

Retrospective of Scientific Production on e-Democracy

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Abstract

E-democracy refers to the use of information technologies in a political system, which facilitates the exchange of information and the articulation of interests between social and political actors in a democracy. This concept is on the rise, and its incidence and impact is of great interest to researchers around the world. Therefore, it is necessary to elaborate a general and structural mapping that helps researchers to understand certain political-social phenomena that occur in contemporary times. The objective of this study was to carry out a bibliometric analysis of the scientific production around the term e-democracy. Methodologically, the research was conducted through the phases of a bibliometric study whose data sources were WoS and Scopus, extracting 311 and 468 articles, respectively. Among the main results, it was found the evolution of research with a growth of less than 5%, with no defined trend and a low international collaboration. United Kingdom stands out as the country with the highest scientific production in both databases consulted. "Coleman S." emerges as the most cited author among the extracted documents. The first institution is the University of Granada.

Keywords

Bibliometrics, Policy, Citizen Participation, Democracy

1. Introduction

E-democracy focuses on the use of information technology (IT) to improve democracy [1]. E-democracy is considered as an approach to improve the quality of citizen participation in democratic processes [2]. IT offers opportunities for greater citizen participation in democratic reform. However, they have only been associated with e-government applications, which focus on one-way information provision and service delivery. In contrast, e-democracy processes facilitate active civic engagement through continuous two-way dialogue [3].

Today, country leaders are making more active use of e-democracy tools to interact with community members on the basis of government transparency and openness [4]. The use of IT in social and political issues is increasing, and the study of its impact is being analyzed by researchers around the world.

In [5] evaluated the introduction of online tools in candidate selection processes in German political parties. They found that support or opposition to the use of technology does not

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depend on a generational difference, but on how power and influence are distributed within the political party and how participants conceive this inclusion. In [6] quantified the communicative behavior of politicians using more than 366000 tweets posted by more than 1000 prominent German politicians in the 2017 election year. They presented how different political parties engage to a greater or lesser extent with prominent topics, and how their strategies evolve in the run-up to elections.

Collecting, synthesizing, and analyzing scientific evidence on a topic is very important. The bibliographic method is considered fundamental for mapping the state of the object of study, consolidating the heterogeneous body of public relations knowledge, and pointing out potential new directions of a research topic [7]. Moving up to the bibliometric method can facilitate the understanding of a topic when trying to locate scientific gaps or mapping where one is, or wants to be, in the field of scientific discourse [8]. Bibliometrics is useful for the in-depth analysis of aspects related to quality scientific production. Sources, authors or countries can be evaluated, providing relevant information for decision-making. For example, an overview of the main trends of a journal can be obtained [9].

The present study used bibliometric methods to provide information on high-impact scientific production related to e-democracy. Data were extracted from two of today's most prominent scientific information databases. In addition, tools with statistical analysis and bibliometric network visualization approaches were employed.

2. Methodology

In order to present the most relevant information on the scientific production related to e-democracy, activities grouped in three stages were developed; some of them are described below.

In the first stage, "data collection", the Web of Science (WoS) and Scopus databases were used to extract data on scientific production related to e-democracy. Scientific articles in the English language were taken, from 2002 to June 2022.

For the second stage, "bibliometric analysis and visualization", the collected data were processed to generate relevant information using the R programming language, through the RStudio integrated development environment, and the Bibliometrix package [10]. Bibliometrix can be used as part of a broader, more general data analysis workflow [11]. RStudio and Bibliometrix allowed the processing of the extracted data. Detailed statistical information was obtained through variables, tables, and graphs.

With VOSviewer 1.6.18 software, knowledge graphs were constructed from data extracted from Scopus and WoS. This tool was developed by Nees Jan van Eck and Ludo Waltman of Leiden University in the Netherlands to map and visualize econometric networks [12]. To improve the results of the maps, the author and subject thesaurus, integrated into the same software, were applied in some cases. In addition, the "full counting" weight assignment method was used in all analyses [13]. This resulted in the identification of the most representative items, which show the largest size in the circle and its label. From this, it is interpreted in the graphs, that the most representative items have more linking strength in the knowledge structure for each analysis unit.

With the variables, tables, and knowledge maps based on data texts, taking the topics from the titles and fields of the summary, the third and last stage "conclusions" began.

3. Results

3.1. Chronology of scientific production

From 2002 to July 2022, 311 articles were evaluated in WoS and 468 in Scopus. The total annual production recorded in both databases is variant, and there is no trend (see Figure 1). The growth rates were low, 4.89% for WoS and 3.53% for Scopus. Despite the difference in the totals for the period evaluated, in the last three years, the annual totals tend to coincide.

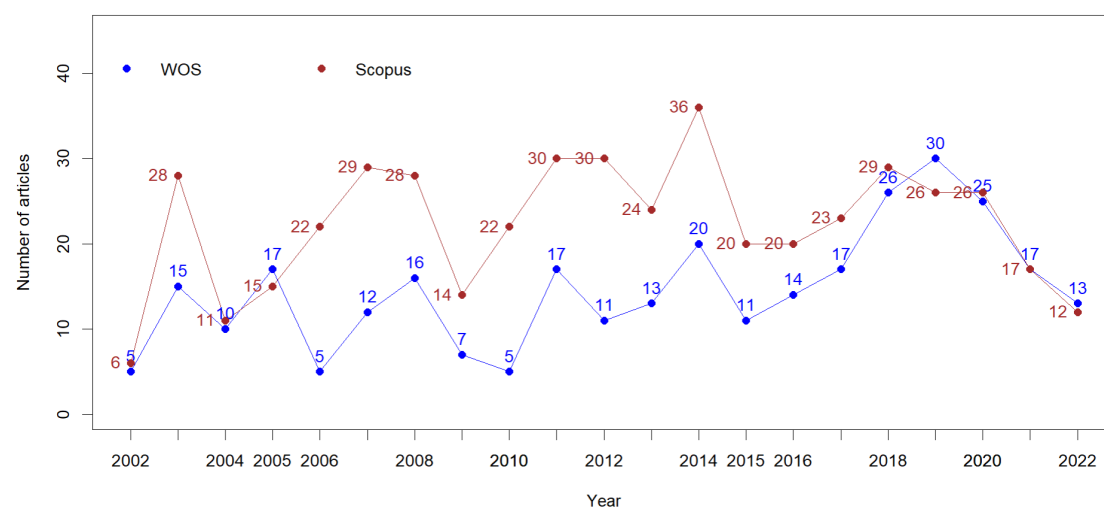


Figure 1: Chronology of research by total articles.

3.2. Countries with outstanding scientific production

When evaluating the ten countries with the highest scientific production, they coincide in both databases: United Kingdom, USA, Italy, Spain, Australia, Sweden, and the Netherlands. Of the countries referred to, all have very low international collaboration; that is, they have an inter-country index below 0.50, see Table 1. These countries have strong national collaboration.

When evaluating the ten countries with the highest number of citations of their scientific production, in the case of WoS, Italy, Ukraine and Germany disappear; Canada, Austria, and Denmark appear. In Scopus, Greece disappears and China appears. See Table 2.

Table 3 contains some of the first titles extracted from the databases, which served as a recognition of the topics dealt with in the scientific productions related to e-democracy. They highlight themes such as the use of government websites; people's participation in political actions; digital communication; populism and technology; misuse of technology in politics;

Table 1

Top ten countries by number of articles

| WoS | | | | | | Scopus | | | | | |
|----------------|----|--------|----|---|-------|----------------|----|--------|----|----|-------|
| A | B | C | D | E | F | A | B | C | D | E | F |
| UNITED KINGDOM | 42 | 0.1364 | 33 | 9 | 0.214 | UNITED KINGDOM | 56 | 0.1662 | 45 | 11 | 0.196 |
| USA | 36 | 0.1169 | 32 | 4 | 0.111 | USA | 43 | 0.1276 | 39 | 4 | 0.093 |
| ITALY | 19 | 0.0617 | 13 | 6 | 0.316 | ITALY | 22 | 0.0653 | 16 | 6 | 0.273 |
| SPAIN | 18 | 0.0584 | 14 | 4 | 0.222 | SPAIN | 22 | 0.0653 | 18 | 4 | 0.182 |
| AUSTRALIA | 17 | 0.0552 | 12 | 5 | 0.294 | GREECE | 19 | 0.0564 | 17 | 2 | 0.105 |
| SWEDEN | 13 | 0.0422 | 11 | 2 | 0.154 | AUSTRALIA | 16 | 0.0475 | 12 | 4 | 0.250 |
| CHINA | 11 | 0.0357 | 8 | 3 | 0.273 | SWEDEN | 15 | 0.0445 | 12 | 3 | 0.200 |
| UKRAINE | 10 | 0.0325 | 10 | 0 | 0.000 | NETHERLANDS | 11 | 0.0326 | 9 | 2 | 0.182 |
| GERMANY | 9 | 0.0292 | 9 | 0 | 0.000 | CANADA | 10 | 0.0297 | 7 | 3 | 0.300 |
| NETHERLANDS | 9 | 0.0292 | 6 | 3 | 0.333 | AUSTRIA | 9 | 0.0267 | 8 | 1 | 0.111 |

(A) Country (B) Articles (C) Frequency (D) Intra-country collaboration index (E) Inter-country collaboration index (F) Inter-country relationship.

Table 2

Top ten countries by number of citations

| WoS | | | Scopus | | |
|----------------|-----------------|---------------------------|----------------|-----------------|---------------------------|
| Country | Total Citations | Average Article Citations | Country | Total Citations | Average Article Citations |
| USA | 1441 | 40.028 | UNITED KINGDOM | 1792 | 32.00 |
| UNITED KINGDOM | 1331 | 31.690 | USA | 1347 | 31.33 |
| SPAIN | 697 | 38.722 | SWEDEN | 634 | 42.27 |
| CHINA | 509 | 46.273 | CANADA | 620 | 62.00 |
| SWEDEN | 493 | 37.923 | SPAIN | 498 | 22.64 |
| CANADA | 407 | 58.143 | CHINA | 305 | 61.00 |
| AUSTRALIA | 357 | 21.000 | AUSTRALIA | 295 | 18.44 |
| AUSTRIA | 191 | 38.200 | ITALY | 290 | 13.18 |
| NETHERLANDS | 155 | 17.222 | NETHERLANDS | 210 | 19.09 |
| DENMARK | 128 | 128.000 | AUSTRIA | 186 | 20.67 |

evaluation of IT integration in democracy; electronic voting; IT to achieve transparency; citizens' acceptance of IT in democratic processes; social networks; the attack on privacy through bigdata in politics; political parties and IT; political disinformation in social networks; electronic data for public decision-making; IT risks in politics; IT as a means of innovation in the public sector and inclusive processes.

Table 3

Featured country research in WoS and Scopus

| Country | Title | Ref. |
|----------------|--|------|
| UNITED KINGDOM | Digital Communication and Representational Interactivity: an Analysis of www.WriteToThem.com in Scotland | [14] |

| | | |
|----------------|--|------|
| USA | E-Democracy, E-Commerce, and E-Research: Examining the Electronic Ties Between Citizens and Governments | [15] |
| ITALY | A role-based mobile-agent approach to support e-democracy | [16] |
| SWEDEN | Technology and democracy: validity in measurements of e-democracy | [17] |
| ITALY | E-Democracy and Digital Activism: From Divergent Paths Toward a New Frame | [18] |
| ITALY | Populisms among technology, e-democracy and the depoliticisation process | [19] |
| USA | The Problem of Citizens: E-Democracy for Actually Existing Democracy | [20] |
| UNITED KINGDOM | Deliberative Manoeuvres in the Digital Darkness: E-Democracy Policy in the UK | [21] |
| AUSTRALIA | Letting the public in: dialectic tensions when local governments move beyond e-government to e-democracy | [22] |
| UNITED KINGDOM | Bringing E-Democracy Back In: Why it Matters for Future Research on E-Governance | [23] |
| UNITED KINGDOM | Cybernetics and e-democracy | [24] |
| USA | E-democracy@China: does it work? | [25] |
| UNITED KINGDOM | Web-enabled strategic GDSS, e-democracy and Arrow's theorem: A Bayesian perspective | [26] |
| SWEDEN | A Knowledge Perspective on e-Democracy | [27] |
| UNITED KINGDOM | The Scottish Parliament and e-democracy | [28] |
| UNITED KINGDOM | Developing local e-democracy in Bristol: From information to consultation to participation and beyond | [29] |
| SPAIN; USA | E-DEMOCRACY WRIT SMALL: The impact of the Internet on citizen access to local elected officials | [30] |
| UNITED KINGDOM | e-Voting: Powerful Symbol of e-Democracy | [31] |
| SPAIN | A Group Decision-Making Methodology with Incomplete Individual Beliefs Applied to e-Democracy | [32] |
| CHINA;USA | Testing the Development and Diffusion of E-Government and E-Democracy: A Global Perspective | [33] |
| UNITED KINGDOM | 'Mind the Gap': e-Government and e-Democracy | [34] |

| | | |
|---------------------|---|------|
| CHINA | Enhancing e-Democracy Via Fiscal Transparency: A Discussion Based on China's Experience | [35] |
| ITALY; SPAIN | Financial Sustainability as a Driver for Transparency and E-Democracy: A Comparative Study in Italian and Spanish Local Governments | [36] |
| KOREA; USA | Will the internet promote democracy? search engines, concentration of online news readership, and e-democracy | [37] |
| UNITED KINGDOM | Local Democracy Shaping e-Democracy | [38] |
| NIGERIA; USA | Empirical study of user acceptance of online political participation: Integrating Civic Voluntarism Model and Theory of Reasoned Action | [39] |
| UNITED KINGDOM | Electronic Democracy and Young People | [40] |
| ITALY | No (e-)Democracy Without (e-)Knowledge | [41] |
| USA | Examining Development of E-Government in Russia and China: A Comparative Approach | [42] |
| SWEDEN | Emerging Electronic Infrastructures: Exploring Democratic Components | [43] |
| ITALY | A protocol for anonymous short communications in social networks and its application to proximity-based services | [44] |
| GREECE | Big data analytics in e-government and e-democracy applications: privacy threats, implications and mitigation | [45] |
| USA | Digital Governance: An Assessment of Performance and Best Practices | [46] |
| UNITED KINGDOM; USA | Learning VAA: A new method for matching users to parties in voting advice applications | [47] |
| SPAIN | Disinformation, social media, bots, and astroturfing: the fourth wave of digital democracy | [48] |
| USA | Does Domestic Political Instability Foster Terrorism? Global Evidence from the Arab Spring Era (2011–14) | [49] |
| SPAIN;USA | E-Voting System Evaluation Based on The Council of Europe Recommendations: Helios Voting | [50] |
| USA | Voting is a right: a decade of societal, technological and experiential progress towards the goal of remote-access voting | [51] |

| | | |
|---|---|------|
| GREECE; IRELAND; UNITED KINGDOM | A study of higher education students' self-perceived digital competencies for learning and everyday life online participation | [52] |
| USA | Assessing e-government capacity to increase voter participation: Evidence from the U.S. | [53] |
| CHINA; SAUDI ARABIA; SPAIN; UNITED KINGDOM | Large-Scale decision-making: Characterization, taxonomy, challenges and future directions from an Artificial Intelligence and applications perspective | [54] |
| USA | A Cross-National Analysis of Lifespan Inequality, 1950–2015: Examining the Distribution of Mortality Within Countries | [55] |
| USA | A Systematic Review of Multiple Terminologies for ICT in Government: A Mesh of Concentric and Overlapping Circles | [56] |
| ITALY; USA | Reply structure and participation in online conversations enabled by argumentation platforms: A real-world experiment of collective deliberation in e-democracy | [57] |
| BELGIUM; FRANCE; SPAIN; UNITED KINGDOM | Power users in online democracy: their origins and impact | [58] |
| SWEDEN | Electronic government: Towards e-democracy or democracy at risk? | [59] |
| GREECE | E-Governance in educational settings: Greek educational organizations leadership's perspectives towards social media usage for participatory decision-making | [60] |
| CHINA; SPAIN; UNITED KINGDOM | Dealing with incomplete information in linguistic group decision making by means of Interval Type-2 Fuzzy Sets | [61] |
| FRANCE; SAUDI ARABIA; SPAIN; UNITED KINGDOM | A social network based approach for consensus achievement in multiperson decision making | [62] |
| ITALY | From Smart-Cities to Smart-Communities: How Can We Evaluate the Impacts of Innovation and Inclusive Processes in Urban Context? | [63] |
| CHINA; SPAIN; UNITED KINGDOM | A review on trust propagation and opinion dynamics in social networks and group decision making frameworks | [64] |

| | | |
|------------------------------|---|------|
| PORTUGAL; SPAIN | Citizens' intention to use and recommend e-participation: Drawing upon UTAUT and citizen empowerment | [65] |
| USA | Harnessing the power of mobile technology to bridge the digital divide: a look at U.S. cities' mobile government capability | [66] |
| CHINA; SPAIN; UNITED KINGDOM | A novel consensus model for multi-attribute large-scale group decision making based on comprehensive behavior classification and adaptive weight updating | [67] |
| UNITED KINGDOM | Seeking Evidence for a Welsh Progressive Consensus: Party Positioning in the 2016 National Assembly for Wales Election | [68] |
| USA | When Does Public Participation Make a Difference? Evidence From Iceland's Crowdsourced Constitution: Public Participation in Constitution Drafting in Iceland | [69] |
| ITALY | Mobilizing young voters? A cross-national analysis of contextual factors in pirate voting | [70] |

3.3. Institutions with the greatest scientific production

A total of 385 different institutions (affiliations) were identified in WoS and 494 in Scopus. Table 4 shows the 10 institutions with the highest number of articles for both WoS and Scopus. The count was made depending on the registered institution of each of the authors involved in scientific production.

Table 4
Top ten institutions by number of articles

| WoS | | | Scopus | | |
|----------------------------|----|-------------|------------------------------|----|-------------|
| A | B | C | A | B | C |
| UNIV GRANADA | 13 | 0.015662651 | UNIVERSITY OF GRANADA | 10 | 0.013966480 |
| UNIV OREBRO | 13 | 0.015662651 | UNIVERSITY OF MANCHESTER | 9 | 0.012569832 |
| UNIV ZARAGOZA | 12 | 0.014457831 | ÖREBRO UNIVERSITY | 8 | 0.011173184 |
| NAPIER UNIV | 11 | 0.013253012 | DE MONTFORT UNIVERSITY | 7 | 0.009776536 |
| UNIV OXFORD | 10 | 0.012048193 | UNIVERSITY AT ALBANY | 7 | 0.009776536 |
| UNIV TECHNOL SYDNEY | 9 | 0.010843373 | UNIVERSIDAD DE ZARAGOZA | 6 | 0.008379888 |
| DE MONTFORT UNIV | 8 | 0.009638554 | UNIVERSITY OF LEEDS | 6 | 0.008379888 |
| UNIV TEHRAN | 8 | 0.009638554 | UNIVERSITY OF OXFORD | 6 | 0.008379888 |
| GERMAN UNIV ADM SCI SPEYER | 7 | 0.008433735 | ERASMUS UNIVERSITY ROTTERDAM | 5 | 0.006983240 |
| UNIV UTRECHT | 7 | 0.008433735 | IONIAN UNIVERSITY | 5 | 0.006983240 |

(A) Affiliations (B) Number of articles (C) Proportion.

3.4. Sources with the greatest scientific production

Figure 2 shows the top ten sources (journals) by the number of articles in each of the databases evaluated. From these lists, the presence in both databases of the journals "Information Communication and Society", "Government Information Quarterly" and "Journal of Information Technology and Politics" stands out. They are accompanied by "Electronic Government Proceedings" and "E-journal of E-democracy and Open Government".

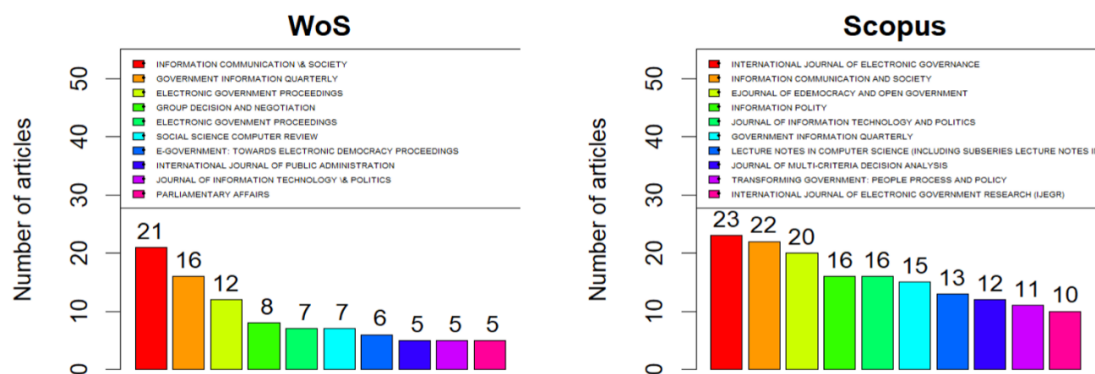


Figure 2: Top ten sources by the number of articles.

3.5. Bradford's Law

Bradford's law states that for a subject area there are few but very productive journals, a larger number of regular producers, and a much larger number with very low productivity. Applying Bradford's law to WoS records, there are 13 sources with 103 articles in the first group, and in the third group, 176 journals are linked to only 311 articles. In the case of Scopus, the concentration is stronger, 10 sources have 158 articles. The three zones according to Bradford's law are shown in Table 5.

From the list of the top five journals with the most publications on e-democracy in WoS and Scopus (see Table 6); as defined by Bradford's law, most of the publications are concentrated in

Table 5

Division of sources according to Bradford's law zones: WoS and Scopus

| | WoS | | | | | Scopus | | | | |
|---|-----|-----|-----|-------|------|--------|-----|-----|-------|-------|
| A | B | C | D | E | F | B | C | D | E | F |
| 1 | 13 | 7 | 103 | 33.12 | 7.92 | 10 | 5 | 158 | 33.76 | 15.80 |
| 2 | 61 | 35 | 106 | 34.08 | 1.74 | 62 | 27 | 156 | 33.33 | 2.51 |
| 3 | 102 | 58 | 102 | 32.80 | 1 | 154 | 68 | 154 | 32.91 | 1 |
| - | 176 | 100 | 311 | 100 | - | 226 | 100 | 468 | 100 | - |

(A) Zone (B) Sources (C) Percentage sources (D) Articles (E) Article percentage (F) Average articles per source

Table 6

Top five magazines belonging to zone one according to Bradford's law: WoS and Scopus

| Data Base | A | B | C | D | E |
|-----------|--|----|----|-------------|-------------|
| WoS | INFORMATION COMMUNICATION & SOCIETY | 21 | 21 | 0,067524116 | 0,067524116 |
| | GOVERNMENT INFORMATION QUARTERLY | 16 | 37 | 0,051446945 | 0,118971061 |
| | ELECTRONIC GOVERNMENT, PROCEEDINGS | 12 | 49 | 0,038585209 | 0,157556270 |
| | GROUP DECISION AND NEGOTIATION | 8 | 57 | 0,025723473 | 0,183279743 |
| | ELECTRONIC GOVERNMENT, PROCEEDINGS | 7 | 64 | 0,022508039 | 0,205787781 |
| Scopus | INTERNATIONAL JOURNAL OF ELECTRONIC GOVERNANCE | 23 | 23 | 0,049145299 | 0,049145299 |
| | INFORMATION COMMUNICATION AND SOCIETY | 22 | 45 | 0,047008547 | 0,096153846 |
| | EJOURNAL OF EDEMOCRACY AND OPEN GOVERNMENT | 20 | 65 | 0,042735043 | 0,138888889 |
| | INFORMATION POLITY | 16 | 81 | 0,034188034 | 0,173076923 |
| | JOURNAL OF INFORMATION TECHNOLOGY AND POLITICS | 16 | 97 | 0,034188034 | 0,207264957 |

(A) Source (B) Frequency, (C) Accumulated frequency (D) Percentage of frequency (E) Percentage of accumulated frequency

these first journals.

3.6. Lotka's Law

Lotka's law is a discrete probability distribution function. Under this law author productivity is characterized. This law states that a large proportion of scientific output is produced by a small number of authors. It states that the number of authors producing 'n' scientific papers is approximately proportional to $\frac{1}{n^2}$.

Table 7

Observed and theoretical distribution of scientific productivity: Lotka law

| Data Base | A | B | C | D | E |
|-----------|---|-----|-------------|-----|------------|
| WoS | 1 | 532 | 0.897133221 | 532 | 1.01399724 |
| | 2 | 47 | 0.079258010 | 94 | 0.25349931 |
| | 3 | 10 | 0.016863406 | 30 | 0.11266636 |
| | 4 | 3 | 0.005059022 | 12 | 0.06337483 |
| | 5 | 1 | 0.001686341 | 5 | 0.04055989 |
| Scopus | 1 | 742 | 0.881235154 | 742 | 0.86525757 |
| | 2 | 65 | 0.077197150 | 130 | 0.21631439 |
| | 3 | 21 | 0.024940618 | 63 | 0.09613973 |
| | 4 | 10 | 0.011876485 | 40 | 0.05407860 |
| | 5 | 1 | 0.001187648 | 5 | 0.03461030 |
| | 6 | 1 | 0.001187648 | 6 | 0.02403493 |
| | 7 | 1 | 0.001187648 | 7 | 0.01765832 |
| | 8 | 1 | 0.001187648 | 8 | 0.01351965 |

(A) Number of articles (B) Number of authors (C) Frequency (Observed Distribution)

(D) Author appearances (E) Theoretical Distribution

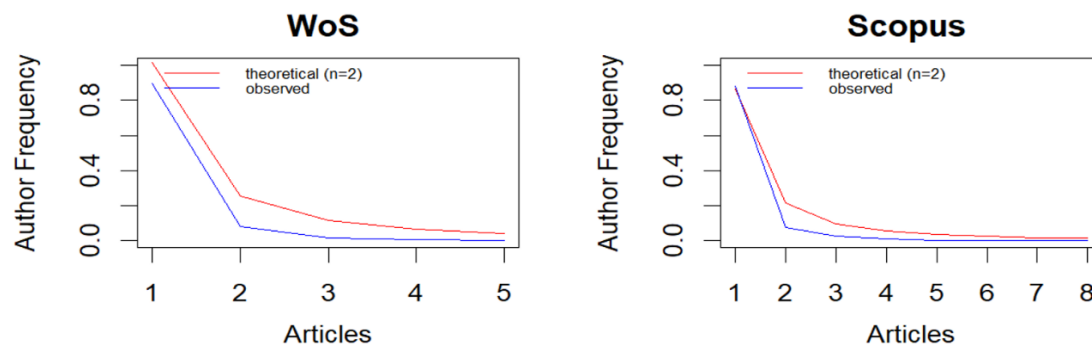


Figure 3: Observed and theoretical distribution (Lotka's law)

Table 7 shows the calculations of the observed and theoretical discrete productivity distribution. For WoS the beta coefficient was 3.857445, the constant 1.013997 and the goodness of fit to the normal distribution was 0.9963046. For Scopus, the value of 3.451103 was calculated for the beta coefficient, 0.8652576 for the constant, and goodness of fit of 0.9558415 was obtained.

The two-sample Kolmogorov-Smirnoff test provided a p-value of 0.3291164 for WoS and 0.08786641 for Scopus. There is no significant difference between the observed and theoretical distributions, see Figure 3.

3.7. Analysis by co-citations

Co-citation analysis is a measure of the relationship between authors or sources, taking as a reference the use of direct citations, through the frequency in which two documents, jointly, cite a third publication [71].

Co-citation analysis was obtained using the VOSviewer tool. Co-citation analysis by cited authors was obtained by calculating the total number of occurrences of a citation in all papers. The results reflect those authors who have influenced the active authors (see Figure 4), being the case for WoS and Scopus of "Coleman, S." with 91 and 227 citations, respectively.

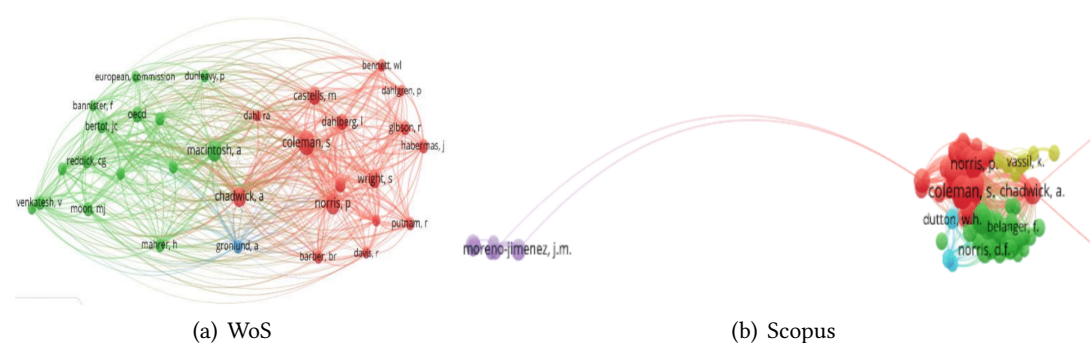


Figure 4: Visualization of author co-citation analysis.

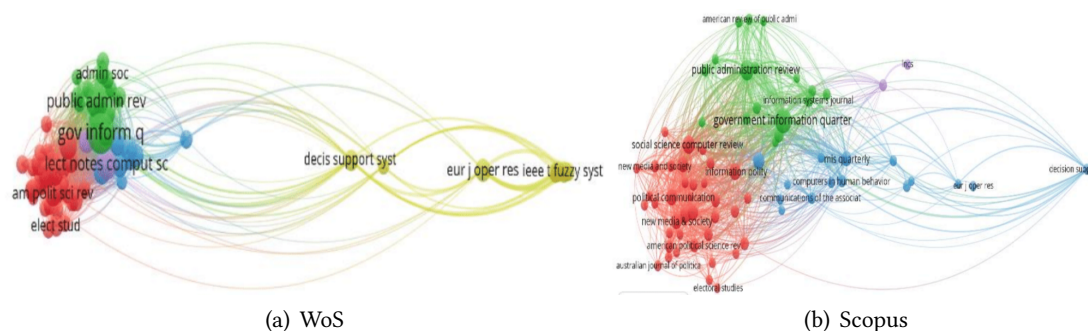


Figure 5: Visualization of co-citation analysis of sources.

Co-citation at the source level reveals within its results, the influence that a source has on the scientific community, evidenced through citations. This is the case for both WoS and Scopus, the source "Government Information Quarterly", with 425 and 390 citations, respectively. This result reflects the influence of this source on the scientific community in relation to e-democracy (see Figure 5).

3.8. Co-Authorship Analysis

In the co-authorship analysis, the size of the circles represents the author link weights, and the color of the gradient is the mean citation scores of the articles. For the identification of the cooperation patterns of authors and organizations, whose research is related to e-democracy, the coauthorship visualization function was used. Figure 6 shows the cooperation network of authors in the research community.

In the identification of the data by author, based on the co-authorship map, a document and a citation were established per author as eligibility criteria, in order to find the most prominent documents (WoS with 609, and Scopus with 842) that had published on e-democracy. In the resulting networks, 501 authors are related in WoS and 729 in Scopus; 17 items from WoS and 16 from Scopus were considered in the analysis. In WoS and Scopus, the author "Palomares Ivan" stands out as one of the most outstanding authors in terms of cooperation, with a value of 13, in the total strength of the link.

As for the co-authorship maps, whose unit of analysis was the cooperation of the organizations, the minimum values of choice for an organization were defined as having a document and a citation, in order to identify the most visible organization (WoS with 387, and Scopus with 737), with research on the topic of e-democracy. There are 323 organizations linked in the resulting networks in WoS and 647 in Scopus; 19 items in WoS and 10 in Scopus were considered in the analysis; see Figure 7.

In WoS, it was obtained as a result that the organization that stands out the most is the University of Granada with 22 cooperation link strengths; on the other hand, the results in Scopus show eight institutions with a value of 8 in the cooperation link strength, they are: University of Granada (Andalusian Research Institute On Data Science And Computational Intelligence), Sichuan University (Business School), Tianjin University (College of Management

and Economics), King Abdulaziz University (Department of Electrical and Computer Engineering), King Abdulaziz University (Faculty of Computing and Information Technology), University of Russia (Peoples' Friendship), Southwestern University of Finance and Economics (School of Business Administration), University of Bristol (School of Computer Science), Beijing Institute Of Technology (School of Management and Economics), Chongqing University (School of Public Affairs), The Alan Turing Institute.

3.9. Analysis by author

Figure 8 shows each author as a unit of analysis with a circle (node) and a label, where the size is associated with the total link strength of the most cited researchers. In the case of WoS, "Bingham, Lb.", "Nabatchi, T." and "O'Leary, R." with 478 citations and 683 as the relationship index. On the other hand, in Scopus, "Wright S." and "Palomares I." obtained 657 and 442 citations, with a ratio strength of 1446 and 1628, respectively.

It is highlighted in this analysis that the closer the nodes are in the visualization, the greater the relationship between them. This is the case of researchers who are located very close to each other; this is because they are citing the same authors in their production; an example are the researchers "Bingham, Lb.", "Nabatchi, T." and "O'Leary, R.". In the analysis of the colors, clusters of researchers emerge with a high level of relationship of bibliographic coupling strength of authors with each other, highlighting 21 clusters for WoS and 35 for Scopus.

3.10. Country analysis

In the AAB by country, the maximum number of countries per document was defined as 25; the minimum number of documents from a country and the minimum number of citations from a country was 1. The result for WoS data was 62 countries and for Scopus 83; of which 58 in WoS and 76 in Scopus are within the limit to be calculated in the total AAB ratio, which was equivalent to 93.54% in WoS and 91.56% in Scopus.

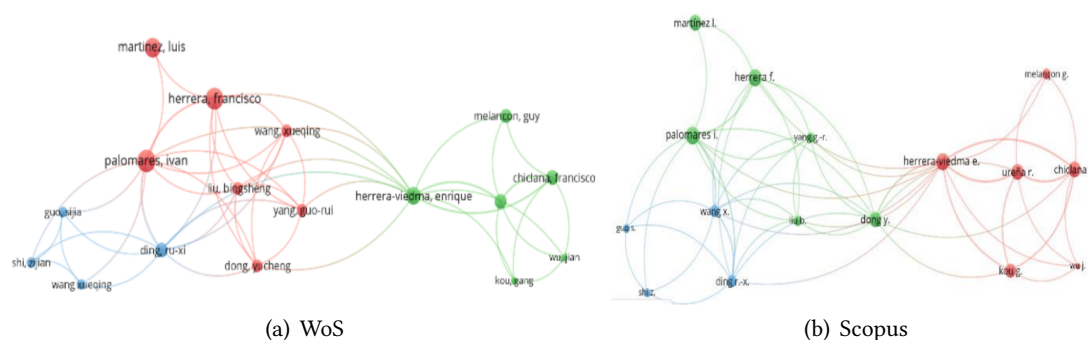


Figure 6: Visualization of the analysis of co-authors by author.

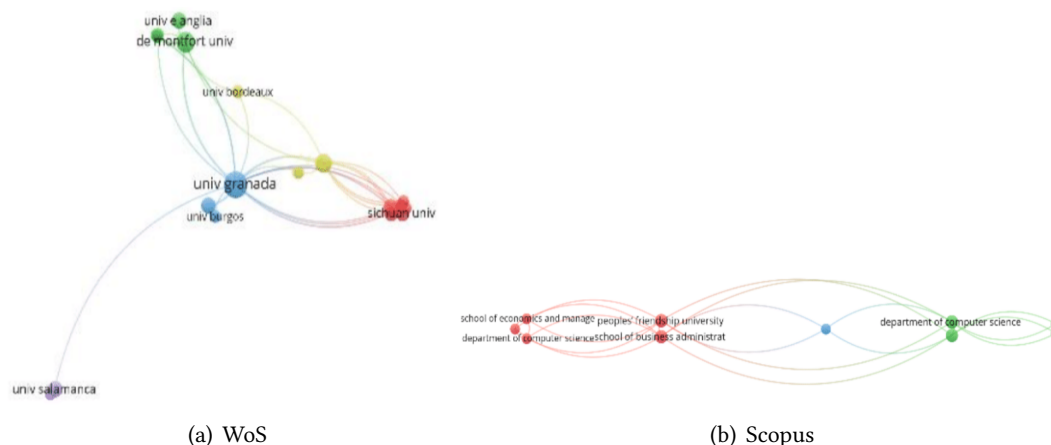


Figure 7: Visualization of the analysis of co-authors by institution.

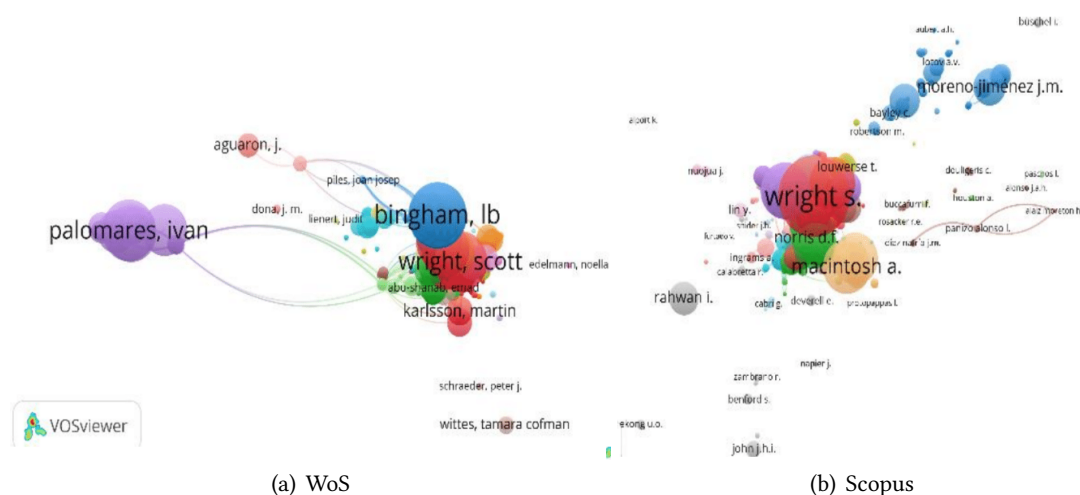


Figure 8: Visualization of the analysis by the author.

3.11. Analysis by sources

In the analysis carried out for the recognition of the main sources in citations, the AAB was used, whose unit of analysis considered as the source (see Figure 9); this occurs when two sources are cited in common by a third [72]. The strength of the coupling between sources is determined by the frequency of common citations. In WoS, the sources with the highest frequency of citations are "Public Administration Review" and "New Media & Society", with 732 and 651 citations, respectively. In Scopus, "A New Media and Society" stands out with 796 citations, and "Information Communication and Society" with 746.

**Figure 9:** Visualization of the analysis by source.**Table 8**

Top 10 terms from WoS and Scopus data theme analysis

| WoS | | | | Scopus | | | |
|-------------|-------------|---------------|-------------|-------------|-------------|---------------|-------------|
| Terms | Occurrences | Terms | Occurrences | Terms | Occurrences | Terms | Occurrences |
| E-Democracy | 248 | Participation | 180 | E-Democracy | 420 | Study | 246 |
| Study | 219 | Analysis | 178 | Democracy | 293 | System | 225 |
| Process | 188 | Paper | 177 | Paper | 292 | Participation | 223 |
| Democracy | 184 | Research | 170 | Process | 290 | Analysis | 218 |
| Citizen | 181 | Government | 167 | Citizen | 279 | Government | 216 |

3.12. Analysis of themes based on text data

For the analysis and identification of trends in themes, the map creation function was used, based on text data. For this purpose, selection criteria were established, a minimum of 30 occurrences, the "Full counting" method for the count, and the default VOSviewer thesaurus of topics was added. With the WoS data, a total of 6753 terms resulted; 43 were found among the most relevant terms that are in the evaluated limit of the model. With the Scopus data, 9010 terms were identified; 84 were found for the evaluation.

The algorithm was executed, representing in a density visualization map the relationships of terms (see Figure 10); each point on the map has a color that depends on the density of elements; if the term is denser, it means that it has a greater number of occurrences. The selected terms were verified, showing the top 10 (see Table 8). The densest term in the map confirms the theoretical assumptions reviewed in this research, related to e-democracy, and the participation of citizens in the democratic government processes that implement it.

4. Conclusions

A total of 468 articles related to e-democracy were extracted from Scopus and 311 from WoS. The annual production, from 2002 to June 2022, in both databases, is variant and has grown at a rate of less than 5%. There is no trend. The number of annual papers has been higher in Scopus, although in the last five years the scientific production of WoS has almost equaled it. The top ten countries, by the amount of production, have very low international collaboration. United

Kingdom, USA, Italy, and Spain have the highest scientific production in both databases.

The topics covered in the scientific productions are multiple; from the use of web pages and social networks by the government and political parties, through electronic voting, to studies on the violation of privacy and disinformation.

The University of Granada and Örebro University is among the first institutions with the highest scientific production, followed by the University of Zaragoza and the University of Manchester.

Few journals concentrate on a greater number of publications, among them are "Information Communication and Society", "Government Information Quarterly", "Journal of Information Technology and Politics" and "E-journal of E-democracy and Open Government".

Lotka's law is confirmed. In both databases, scientific production is produced by a small number of authors. There is no significant difference between the observed and theoretical distributions.

The co-citation map of cited and citing authors and sources presents, from the published papers, a retrospective look at the most influential authors and sources in the e-democracy research field. The author "Coleman S.", stood out as the researcher with the highest citation in the two databases worked. In terms of sources, "Government Information Quarterly" stands out as the most influential in WoS and Scopus. This makes it easier to know the thematic associations between scientific papers and improves their visibility.

A map of co-authorship networks was constructed, making it possible to identify authors and institutions that produce research in knowledge domains related to e-democracy. In the analysis of the author cooperation network, it is revealed that from the result of the initial extraction, less than 1% of the total in both databases make up the network, indicating that the phenomenon of cooperation among multiple authors is not very widespread for the object under study. Regarding the co-authorship network by institutions, there is a marked tendency

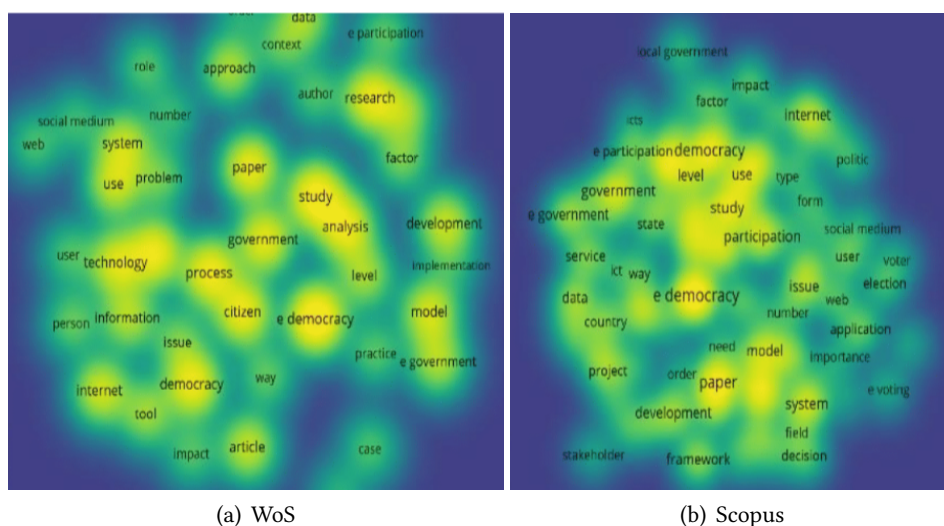


Figure 10: Text-based subject analysis of data.

for the "University of Granada" to cooperate in both databases. In Scopus, there are seven other institutions that jointly lead the cooperation networks in existing research in e-democracy.

With the bibliographic coupling function at the level of author, countries, and sources (journals) used in documents related to e-democracy from the analyzed sample, the most important author, countries, and journals within the thematic flow under study were identified, which are potentially generating impact in the development of new research.

Finally, a trend analysis of terms was performed using a text mining algorithm, facilitating the construction and visualization of a map of the co-occurrence of terms extracted from research related to e-democracy in WoS and Scopus, showing stronger interrelationships between the keywords used in the source documents.

Further content analysis is recommended for future research in characterizing bibliometric analysis.

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