

Citation, co-citation and co-word analysis on public media and digital ecosystem

Análisis de citación, co-citación y co-palabras sobre los medios de comunicación pública y ecosistema digital

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ABSTRACT

Introduction: This paper examines the scientific production related to the public media in the digital world, due to the increase in the last decade. **Methodology:** 292 indexed references in Web of Science between 2012-2022 are selected, carrying out a bibliometric analysis of citation, co-citation and co-words of scientific research on the subject. **Results:** The aforementioned analysis determines that the countries with the highest number of citations on the subject are Belgium, the United States, England and Austria; the source with the highest number of citations is Journalism Studies; the most cited documents are those of Van Dijck and Poell, (2015) and Aalberg et al. (2013); concerning authors, the most cited are *Shanto Iyengar* and *Hilde Van den Bulck*. Concerning the analysis of co-citations, the most mentioned papers are Bardoel, (2003), Hallin y Mancini (2004) and Brevini,

B. (2013), and the most cited authors are Hallin, D. C., Van den Bulck, H. and Benson, R. In both cases, the thematic groupings are: public television services, media and politics and influence of the media on public opinion. Regarding the co-citation of sources, *Media, Culture & Society; Journal of Communication* and *Revista Latina de Comunicación Social*, among others. The analysis of co-words shows the main research subjects: news communication, mass communication, European journalism and global journalism. **Discussion and conclusions:** This paper makes possible the identification of the main trends and theoretical fundamentals in the studied field, as well as to detect emerging trends.

Keywords: Public media; Public service media; Digital ecosystem; Bibliometric analysis; Citation analysis; Co-citation analysis; Co-word analysis.

RESUMEN

Introducción: Este trabajo examina la producción científica relacionada con los medios de comunicación públicos en el mundo digital, debido al aumento de la última década. **Metodología:** Se seleccionan 292 referencias indexadas en *Web of Science* entre 2012-2022 y se realiza un análisis bibliométrico de citación, co-citación y co-palabras de la investigación científica sobre el tema. **Resultados:** El análisis de citación determina que los países con mayor número de citas sobre el tema son Bélgica, Estados Unidos, Inglaterra y Austria; la fuente con mayor número de citas es *Journalism Studies*; los documentos más citados son los de Van Dijck y Poell, (2015) y Aalberg *et al.* (2013) y los autores más citados son *Shanto Iyengar* y *Hilde Van den Bulck*. Según el análisis de co-citaciones, los trabajos más mencionados son los de Bardoel, (2003), Hallin y Mancini (2004) y Brevini, B. (2013), y los autores más citados son Hallin, D. C., Van den Bulck, H. y Benson, R. En ambos casos, los agrupamientos temáticos son: servicios de televisión pública, medios de comunicación y política e influencia de los medios de comunicación en la opinión pública. En cuanto a la co-citación de fuentes, destacan *Media, Culture & Society; Journal of Communication* y *Revista Latina de Comunicación Social*, entre otras. El análisis de co-palabras muestra las principales temáticas de investigación: comunicación de noticias, comunicación de masas, periodismo europeo y periodismo global. **Discusión y conclusiones:** Este estudio permite identificar las principales tendencias y fundamentos teóricos del campo estudiado, así como detectar las tendencias emergentes.

Palabras clave: Medios de comunicación públicos; Medios de servicio público; Ecosistema digital; Análisis bibliométrico; Análisis de citas; Análisis de co-citación; Análisis de co-palabras.

1. Introduction

Public media in the digital era have as their main objective to provide information of public interest and promote diversity and plurality of voices in the public space. These media outlets seek to fulfill a social and democratic function, ensuring citizen participation in decision-making and contributing to building a more informed and critical society (del-Rosario-González, 2019).

The digital era has transformed the way we access and consume media content, which has forced public media to be innovative and willing to adapt to changes. An example of these changes is the increase in the use of mobile devices and social media, which has generated a greater demand for digital content (Prasetya and Murata, 2020).

Another crucial aspect that the current digital environment has impacted is the politics within digital public media, with a focus on political polarization in the digital sphere (Yarchi et al., 2021). On the other hand, public media also play an important role in shaping public opinion in the digital environment, but they must adapt to changes in information consumption patterns and work to engage their audience in dialogue (de-Dios et al., 2020).

Due to the aforementioned reasons, the importance of studying public media in the digital environment is increasingly significant, leading to a significant number of research studies in this field (Casado et al., 2022;

Donders, 2019, among others). Precisely because of the growing number of publications, this bibliometric analysis emerges to consolidate the findings concerning the country, references, journals, authors, as well as the most recurrent terms. The bibliometric analysis focuses on the last decade (2012-2022) to ensure the relevance and accuracy of the scientific production, providing a historical context to the technological and social changes that have transformed the way public media operate in the digital ecosystem.

Bibliometric analysis is a statistical technique used to evaluate scientific production. It relies on bibliographic data, such as citation counts, publications, and collaborations among authors, to measure the importance and impact of a work or author in a specific field. Citation analysis, co-citation analysis of references, sources, and authors, as well as co-word analysis, are carried out as part of this analysis. These analyses help understand how different sources and authors are related to each other and identify influential publications and authors in the field of public media and the digital ecosystem, as well as the key terms used in research on the topic. Unlike other methods of literature review, bibliometric analyses are more objective, precise, and rigorous (Zupic and Čater, 2015).

Evaluating trends and emerging topics in the literature using bibliometric techniques is essential to understand the current state of a specific field, especially in the communication area, where most bibliometric analyses focus on topics such as social networks (Quevedo-Redondo et al., 2022; Rejeb et al., 2022), misinformation and fake news on social media (Pari et al., 2022), television series (Gutiérrez-González and González, 2021), consumer-related aspects (Shu and Liu, 2021), public relations (Demir et al., 2020; Morehouse and Saffer, 2018), and even communication journals (Castillo et al., 2012; Rogel-Salazar et al., 2017). However, there are few studies that conduct a comprehensive bibliometric analysis on public media and digitalization, despite the relevance of the topic. For instance, a recent bibliometric review conducted by Gutiérrez-González and González (2021) exclusively focused on public television.

As a result, the present study stands out for encompassing a comprehensive bibliometric analysis of public media and the digital ecosystem, which is a perspective that has been scarcely addressed in current research.

2. Methodology

The methodology of the bibliometric analysis to be carried out in this study is based on the phases proposed by Velt et al. (2020), ensuring a systematic and rigorous process. These phases are:

- (1) Formulation of research objectives.
- (2) Identification of relevant data through bibliographic databases and web search engines.
- (3) Selection of data, using specific criteria to determine the relevance and validity of the collected data.
- (4) Data confirmation, through the review and verification of the selected information.
- (5) Data analysis, using statistical techniques and computer tools to interpret and present the results.

2.1. Formulation of research objectives

There are several studies that focus on public media, but this work aims to emphasize their adaptation to the digital environment. With this objective in mind, the main purpose of this study is to conduct a bibliometric analysis of the scientific production related to public media in the current context of the digital ecosystem.

Among the specific objectives, the following stand out:

- Analyze the chronological productivity of studies on public media and the digital ecosystem in the last decade (2012-2022).

- Evaluate the scientific production based on the country of publication, journal, author, and received citations to understand the geographic distribution and quality of research on public media and the digital ecosystem.
 - Identify relationships and clusters among publications, sources, and authors in the field of public media and the digital ecosystem through co-citation analysis to determine the most influential publications, sources, and authors in this field.
 - Establish the most used keywords and their clusters in research through co-word analysis to identify the main terms and trends in the field of public media and the digital ecosystem.
- "The study also focuses on the impact of news coverage on public interest and knowledge of international affairs"

2.2. Identification of data

In this phase, the database from which scientific publications will be extracted is selected, and the search strategy used, as well as the eligibility criteria, are presented.

For the bibliometric analysis, the Web of Science (WoS) database has been selected due to its prestige and international recognition in the scientific field. The search strategy used combines descriptors with Boolean operators and truncations to ensure an efficient and comprehensive search for relevant scientific contributions. This search phrase is shown in Table 1 and can be replicated by other researchers. Eligibility criteria were established beforehand to ensure that the selected studies meet the research objectives.

Table 1. Search phrase.

| Database | Search Phrase | Filter |
|----------------|--|--|
| Web of Science | "public media" OR "public broadcasting" OR "public service media" AND (digital* OR "ecosystem digital*") | TS= Topics in title, abstract, author keywords and KeyWords Plus |

Source: Author's own work.

This search phrase has allowed us to find studies that focus on public media and their relationship with the digital ecosystem. The following Boolean operators have been used for the proper identification of articles:

- The OR operator is used to indicate that documents containing at least one of the specified terms should be searched. For example, "public media" OR "public broadcasting" OR "public service media" means that documents containing at least one of the three terms will be searched.
- The * sign is used to search for words with prefixes. For example, if we use digital*, it will search for words containing the prefix digital, such as digitalization, digital transformation, digital media, etc.
- The AND operator is used to indicate that documents containing all the specified terms should be searched. In our case, it will search for documents containing at least one of the terms "public media," "public broadcasting," or "public service media" and at least one of the terms "digital" or "digital ecosystem."

In the first phase of study identification, using the search phrase, a total of 1522 articles indexed in the Web of Science database were collected. Table 2 establishes the eligibility criteria to determine which studies should be included or excluded in the analysis.

Table 2. Inclusion and exclusion criteria.

| Inclusion Criteria | Exclusion Criteria |
|---|---|
| Database: Web of Science Search date: December 2022 | |
| (1) Articles published between the year 2012 and the year 2022. | (1) Articles published before 2012 |
| (2) Research articles published in scientific journals. | (2) Studies that are not research articles published in scientific journals (doctoral theses, books, conferences...). |
| (3) Research area: Communication or Film Radio Television | (3) Research area other than Communication or Film Radio Television |

Source: Author's own work.

Through filtering, 454 articles were excluded from the analysis as they had been published before the year 2012. Additionally, 271 studies were identified that were not research articles published in scientific journals, and 535 studies did not correspond to the specific research area (Communication or Film Radio Television).

2.3. Selection and confirmation of data

After the aforementioned filtering, a review of the 292 included studies was conducted. Titles, keywords, and, if necessary, abstracts were reviewed to ensure they corresponded to the specified search phrase or topic. Once it was confirmed that the 292 articles were included in the bibliometric analysis, a manual data cleaning process was performed on the database (author initials, full journal names, etc.) to ensure data accuracy and consistency, thereby enhancing the reliability of the study.

2.4. Data analysis

The bibliometric analysis conducted focuses on citation analysis (of countries, references, sources, and authors), co-citation analysis (of references, sources, and authors), and co-word analysis.

Citation analysis of countries, references, sources, and authors provides us with information about the geographical distribution and quality of research on the topic. In this case, we can determine which countries, journals, sources, and authors are the most productive and cited in research on media and the digital ecosystem. On the other hand, co-citation analysis of references, sources, and authors provides information about the relationships and clusters among publications, sources, and authors in a research field by analyzing the frequency with which they are cited together. This allows us to identify the most influential publications, sources, and authors in research on media and the digital ecosystem (Arencibia-Jorge et al., 2020; Orduña-Malea and Costas, 2021). Finally, co-word analysis provides us with information about the most frequently used keywords and their clusters in research on media and the digital ecosystem. It involves analyzing the frequency of word occurrences in a set of texts and determining the most relevant or recurring keywords in that set (Van Eck and Waltman, 2010).

The co-citation and co-word data analysis was conducted using the VOSviewer software, applying the Association Strength method to measure the strength of association based on citation weight. Additionally, to visually illustrate the frequency of keyword occurrences and the relationships between publications, sources, and authors, network maps of co-words and co-citation were generated using VOSviewer. In these types of maps, nodes represent publications, sources, authors, and keywords, with larger nodes indicating higher impact

and influence, while smaller and more isolated nodes represent those with less influence and less frequency in the field of public media and the digital ecosystem. As for the lines or links, they represent the co-citation relationships between nodes, with their thickness related to the strength of the links. Finally, the colors depict the created clusters, which were labeled based on the most recurrent topics.

3. Results

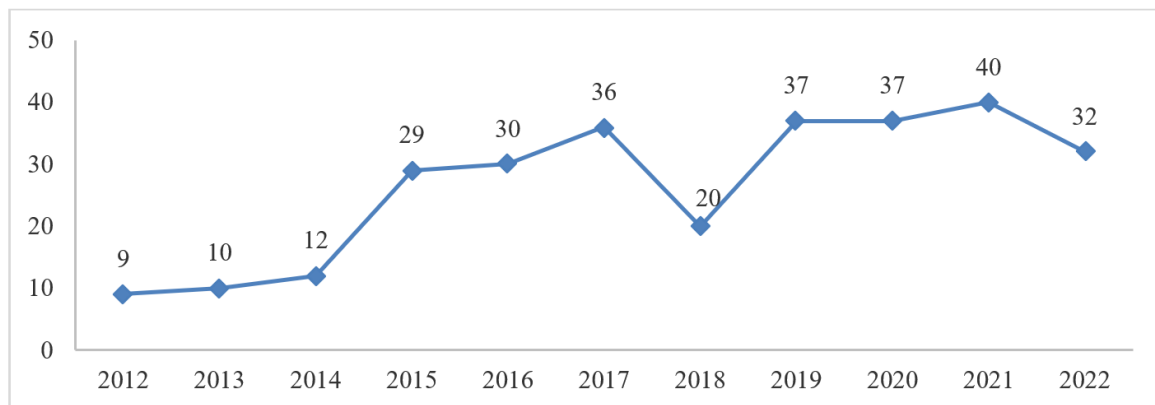
In this section, the most relevant results of the 292 articles included in the bibliometric analysis are presented. The results are organized according to the specific objectives established in this research.

3.1. Evolution of scientific production according to the year of publication

Figure 2 illustrates the temporal distribution of scientific productivity, highlighting four key years (2021, 2020, 2019, and 2017) in which a significantly higher number of articles have been published compared to other periods. In these years, 40, 37, 37, and 36 publications have been made, representing 51.4% of the total production. This result is consistent with the increased use of digital media, which has sparked a greater number of research studies in this area (Morales-Vargas et al., 2022).

The increase in scientific production from 2015 is also noteworthy, with a 5.82% increase compared to the previous year. On the other hand, there is a decrease in production in 2018, with a 5.48% decrease compared to the previous year.

Figure 1. Number of publications per year.

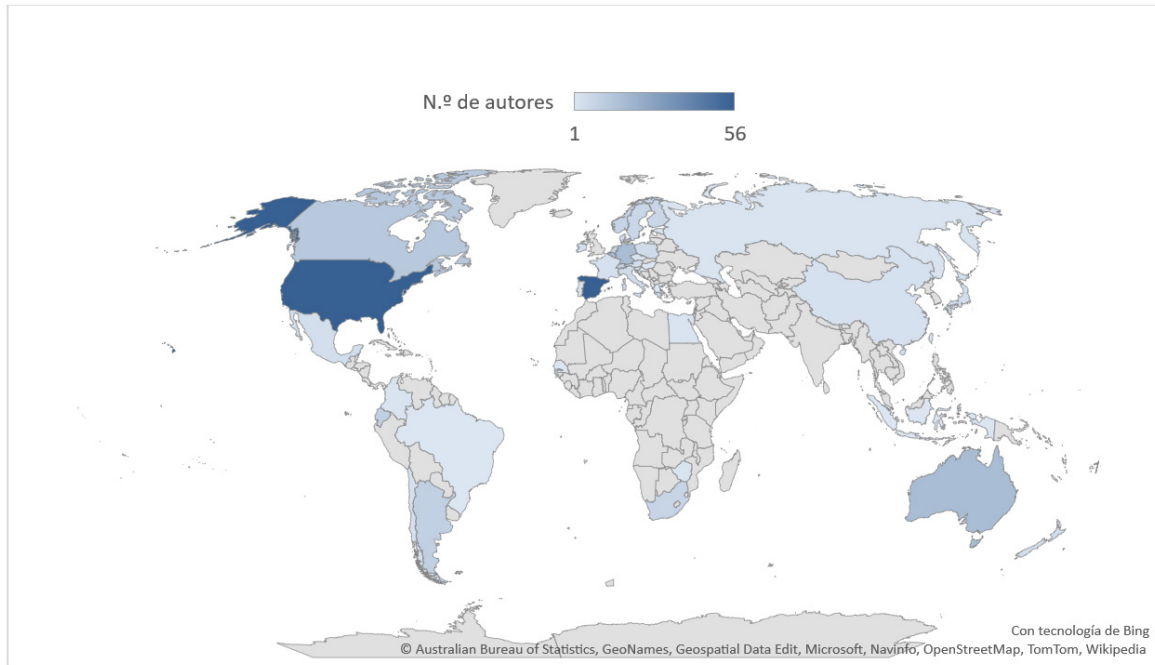


Source: Author's own work.

3.2. Geographical location of the authors

Figure 2 displays the geographical distribution of the authors. Spain and the United States are the countries with the highest participation, each having 56 authors. They are followed by England with 24 authors, and Australia, Belgium, and Germany with 18 authors each.

Figure 2. Geographical location of the authors.



Source: Author's own work.

3.3. Citation analysis

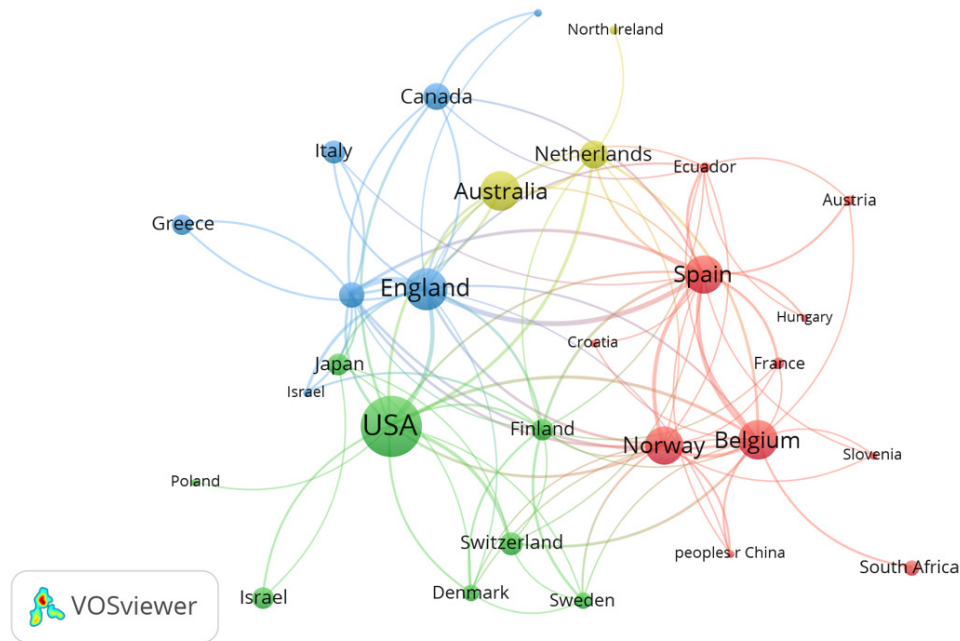
Among the citation analysis carried out, we highlight four: citation of countries, references, sources and authors.

3.3.1. Aountry Citation Analysis

Next, we present the citation and country network map. This visual representation is useful for understanding the relationships between scientific articles through citations and the authors' countries. The size of the nodes reflects the number of citations received by each country, and the colors indicate clustering of countries based on authors.

In Figure 3, the citation and country network based on the number of citations is displayed, showing the existence of document production links among countries with the highest citations in the field of public media and digitalization. The larger nodes in the graph represent countries with a higher number of citations, such as Belgium (203 citations), the United States (482 citations), England (229 citations), and Austria (202 citations). As for the lines, they connect to nodes, indicating citation relationships. Thicker lines indicate stronger citation relationships.

Figure 3. VOSviewer network map of citation and country based on the number of citations.



Source: Author's own work¹.

The node groups created in the citation network by country were four (identified by the colors red, green, blue, and yellow). Table 3 shows the summary of the network based on countries and the number of citations.

Table 3. Groupings of countries based on the number of citations.

| Cluster | Countries |
|---------------|--|
| 1 (red) | Belgium (203 citations); Spain (191 citations); Norway (189 citations); South Africa (34 citations); France (19 citations); Austria (15 citations); Ecuador (15 citations); Peoples R. China (6 citations); Croatia (4 citations); Slovenia (3 citations); Hungary (1 dates) |
| 2 (green) | USA (482 citations); Switzerland (71 citations); Israel (67 citations); Japan (64 citations); Finland (61 citations); Denmark (40 citations); Sweden (37 citations); Poland (6 dates) |
| 3 (blue) | England (229 citations); Canada (94 citations); Germany (87 citations); Italy (68 citations); Greece (54 citations); Israel (9 citations); Czech Republic (1 citations) |
| 4 (yellow) | Australia (202 citations); Netherlands (102 citations); North Ireland (11 citations) |

Source: Author's own work.

¹ Cut-off point of 1 document and 1 citation

3.3.2. Reference citation analysis

Table 4 presents a summary of articles that have received at least 20 citations. It can be observed that the most cited papers belong to authors Van Dijck and Poell (2015) and Aalberg et al. (2013), with a total of 54 citations received for each paper.

In the article by Van Dijck and Poell (2015), titled "Making Public Television Social? Public Service Broadcasting and the Challenges of Social Media," the authors investigate how public television in Europe, specifically in the United Kingdom and the Netherlands, faces the challenges of social media and how it can adapt to maintain its relevance in a digital world.

Regarding the article by Aalberg et al. (2013), titled "International TV news, foreign affairs interest and public knowledge: A comparative study of foreign news coverage and public opinion in 11 countries," which also has 54 citations, the authors present a comparative study on the relationship between international news coverage in television news programs and public opinion in 11 different countries. In the digital age, there is a greater availability of news sources, including social media and online news websites, which can affect how people obtain information about foreign affairs and how this, in turn, impacts their opinion on international issues. The study also focuses on the impact of news coverage on public interest and knowledge of international affairs.

Other relevant articles on the topic of public media and the digital ecosystem focus on how these media are adapting to the digital age, including the use of online news. The importance of engaging the audience in content production and distribution is also discussed, as well as the personalization of content to enhance the user experience.

Tabla 4. Summary of citations according to the author and his work (at least 20 citations).

| Authors | Title | Publication year | Citation |
|--|--|------------------|----------|
| Van Dijck, Jose; Poell, Thomas | Making Public Television Social? Public Service Broadcasting and the Challenges of Social Media. | 2015 | 54 |
| Aalberg, Toril; Papathanassopoulos, Stylianos; Soroka, Stuart; Curran, James; Hayashi, Kaori; Iyengar, Shanto; Jones, Paul K.; Mazzoleni, Gianpietro; Rojas, Hernando; Rowe, David; Tiffen, Rodney | International tv news, foreign affairs interest and public knowledge: A comparative study of foreign news coverage and public opinion in 11 countries. | 2013 | 54 |
| Pickard, Victor | Restructuring Democratic Infrastructures: A Policy Approach to the Journalism Crisis. | 2020 | 53 |
| Van den Bulck, Hilde; Moe, Hallvard | Public service media, universality and personalisation through algorithms: mapping strategies and exploring dilemmas. | 2018 | 53 |
| Belair-Gagnon, Valerie; Nelson, Jacob L.; Lewis, Seth C. | Audience Engagement, Reciprocity, and the Pursuit of Community Connectedness in Public Media Journalism. | 2019 | 49 |
| Fletcher, Richard; Nielsen, Rasmus Kleis | Paying for online news a comparative analysis of six countries. | 2017 | 45 |
| Fraille, Marta; Iyengar, Shanto | Not All News Sources Are Equally Informative: A Cross-National Analysis of Political Knowledge in Europe. | 2014 | 39 |

| | | | |
|---|---|------|----|
| Benson, Rodney; Powers, Matthew; Neff, Timothy | Public Media Autonomy and Accountability: Best and Worst Policy Practices in 12 Leading Democracies. | 2017 | 32 |
| Larrondo, Ainara; Domingo, David; Erdal, Ivar John; Masip, Pere; Van den Bulck, Hilde | A comparative study on European public service broadcasting organisations. | 2016 | 31 |
| Karppinen, Kari; Moe, Hallvard | What We Talk About When Talk About Media Independence. | 2016 | 30 |
| Rauch, Jennifer | Exploring the Alternative-Mainstream Dialectic: What Alternative Media Means to a Hybrid Audience. | 2015 | 30 |
| Malka, Vered; Ariel, Yaron; Avidar, Ruth | Fighting, worrying and sharing: Operation 'Protective Edge' as the first WhatsApp war. | 2015 | 28 |
| Edmond, Maura | All platforms considered: Contemporary radio and transmedia engagement. | 2015 | 27 |
| McCallum, Kerry; Waller, Lisa; Meadows, Michael | Raising the volume: indigenous voices in news media and policy. | 2012 | 25 |
| Donders, Karen | Public service media beyond the digital hype: distribution strategies in a platform era. | 2019 | 24 |
| Hanitzsch, Thomas; Hanusch, Folker; Lauerer, Corinna | Setting the agenda, influencing public opinion, and advocating for social change. Determinants of journalistic interventionism in 21 countries. | 2016 | 24 |
| Castro-Herrero, Laia; Nir, Lilach; Skovsgaard, Morten | Bridging Gaps in Cross-Cutting Media Exposure: The Role of Public Service Broadcasting. | 2018 | 23 |
| Carlyle, Kellie E.; Orr, Caroline; Savage, Matthew W.; Babin, Elizabeth A. | News Coverage of Intimate Partner Violence: Impact on Prosocial Responses. | 2014 | 22 |
| Tambini, Damian | Five Theses on Public Media and Digitization: From a 56-Country Study. | 2015 | 21 |
| Evans, Sandra K. | Making sense of innovation. Process, product, and storytelling innovation in public service broadcasting organizations | 2018 | 20 |

Source: Author's own work based on the data extracted from the Web of Science citation report.

3.3.3. Source citation analysis

In the following section, an analysis of citations and the journals where the 292 articles have been published is conducted, with a total of 1611 citations recorded.

To facilitate understanding of the results, Table 5 provides a summary of journals that have received at least 20 citations. Three journals stand out with over 100 citations: Journalism Studies (183 citations) focuses on research on journalism and media; its main topics include media content, audience, technology, ethics, and diversity in journalism, among others. Digital Journalism (127 citations) specializes in digital journalism and digital trends in the media; it covers topics such as the use of digital technologies in news production, journalism innovation, social media, privacy, and security. Lastly, Media, Culture & Society (123 citations) focuses on the

interdisciplinary study of media and its relationship with culture and society; it covers topics such as technology, politics, gender, and representation in the media, among others.

Table 5. Summary of citations according to the name of the journal (at least 20 citations).

| Magazine name | N.º articles | Citations |
|---|--------------|-----------|
| Journalism Studies | 13 | 183 |
| Digital Journalism | 6 | 127 |
| Media, Culture & Society | 11 | 123 |
| Television & New Media | 6 | 97 |
| International Journal of Communication | 15 | 96 |
| Media International Australia | 12 | 92 |
| Journalism Practice | 8 | 67 |
| International Journal of Press-Politics | 3 | 61 |
| Political Communication | 3 | 50 |
| Javnost-The Public | 8 | 49 |
| Journal of Radio & Audio Media | 10 | 46 |
| International Communication Gazette | 10 | 34 |
| European Journal of Communication | 6 | 32 |
| Communication Culture & Critique | 1 | 30 |
| Media War and Conflict | 1 | 28 |
| New Media & Society | 1 | 27 |
| African Journalism Studies | 6 | 27 |
| Revista Latina de Comunicacion Social | 6 | 24 |
| Media Psychology | 1 | 22 |
| Media and Communication | 6 | 20 |

Source: Author's own work.

3.3.4. Author citation analysis

To conclude the analysis of citations, Table 6 provides a summary of authors with at least 50 citations, regardless of their publications. Among the authors with the highest number of citations are Shanto Iyengar, a professor of Political Science and Communication at Stanford University, whose research focuses on topics related to communication and advertising from a political perspective. His work encompasses aspects such as political persuasion, propaganda, online political communication, psychology of information perception, and public media. Another prominent author is Hilde Van den Bulck, a professor at Drexel University specializing in media and cultural studies. Her research focuses on public television, public media, and how these media face the challenges of digitalization and social media, striving to adapt and maintain their relevance and effectiveness in contemporary society.

Table 6. Summary of authors and their citations (filter on citations greater than 50).

| Author | Documents | Citations | Author | Documents | Citations |
|-------------------|-----------|-----------|------------------------|-----------|-----------|
| Iyengar, S. | 2 | 93 | Aalberg, T. | 2 | 54 |
| Van Den Bulck, H. | 3 | 84 | Curran, J. | 1 | 54 |
| Benson, R. | 4 | 83 | Hayashi, K. | 1 | 54 |
| Moe, H. | 2 | 83 | Jones, P. K. | 1 | 54 |
| Neff, T. | 3 | 80 | Mazzoleni, G. | 1 | 54 |
| Poell, T. | 3 | 74 | Papathanassopoulos, S. | 1 | 54 |
| Donders, K. | 6 | 64 | Rojas, H. | 1 | 54 |
| Powers, M. | 2 | 64 | Rowe, D. | 1 | 54 |
| Nielsen, R. K. | 2 | 60 | Soroka, S. | 1 | 54 |
| Pickard, V. | 3 | 59 | Tiffen, R. | 1 | 54 |
| Fletcher, R. | 2 | 57 | Van Dijck, J. | 1 | 54 |

Source: Author's own work.

3.4. Co-citation analysis

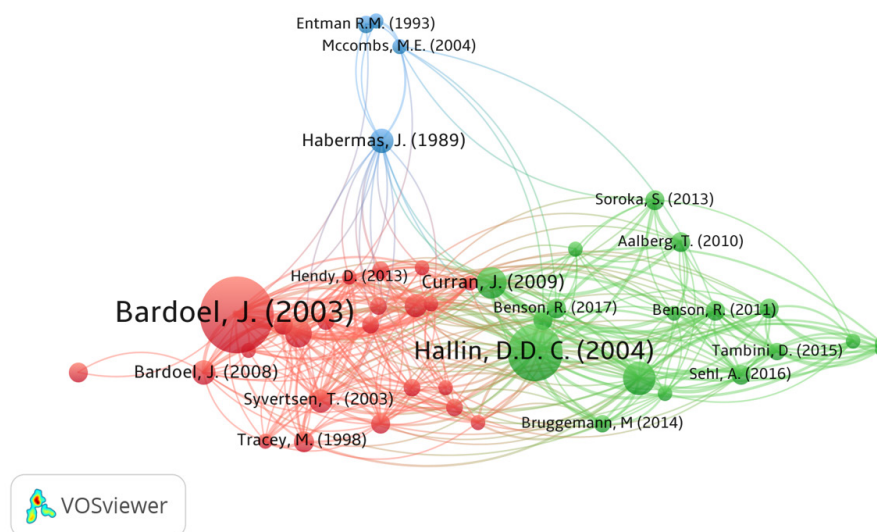
Among the co-citation analysis carried out, we highlight three: co-citation of references, sources and authors.

3.4.1. Analysis of co-citation of references

Figure 4 presents the co-citation network map of the cited references based on the citation weight. Out of the 11,376 cited references, a cut-off point of 6 was established, meaning that only documents cited at least 6 times were selected, resulting in a total of 46 documents.

The larger nodes in the graph represent the references with a higher number of citations, and the thickness of the lines connecting the nodes indicates the strength of the co-citation relationships.

Figure 4. VOSviewer network map of co-citation of references based on the number of citations.



Source: Author's own work.

The co-citation network of references formed three clusters, represented by different colors (red, green, and blue). The high number of citations within each cluster indicates the impact of the topic and the debate surrounding the role of media in society, politics, and public opinion.

In Table 7, a summary of the network and the thematic categories created can be observed.

- Cluster 1 (red) contains 23 references, with notable weight in terms of the number of citations received, such as Bardoel (2003, 2008), Jenkins and Deuze (2008), and Enli (2008). These works address the topic of communication and media, specifically in relation to public service and public television.
- Cluster 2 (green) consists of 18 references, with notable weight in terms of the number of citations received, such as Hallin and Mancini (2004), Brevini (2013), Curran et al. (2009), and Aalberg (2010). In this case, the theme revolves around the relationship between media and politics.
- Cluster 3 (blue) includes 4 references, with notable weight in terms of the number of citations received, such as Habermas (1989), Entman (1993), McCombs and Shaw (1972), and McCombs (2004). These works focus on the influence of the media on public opinion.

Table 7. Groupings of co-citations of references based on the number of citations.

| Cluster | Thematic categories | Selection of co-citations of references |
|-------------------|---|--|
| Cluster 1 (red) | Public television services. | Bardoel, J. (2003) – 50 citations Jenkins, H., (2008) – 13 citations Bardoel, J. (2008) – 11 citations Enli, G.S. (2008) – 10 citations |
| Cluster 2 (green) | Media and politics. | Hallin, D.D. C. (2004) – 34 citations Brevini, B. (2013) – 17 citations Curran, J. (2009) – 15 citations Aalberg, T. (2010) – 8 citations |
| Cluster 3 (blue) | Influence of the media on public opinion. | Habermas, J. (1989) – 11 citations Entman R.M. (1993) – 7 citations Mccombs, M.E. (2004) – 6 citations Mccombs, M.E. (1972) – 6 citations |

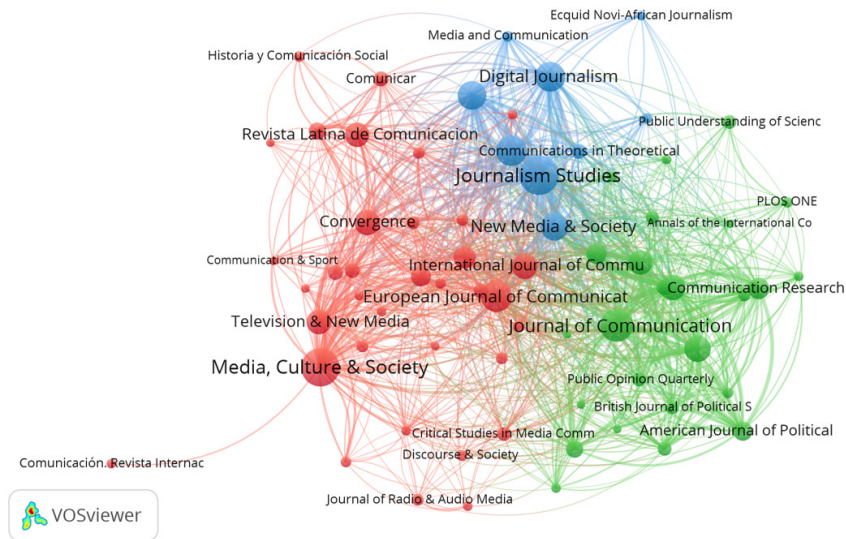
Source: Author's own work.

3.4.2. Analysis of co-citation of sources

Figure 5 presents the co-citation network of cited sources based on citation weight. From a total of 7,093 cited sources, a cutoff point of 10 was established, meaning that only sources cited at least 10 times were selected, resulting in a total of 99 sources. Among these sources, highly impactful scientific journals were selected (a total of 69), while 33 documents from books, theses, and reports were eliminated, as well as 26 sources from newspaper, radio, and television news (such as The Guardian, The New York Times, or The Globe and Mail).

The larger nodes in the graph represent the most cited sources, while thicker lines indicate stronger co-citation relationships. The most relevant nodes correspond to highly cited journals in the field, suggesting that these topics are of interest and are being extensively researched.

Figure 5. VOSviewer co-citation network map based on the number of citations.



Source: Author's own work.

In the co-citation network, three groups of nodes were created from the 69 sources with at least 10 citations, represented by colors (red, green, and blue). Table 8 provides a summary of the network and the thematic categories created.

- Cluster 1 (red) consists of 35 sources focused on communication and media. These sources examine how technology, culture, and society impact how people communicate and how messages are received and processed. Notable nodes include the journals *Media, Culture & Society* (165 citations), *European Journal of Communication* (108 citations), *International Journal of Communication* (78 citations), *Convergence* (76 citations), *Revista Latina de Comunicación Social* (69 citations), and *Television & New Media* (68 citations).
- Cluster 2 (green) consists of 25 sources centered around political and journalistic communication. These sources investigate how political and journalistic communication affects public opinion and democracy. Notable nodes include the journals *Journal of Communication* (126 citations), *Political Communication* (81 citations), *Journalism & Mass Communication Quarterly* (76 citations), and *International Journal of Press/Politics* (72 citations).
- Cluster 3 (blue) consists of 9 sources with a common theme of journalism, particularly digital journalism and new technologies. These sources focus on how journalism is evolving in the digital age and how this impacts the production, distribution, and consumption of news. Notable nodes include the journals *Journalism Studies* (175 citations), *Journalism* (110 citations), *Digital Journalism* (100 citations), *Journalism Practice* (92 citations), and *New Media & Society* (89 citations).

"The significant changes brought about by digital technology in how people consume and produce information. These changes have generated new challenges and opportunities for public media"

Table 8. Groupings of co-citations of sources based on the number of citations.

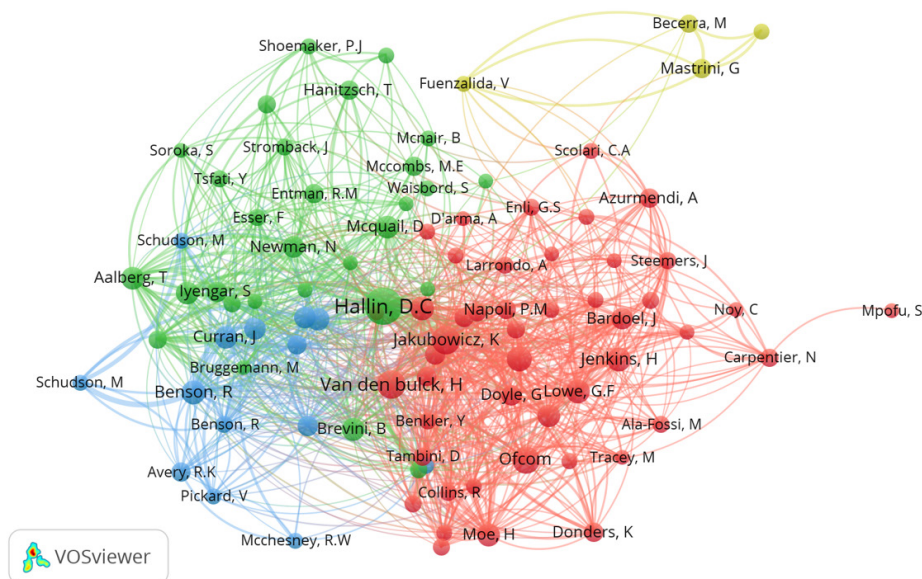
| Cluster | Thematic categories | Name of the magazines |
|-------------------|--|---|
| Cluster 1 (red) | Communication and the media | Media, Culture & Society; European Journal of Communication; International Journal of Communication; Convergence; Revista Latina de Comunicación Social; Television & New Media; International Communication Gazette; Javnost - The Public; Profesional de la información; Comunicar; Media International Australia; Canadian Journal of Communication; Communication & Society; Critical Studies in Media Communication. |
| Cluster 2 (green) | Political and journalistic communication | Journal of Communication; Political Communication; Journalism & Mass Communication Quarterly; International Journal of Press/Politic; Communication Research; Information, Communication & Society; American Journal of Political Science; Journal of Broadcasting & Electronic Media; Mass Communication and Society; International Journal of Public Opinion Research; Public Opinion Quarterly; Public Understanding of Science. |
| Cluster 3 (azul) | Digital journalism and new technologies | Journalism Studies; Journalism; Digital Journalism; Journalism Practice; New Media & Society. |

Source: Author's own work.

3.4.3. Analysis of co-citation of authors

In Figure 6, the co-citation network of cited authors is presented based on the weight of the citation. From the 7,935 cited authors, a cutoff of 10 was established, meaning that only authors cited at least 10 times were selected, resulting in a total of 100 authors. Six authors referring to institutional documents (BBC, Unesco, Union European broadcasting, Commission European, European Audiovisual Observatory, Rtve) were excluded. The larger nodes in the graph represent the most cited authors, while thicker lines indicate stronger co-citation relationships.

Figure 6. VOSviewer network map of co-citation of authors based on the number of citations.



Source: Author's own work².

² Web of Science only includes the first author cited in a document, so the analysis does not consider the other authors of the work.

In the co-citation network of authors who have received a significant number of citations (at least 20 citations), three clusters of nodes were created again, represented by colors (red, green, and blue), reflecting the diversity of research topics in the field of communication and highlighting the importance of public television, politics, and society in media research.

In Table 9, a summary of the network and the created thematic categories is presented:

- Cluster 1 (red) consists of 46 authors and is focused on public television services. Among the most relevant nodes are the following authors: Van den Bulck, H.; Jakubowicz, K.; Ofcom; Losifidis, P. and Donders, K.; Jenkins, H.; Lowe, G.F.; Moe, H.; Bardoel, J. These authors specialize in researching public media, with an emphasis on public television and its importance in shaping public opinion, its adaptation to the digital age, and regulation and policies to ensure its financial viability and independence.
- Cluster 2 (green) consists of 29 authors and is centered on media and politics. Among the most relevant nodes are the following authors: Hallin, D.C.; Aalberg, T.; Brevini, B.; Mcquail, D.; Sehl, A.; Newman, N. These authors specialize in researching media and its relationship with politics and society, with an emphasis on comparative analysis of media systems in different countries and regions, the role of media in shaping public opinion and democracy, and media regulation and policies.
- Cluster 3 (blue) consists of 14 authors and is focused on the influence of media on public opinion. Among the most relevant nodes are the following authors: Benson, R.; Bourdieu, P.; Curran, J.; Pickard, V.; Habermas, J. These authors specialize in researching media and its relationship with society and democracy, with an emphasis on analyzing the relationship between media and society, including the role of media in shaping public opinion and constructing reality.

Table 9. Groups of author co-citations based on the number of citations (at least 20 citations).

| Cluster | Thematic categories | Author with citations ≥ 20 |
|-------------------|--|---|
| Cluster 1 (rojo) | Public television services | Van den Bulck, H. (36 citations); Jakubowicz, K. (35 citations); Ofcom (33 citations); Losifidis, P. (27 citations); Donders, K. (26 citations); Jenkins, H. (26 citations); Lowe, G.F. (25 citations); Moe, H. (24 citations); Bardoel, J. (20 citations). |
| Cluster 2 (verde) | Media and politics | Hallin, D.C. (62 citations); Aalberg, T. (23 citations); Brevini, B. (22 citations); Mcquail, D. (22 citations); Sehl, A. (22 citations); Newman, N. (20 citations). |
| Cluster 3 (azul) | Influence of the media on public opinion | Benson, R. (26 citations); Bourdieu, P. (24 citations); Curran, J. (22 citations); Pickard, V. (21 citations); Habermas, J. (20 citations). |

Source: Author's own work.

3.5. Co-word analysis

The following keyword analysis aims to identify important research topics on public media in the digital ecosystem. A co-occurrence analysis of keywords from the 292 articles included in the study was conducted.

To facilitate the interpretation of the analysis, a maximum of 3 keywords were selected (i.e., co-occurrence relationships between every three keywords were studied). Out of a total of 1244 keywords, 121 keywords were obtained after applying the established threshold.

Table 10. Keywords groupings based on co-occurrence.

| Cluster | Thematic categories | Keywords |
|-----------------------|---------------------|--|
| Cluster 1 (red) | News communication | news; communication; coverage; Germany; knowledge; Internet; Twitter; audiences; covid-19; news media; science Communication; service media; crisis; digital media; impact; independence; agenda-setting; attitudes; Ecuador; rtve; social networks; women; access; agenda; attention; Belgium; China; consumption; debate; democratization; information; news coverage; pluralism; political communication; populism; science; selective exposure; YouTube. |
| Cluster 2 (green) | Mass communication | television; social media; participation; audience; diversity; democracy; bbc; public sphere; communication policies; competition; citizen journalism; israel; psb; public radio; state media; advertising; documentary; engagement; funding; history; media reform; media regulation; mobile media; neoliberalism; new media; state; survey; argentina; cbc; cultural citizenship; era; flanders; national identity; participatory journalism; podcasting; poland. |
| Cluster 3 (blue) | European journalism | europe; politics; public television; newspapers; comparative research; content analysis; policy; fake news; government; latin america; online; systems; algorithms; culture; france; media ownership; misinformation; online news; personalization; sweden. |
| Cluster 4 (yellow) | Global journalism | journalism; convergence; media policy; radio; spain; journalists; framing; innovation; children's television; digital journalism; discourse; governance; new zealand; performance; political economy; strategies; transmedia; zimbabwe. |

Source: Author's own work.

4. Discussion and Conclusions

This bibliometric study provides a better understanding of how research on public media in the digital environment is conducted, as well as the main terms used, countries, journals, and authors with the highest production in the field. Additionally, it reveals an increase in scientific production on media and the digital ecosystem in the past decade, particularly in the years 2017, 2018, 2020, and 2021. This indicates that it is a relevant and interesting topic for the scientific community, likely due to the global health crisis and the significant changes brought about by digital technology in how people consume and produce information. These changes have generated new challenges and opportunities for public media (Bolognesi, 2023).

Among the 350 authors involved in the analysis of the 292 articles, Spain and the United States have the highest participation, with 56 authors each. Regarding the countries that receive the highest number of citations in articles on public media and the digital ecosystem, Belgium, the United States once again, England, and Austria stand out. These countries likely receive a higher number of citations in articles on public media and the digital ecosystem because they have a long history of technological development and a significant presence in the media industry. Moreover, these countries have high internet penetration and a large number of digital media users, making them important locations for studying the digital ecosystem.

Regarding the most cited source, the journal *Journalism Studies* stands out. One of the reasons why this journal receives numerous citations is its interdisciplinary approach, covering a wide range of topics related to journalism and media, including public media in the digital era. The journal is also recognized for its rigor and peer-review process, ensuring the quality and credibility of the published articles.

In terms of the most cited papers among the 292 analyzed articles, the works of Van-Dijck and Poell (2015) and Aalberg et al. (2013) stand out. These papers are highly regarded due to the relevance of their topics, methodological rigor, and significant findings. Moreover, they were published in high-impact academic journals in the field of communication and media (*Television & New Media* and *Journalism Studies*, respectively), which increased their reach and visibility.

Regarding the most cited authors, Shanto Iyengar and Hilde Van den Bulck stand out. Both have a substantial body of research and publications on the topic of public media in the digital era.

The conclusions regarding the networks achieved in the study are as follows:

1) A co-citation network of references based on three specific thematic blocks that address fundamental aspects and whose understanding is crucial for developing policies that promote the quality and diversity of public media, analyzing how politicians use the media to reach the public, and understanding how the media impact public opinion and democracy.

- Communication and media: The references grouped in this block (Bardoel, 2003, 2008; Jenkins and Deuze, 2008; Enli, 2008, etc.) focus on how public media, especially public television, fulfill their public service function and how these media interact with society in the current context.
- Relationship between media and politics: The references grouped in this block (Hallin, 2004; Brevini, 2013; Curran et al., 2009; Aalberg, 2010, etc.) focus on analyzing how the media cover politics, how politicians use the media to reach the public, and how the relationship between media and politics affects public opinion and democracy.
- Influence of media on public opinion: The references grouped in this block (Habermas, 1989; Entman, 1993; McCombs and Shaw, 1972; McCombs, 2004, etc.) focus on analyzing how the media influence the formation of public opinion and how this public opinion, in turn, affects society.

2) A co-citation network of sources based on three specific thematic blocks focused on how digital platforms have transformed the way communication and information sharing occur. This network reflects the main research topics in the field, and its analysis can help understand how the media impact society and how to improve the quality of information.

- Communication and media studies: The sources grouped in this block (*Media, Culture & Society*, *European Journal of Communication*, *International Journal of Communication*, *Convergence*, *Revista Latina de Comunicación Social*, *Television & New Media*) refer to the study of how media function, how they impact society, and how they relate to each other.
- Political and journalistic communication: The sources grouped in this block (*Journal of Communication*, *Political Communication*, *Journalism & Mass Communication Quarterly*, *International Journal of Press/Politics*) refer to the study of how media cover and present politics, and how politicians use media to reach the public.
- Digital journalism and new technologies: The sources grouped in this block (*Journalism Studies*, *Journalism*, *Digital Journalism*, *Journalism Practice*, *New Media & Society*) focus on how digital technologies are changing the way news is produced, distributed, and consumed.

3) A co-citation network of authors based on three specific thematic blocks centered around key aspects of the media and its relationship with society and politics, such as public television services, the influence of media on public opinion, and the relationship between media and politics. Understanding these topics can be essential for making informed decisions and promoting an informed and critical society.

- Public television services: The most influential authors grouped in this block (Van den Bulck, H.; Jakubowicz, K.; Ofcom; Losifidis, P. and Donders, K.; Jenkins, H.; Lowe, G.F.; Moe, H.; Bardoel, J.) focus on studying topics such as the funding, regulation, content, and audience of public television, as well as its relationship with the market and government policies.
- Media and politics: The most influential authors grouped in this block (Hallin, D.C.; Aalberg, T.; Brevini, B.; Mcquail, D.; Sehl, A.; Newman, N.) focus on analyzing the representation of politics in the media, the power of media in society, media coverage of political processes, and the impact of media on public opinion.
- Influence of media on public opinion: The most influential authors grouped in this block (Benson, R.; Bourdieu, P.; Curran, J.; Pickard, V.; Habermas, J.) focus on topics such as the nature and extent of media influence on public opinion, strategies used by media to influence public opinion, relationships between media and audiences, and the role of media in shaping public opinion.

4) A co-word network of four thematic groups that allows us to understand the role of media in society, comprehend the unique characteristics and current challenges in freedom of expression and democracy in different contexts and countries, as well as develop effective communication policies and strategies.

- News communication: This thematic group refers to the study of news production, distribution, and consumption, as well as its impact on society.
- Mass communication: This thematic group refers to the study of how messages are transmitted through mass media such as television, radio, newspapers, and social media, and how these messages affect society.
- European journalism: This thematic group refers to the study of journalism in Europe, including the production, distribution, and consumption of news in different European countries and cultural contexts.
- Global journalism: This thematic group refers to the study of journalism at a global level, including the production, distribution, and consumption of news in different countries and cultural contexts worldwide.

In summary, the presented study has used citation analysis, co-citation analysis, and co-word analysis techniques to investigate the current state of research on public media and the digital ecosystem. The obtained results have allowed for the identification of major trends and theoretical foundations in this field. For future research, these analyses could be replicated to delve deeper into other topics and expand the search to other prestigious databases such as Scopus, among others.

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