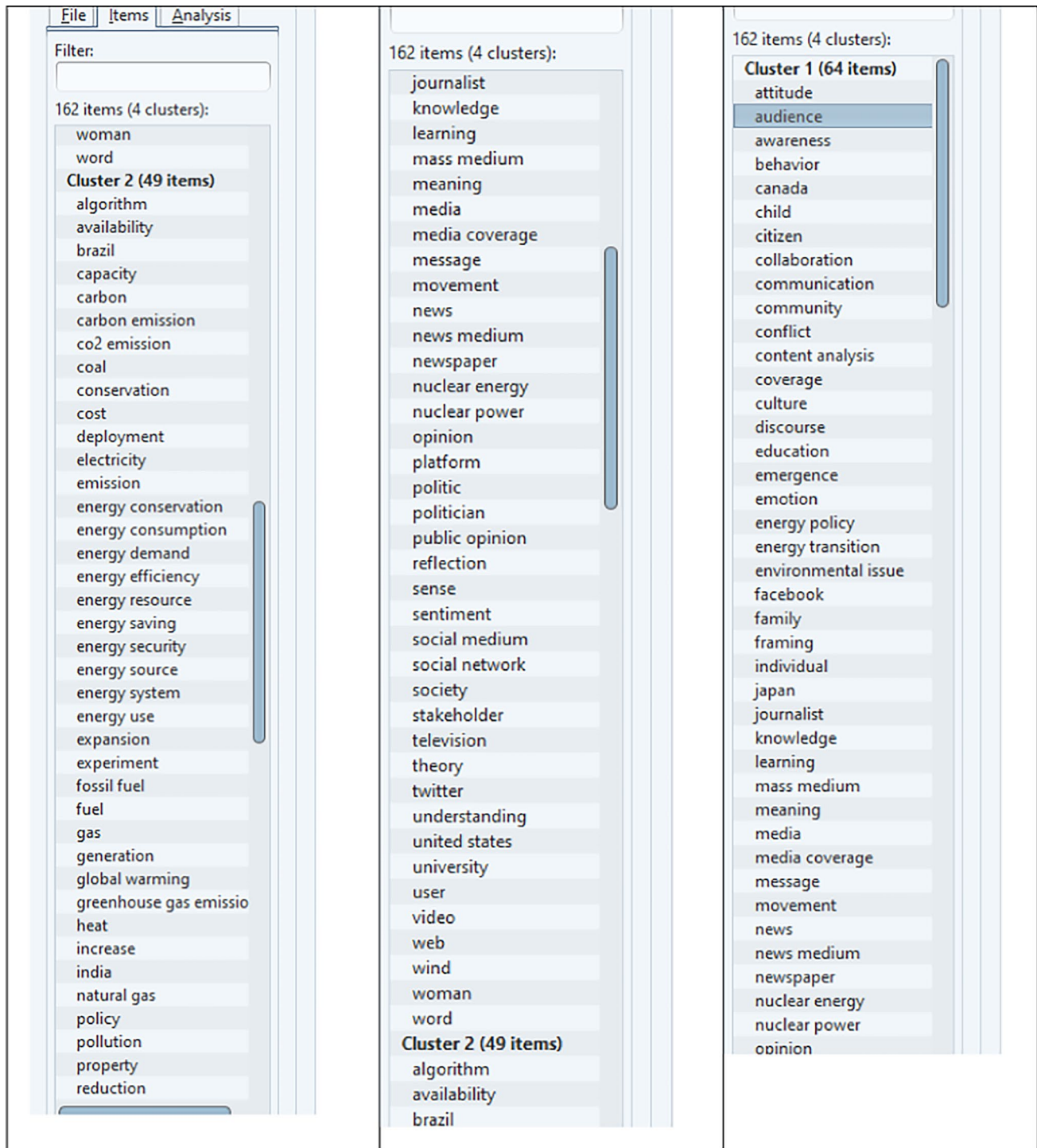
Fig. 4 Most frequent terms identified by VOSviewer analysis

these findings. Schäfer [30] observed a significant uptick in studies examining media coverage of scientific issues, predominantly conducted by Western nations. Similarly, Ho et al. [10] noted a concentration of research on public perceptions of nuclear energy in Europe, North America, and East Asia, with underrepresentation from regions such as South America, Australia, Africa, South Asia, Southeast Asia, and the Middle East.
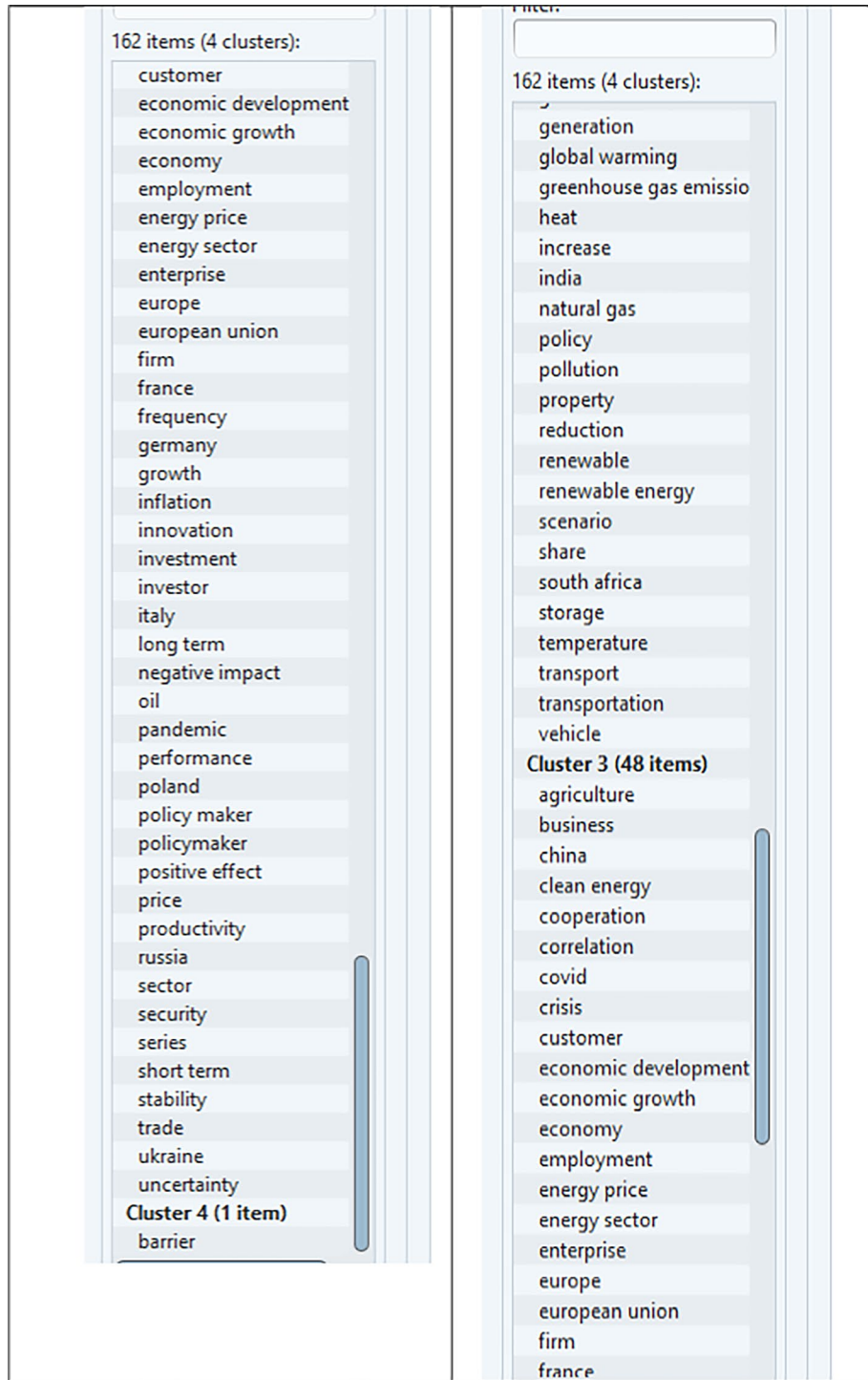
162 items (4 clusters):

- customer
- economic development
- economic growth
- economy
- employment
- energy price
- energy sector
- enterprise
- europe
- european union
- firm
- france
- frequency
- germany
- growth
- inflation
- innovation
- investment
- investor
- italy
- long term
- negative impact
- oil
- pandemic
- performance
- poland
- policy maker
- policymaker
- positive effect
- price
- productivity
- russia
- sector
- security
- series
- short term
- stability
- trade
- ukraine
- uncertainty

Cluster 4 (1 item)
- barrier

Filter:

162 items (4 clusters):

- generation
- global warming
- greenhouse gas emissio
- heat
- increase
- india
- natural gas
- policy
- pollution
- property
- reduction
- renewable
- renewable energy
- scenario
- share
- south africa
- storage
- temperature
- transport
- transportation
- vehicle

Cluster 3 (48 items)
- agriculture
- business
- china
- clean energy
- cooperation
- correlation
- covid
- crisis
- customer
- economic development
- economic growth
- economy
- employment
- energy price
- energy sector
- enterprise
- europe
- european union
- firm
- france

Fig. 4 (continued)

In this study, the network of collaboration among nations involved in scientific production in the field highlights four main clusters led by the United States, China, the United Kingdom, and Germany. Latecomers to the field include countries such as Turkey, Pakistan, and Lebanon, following earlier entrants like Egypt and Saudi Arabia. Some countries, such as Costa Rica, Israel, Estonia, and Northern Ireland, displayed scientific collaboration primarily with the United States or the United Kingdom.
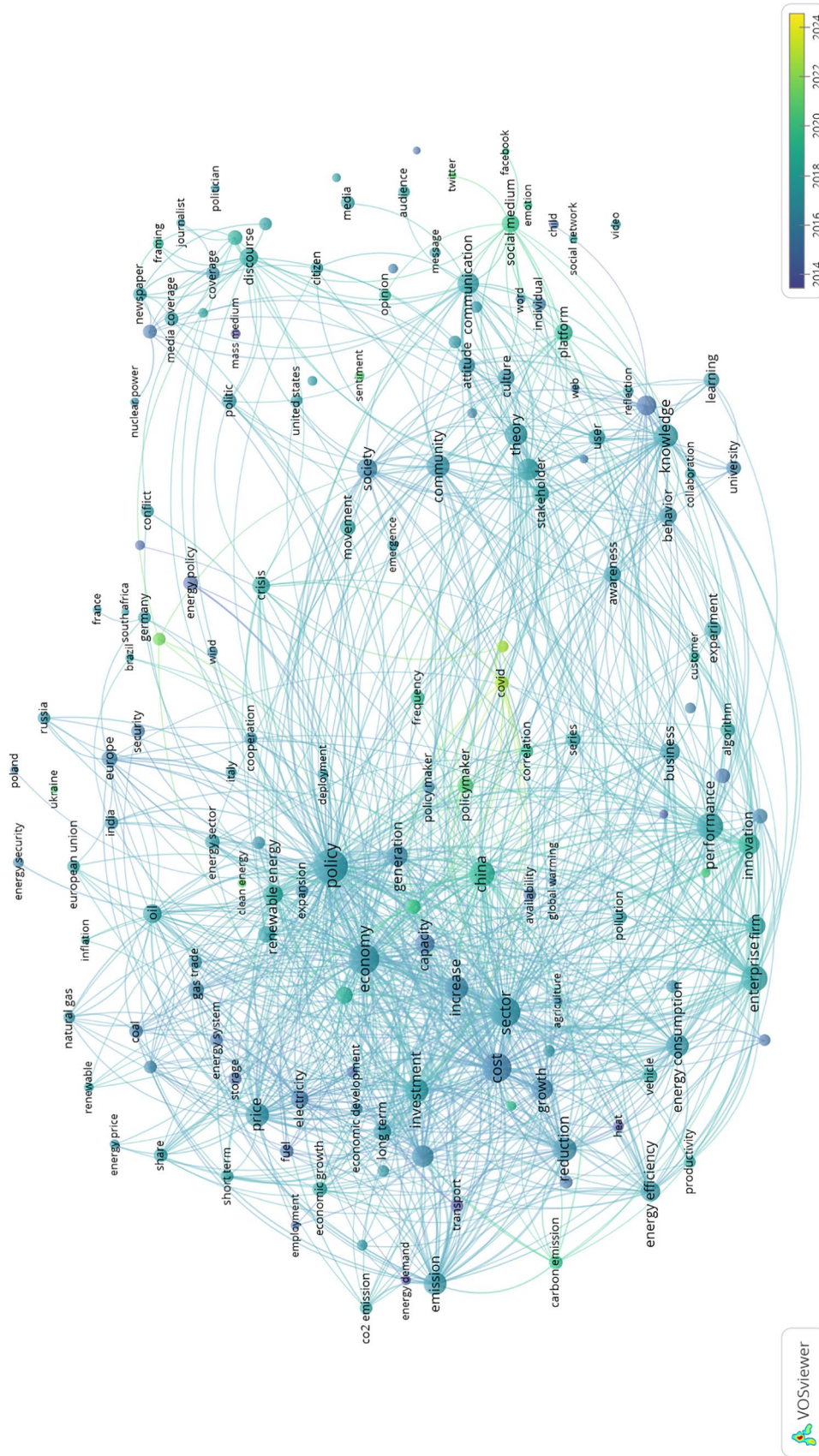
Fig. 5 The overlay visualization, WoS literature on media, and energy literacies (N = 3498)

Findings reveal a contemporary shift in media and energy research, with a pronounced emphasis on the influence of digital platforms and social media networks in shaping public understanding of energy issues. This observation contrasts with earlier studies. While Schäfer [30] pointed out that media and science literature up to 2012 primarily focused on analyzing the content of print media, Ho et al. [10] emphasized that most studies on public perceptions of nuclear energy benefits and risks analyzed offline perceptions. Social media discussions received limited research attention during this period.

The corpus of target literature primarily focuses on economics and environmental studies, each constituting approximately 27% of the total research output. Management studies follow, with communication and media studies accounting for 8.3%. The bibliometric network analysis of shared keywords identified three main research clusters:

- Society, communication, and Knowledge: This cluster emphasizes studies on public attitudes and opinions regarding energy issues, media coverage, the role of communication, educational institutions, family dynamics, and social media platforms. Topics include nuclear energy and environmental issues, with notable contributions from studies in Canada and the United States.
- Policy studies: Topics in this cluster include energy conservation, cost analysis, policies for sustainable energy, global warming, environmental pollution, renewable energy, and transportation. Studies in this area prominently feature research from Brazil, India, and South Africa.
- Economics: This cluster investigates topics such as clean energy, economic crises, unemployment, inflation, productivity, trade, energy prices, economic growth, investment, and the impact of the COVID-19 pandemic. Research in this cluster often focuses on countries like China, Russia, Ukraine, and the European Union.

Although the clusters are relatively distinct, significant overlaps exist among issues such as energy, climate, and environmental topics. This aligns with previous findings that energy and climate issues are closely intertwined [12]. Comparative studies on media coverage of different energy technologies or risks can enhance our understanding of how media portray energy technologies and how nations address climate change challenges. As more countries integrate environmental sustainability into national development plans, renewable energy utilization has increased. Future research could explore public attitudes toward various renewable energy sources and nuclear energy, analyzing public opinion trends [10].

Several studies, such as Matthews and Hansen 18, employed environmental communication perspectives to understand media coverage of energy issues, exploring discussions on economic benefits and environmental risks. They emphasized the importance of studying the wider institutional contexts—including geographic, economic, and political dimensions—that shape media narratives on energy and the environment.

The bibliometric analysis, which revealed three prominent research themes—media, policy, and economics—aligns with prior research exploring the interplay between media coverage, policy outcomes, and public engagement with energy and environmental issues [42].

7 Implications and future directions

The research findings emphasize the critical need for a holistic approach to energy research that transcends disciplinary boundaries. Recognizing the intricate interplay of economic, political, societal, and communicative factors is paramount. This necessitates collaborative research endeavors involving scholars from diverse disciplines to facilitate comprehensive interdisciplinary investigations. In this context, the study's results align with previous research efforts, such as Kristiansen's [12] comprehensive review of communication literature, which focused on media coverage of energy-related risks, framing techniques and potential avenues for future research. Suggested areas include more longitudinal and comparative studies that analyze media coverage of nuclear events both before and after incidents over extended periods. This approach would enable the identification of significant patterns in public opinion shifts at specific points in time.

Future research should prioritize cross-national studies and comparisons to understand how media in different countries address energy issues and the underlying reasons for these variations. For instance, studies could compare public perceptions of nuclear energy across nations with varying levels of nuclear reliance [10, 12]. Additionally, there is a critical need for mixed-methods research combining quantitative and qualitative content analyses, risk perception surveys, interviews with journalists and experts, and experiments examining audience interactions with various forms of energy risk coverage [12].

The three primary research trends in policy, economics, and communication have evolved in parallel over time, with exceptions such as research on the COVID-19 pandemic, China and Ukraine, social media's role, clean energy, and carbon

emissions, which are relatively recent additions to the literature. and they require a greater degree of research focus in the future compared to other issues and research interests.

The results of this study should be interpreted within the context of its limitations. It relied solely on the literature available in the Web of Science database. While this source is highly valuable, it may not provide a comprehensive view of media and energy research over extended periods, particularly studies and publications in languages other than English. Furthermore, the interpretation of the results must consider the methodology employed in this study, namely bibliometric analysis, which has its strengths and weaknesses. This necessitates the adoption of additional methodologies and tools in future research to explore the relationship between media and energy, whether by analyzing prior scientific literature or by examining expert opinions and policy analysis.

Overall, the bibliometric analysis in this study provides a clear roadmap of research trends in media and energy studies, offering critical insights for addressing research gaps and guiding future explorations in this vital field.

Data availability The author confirms that all data generated or analysed during this study are included in this article.

Declarations

Ethics approval and consent to participate Not applicable.

Consent to Publications Not applicable.

Competing interest The authors declare no competing interests.

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