Article

Governance Democratic and Big Data: A Systematic Mapping Review

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Abstract: The use and management of Big Data in the political sphere has posed unprecedented challenges concerning democratic governance, equity, and the rule of law. As Big Data establishes itself as a resource of growing value, it is imperative to address one of the most critical challenges: data sustainability. Data sustainability involves social and ethical considerations relating to the correct use of personal data. Lack of informed consent and transparency in collecting and using personal data raises serious concerns regarding privacy and individual rights. It is necessary to define regulations and public policies that guarantee citizens' digital rights based on ethical and democratic standards associated with data management. This article aims to review the literature in the context of data sustainability to identify how Big Data is used, particularly emphasizing its application in the policy domain and the challenges it poses for democratic governance, equity, and law. We have used systematic mapping methodology to collect relevant papers, finding 28 papers associated with democratic governance and Big Data in the context of data sustainability. From the review of these papers, there appears to be a lack of proposals focusing on applying or implementing democratic governance and Big Data. Furthermore, there seem to be no measures to assess the application of Big Data in democratic governance. From these, the need to move towards the definition of formal models that integrate Big Data practices in democratic governance is identified.

Keywords: democratic governance; Big Data; data sustainability

1. Introduction

The digital era has transformed how we communicate, consume information, and participate in politics. Big Data has emerged as an invaluable resource for decision making in different fields, including politics [1]. Politicians and parties seek to use the information gathered about citizens to better understand their needs, interests, and preferences, thus developing more effective campaign strategies [2].

However, the use and management of Big Data in politics has raised new challenges for democratic governance, justice, and the rule of law [3,4], and as big data becomes an increasingly valuable resource, a critical challenge must be addressed: data sustainability. The handling and use of large amounts of information raises questions about respect for privacy and the rights of those involved, as well as the environmental and social impacts.

The collection and use of personal data without the explicit consent of the data subjects has generated concern in different countries to define regulations and public policies to ensure the digital rights of citizens and to commit to ethical and democratic standards in data management [5]; this has led, for example, to the enactment of laws such as the General Data Protection Regulation (GDPR) in the European Union [6,7].

On the other hand, data sustainability also involves social and ethical considerations. Misuse of personal data, lack of informed consent, and lack of transparency in data collection and use are the main privacy risks [8]. The Facebook and Cambridge Analytica scandal is a clear example of how the misuse of data can compromise privacy and manipulate public opinion, along with exposing the ability of corporations and political campaigns to manipulate public opinion by segmenting audiences and disseminating misleading information [9]. This episode has led to increased scrutiny of personal data collection and use practices in politics, as well as transparency and accountability in decision making [7].

The issues associated with data sustainability lie in the privacy and security of information. The use of data without consent and misuse are concerns in terms of individual rights and privacy [10]. However, other issues arise regarding mass data, such as the biased use of information, which can lead to discrimination and unfair or arbitrary decisions. This situation represents a challenge for sustainability, as it can increase privacy and security risks. In Chile, too, legislation is already being passed to regulate the protection and processing of personal data [11].

In this context, it is essential to reflect on the importance of ensuring data sustainability for effective and fair democratic governance in the era of Big Data [3]. As Big Data involves massive collection and analysis of large amounts of data, lack of privacy protection can undermine trust in government and institutions. If citizens feel that their data is used without consent, they become reluctant to participate, affecting the perception and acceptance of government processes or entities. Transparency is, therefore, vital for effective democratic governance, as it ensures that leaders and institutions act ethically without generating unethical practices and decisions [12]. It is essential to ensure that the use of data is ethical, transparent, and respectful of citizens' privacy, as this is crucial to preserving the integrity of the democratic system and fostering a fair and equitable society [10]. From this perspective, how can citizens protect their privacy and rights in the digital sphere, and how can the state guarantee these rights? How can judicial authorities enforce laws and protect citizens' rights against the abuse of data-driven power? These are critical questions in the current debate on democratic governance, justice, the rule of law, and Big Data [13,14].

Corruption and lack of transparency are the most important obstacles to development [15]. According to the World Economic Forum's Global Competitiveness Index 2017–2018, corruption is one of the main factors affecting doing business in Latin America and the Caribbean [16]. Moreover, in Colombia, Mexico, and Paraguay, this is the main factor, and according to the 2018 Latinobarómetro Report, corruption is the third most important problem affecting Latin American countries [17,18].

One of the elements that have strongly impacted the credibility of judicial institutions in Latin America in the public opinion [19] are the corruption events that have been known in recent times. Situations such as the "Pacogate" and "Milicogate" cases in Chile [20], the Fernandez de Kirchner case in Argentina [21], or multinational cases, such as the Odebrecht case [18].

The responses of the judicial system have been considered insufficient by broad sectors of the population, which has generated a significant feeling of impunity and discontent due to the differentiated treatment that this type of criminality would receive concerning other common crimes [22]. By way of example, in Chile alone, out of five paradigmatic corruption cases, "Penta", "SQM", "Corpesca", "Fragatas", and Basura, only one of the convictions handed down was effective. This, in turn, represents the only conviction that has been handed down in an oral trial in the country. All the others were obtained through negotiated procedures between the Public Prosecutor's Office and the accused [23,24].

Some factors could influence the weak responses provided by the institutional design of the bodies in charge of investigating and judging these facts, as well as the regulations, adding that neither the Police, the Public Prosecutor's Office, nor the Judiciary has the necessary levels of specialization to take charge of the tasks entrusted to combat corruption effectively [25,26].

Although there are laws and initiatives in favor of transparency, they need to be more comprehensive to establish a methodological guide to support judicial institutions on their way to improving transparency [27]. Standards and laws only provide sets of actions and good practices to be implemented [28]. Therefore, an appropriate initial approach is to provide judicial institutions with the necessary resources to effectively manage progress toward meeting the required levels of transparency.

Based on the above, a concern arises regarding what Big Data systems are being used and are evident in the literature supporting democratic governance. The question arises and generates several edges, given that there are components, such as the Big Data architectures themselves or the contexts under which these works are developed, that should be mentioned and highlighted to understand the systems' usefulness.

The objective of this article is to identify the use of Big Data to promote democratic governance, considering its use in politics and the challenges in terms of democratic governance, justice, and the rule of law. To do so, we apply systematic mapping methodology that provides an overview of a research area by classifying [29]. In addition, it discusses how citizens can protect their privacy and rights in the digital realm, how the state can ensure the protection of these rights, and how judicial authorities can enforce laws based on sustainable information management and protect citizens' rights against the abuse of data-driven power.

The article's format is organized in the subsequent manner: in Section 2, we describe the relationship between democratic governance, Big Data, open governance and e-Government, and Data Sustainability. In Section 3, we analyze systematic reviews or mappings of the literature and proposals in this field to identify elements that could complement our proposed framework. In Section 4, we present the steps of the study methodology, and in Section 5, we present the results. In Section 6, we describe the discussion in the research. Then, in Section 7, we present a proposal for future work based on our findings, followed by Section 8 of the study limitations. Finally, in Section 9, we present our conclusions.

2. Background

In the information age, where Big Data is one of the main players, democratic governance and sustainability represent two essential concepts that must be redefined and adapted to this new context [1].

Democratic governance is a participatory, transparent, and accountable process that seeks to ensure citizen participation in the decision making and accountability of governments and other relevant actors [30,31]. Values such as transparency, justice, equality, and the rule of law are promoted, fostering a political culture that respects human rights and promotes citizen participation [32]. This approach is essential for global political stability, peace, and sustainable development.

According to Gantz and Rensel, Big Data technologies refer to innovative tools and infrastructures engineered to gain insights from a vast and diverse amount of data, enabling rapid collection, exploration, and/or examination [33]. According to several authors, and reaffirmed by Gantz and Gutta [33], to be called Big Data, in addition to handling both structured and unstructured data, it must be able to meet the so-called five Vs: (i) Volume: huge volumes of data, which are constantly growing. (ii) Speed: the results of these large queries are available when needed, which varies from problem to problem. In some systems, these answers are required in a range of hours. In others, in a matter of minutes. (iii) Variety: data from different sources with different types of structures. (iv) Veracity: the data are reliable and have adequate traceability to their sources. (v) Value: the results delivered by this system generate a real contribution to the organization and its functions.

2.1. Democratic Governance and Big Data

Democratic governance and Big Data are two increasingly related concepts today [34]. The use of large amounts of data and innovative technologies, such as artificial intelligence, can majorly impact decision making and governance [35].

On the one hand, Big Data can be a very valuable tool for democratic governance, as it allows data collection, analysis, and use in real-time [36]. This can facilitate more informed and efficient decision making and monitoring and evaluation of public policies [37]. For example, governments can use Big Data to analyze trends and patterns in the economy, public health, or security and adapt their policies accordingly [38,39].

However, using Big Data also poses significant challenges for democratic governance, such as privacy protection and data security [40]. There may also be concerns around the lack of transparency and accountability in how data is collected and used [41]. Therefore, strong regulatory and ethical frameworks need to be put in place to ensure that the use of Big Data in democratic governance is transparent, accountable, and respects individual rights and freedoms [42].

Democratic governance refers to how decisions are made and power is exercised in a society and is based on the active participation of citizens in decision making and government control [43,44]. On the other hand, Big Data refers to the collection, processing, and analysis of large amounts of data to identify patterns, trends, and relationships [33,40].

2.2. Open Government e-Government

Open government is an approach to government management that promotes transparency, citizen participation, and collaboration in decision making [45,46]. It is based on the idea that government should be more accessible and accountable to citizens and encourage their active participation in decision making [47].

With the combination of democratic governance and Big Data comes the possibility of using Big Data to improve democratic governance through transparency and accountability [48]. Open government, on the other hand, is an approach that seeks to encourage citizen participation in decision making and access to public information, which is also related to democratic governance [49].

In this context, using Big Data can help government institutions make more informed, data-driven decisions, improving the effectiveness and efficiency of public policies [50,51]. For example, by analyzing large amounts of public health data, the government can identify patterns of diseases or health risks and take preventive measures before they become a serious problem [52,53].

In addition, open government and transparency in data management can enable citizens to actively participate in decision making and monitor government actions, which increases trust in institutions and can encourage citizen participation [54].

It is important for government institutions to be transparent about how they use data and to respect the privacy rights of citizens [55].

E-government is a concept that refers to the use of information and communication technologies (ICT) in the management and delivery of public services [56]. In this sense, e-government is also related to democratic governance, Big Data, and open government [50,51].

E-government can improve democratic governance by enabling greater citizen participation in decision making and management of public services through digital platforms and online communication tools [57].

E-government can also foster open government by enabling greater access to public information through online platforms and transparency portals, thereby increasing government transparency and accountability [58].

E-government, democratic governance, Big Data, and open government are interconnected and can work together to improve government effectiveness and efficiency, as long as citizens' privacy rights are respected and citizen participation in decision making is encouraged [59,60].

2.3. Data Governance and Sustainability

The United Nations (UN) sets out 17 Sustainable Development Goals (SDGs), and specifically Goal 16 states, "Promote just, peaceful and inclusive societies" [61].

Successful implementation of Goal 16 can significantly impact building a more just and sustainable society and create an environment that respects human rights; combats discrimination; and promotes the inclusion of all groups in society by promoting fairness, equal access to justice, and accountability [62]. In addition, promoting a peaceful society and reducing violence contributes to a more peaceful, inclusive, and sustainable world.

In this context, Governance and Big Data can be key allies in achieving sustainability, providing valuable information for decision making on climate change, biodiversity conservation, efficient use of resources, and social equity. However, their use also raises concerns about privacy and responsible data management. States must consider the responsibility of data processing, the prospective management of Big Data technologies, and ensuring that the data is used responsibly [63].

In summary, the intersection of democratic governance, Big Data, and sustainability poses great opportunities and challenges. To fully harness the potential of Big Data, we need a robust, democratic, and sustainability-oriented governance framework that balances the possibilities these technologies bring with the risks inherent in their use [64]. This requires the active participation of all actors in society, including governments, businesses, academia, civil society, and citizens.

3. Related Works

This section explores the literature on analytics in terms of democratic governance and Big Data. We analyzed systematic reviews or mappings of the literature and proposals in this field to identify elements that could complement our proposed framework. In the following, we will outline some relevant studies reviewed to understand the existing research in this area comprehensively.

In the article [65], the authors conduct a systematic literature review that provides a comprehensive understanding of the concept of Big Data in the public sector, including its evolution, definition, applications, challenges, and future. They focus on providing a comprehensive understanding of the concept of Big Data in the public sector and how it is understood theoretically and practically in academia. They point out that the future of Big Data in the public sector shows great potential for practical development, such as improved decision making, optimization of public services and identification of patterns and trends, data privacy and security, lack of adequate skills and expertise, and the need for greater collaboration between public sector organizations. Overall, they expect Big Data to remain an important issue in the public sector for the foreseeable future [65].

An interesting proposal is presented in [66], in which the potential of Big Data analytics to create a more just democracy is explored. It discusses the infiltration of Big Data into the normative concept of the public sphere and how participatory processes and the commons can benefit from a comprehensive use of Big Data analytics. Challenges and risks associated with using Big Data, such as outright politicization and the need to protect individual rights and privacy, are discussed. Overall, it is argued that careful and critical use of Big Data analytics can benefit society if approached from an ethical and normative perspective.

In [67], the use of evidence in decision making and the role of Big Data in public administration is described. The authors present a comprehensive summary of the theoretical, significant, and practical matters related to the use of Big Data in public matters. They describe Big Data in public affairs as a fusion of administrative data amassed through conventional methods and extensive data sets produced by sensors, computer networks, or individuals during internet use. Furthermore, they explore the methodological and analytical difficulties of incorporating Big Data into public affairs research and practical applications. In addition, they discuss the opportunities and challenges presented by Big Data for public sector decision making, as well as the implications for public policy. This piece offers valuable insights on how the domain of public affairs can effectively respond to the massive influx of Big Data.

In Big Data and Democracy, in [68], the authors also make insightful discussions on the impact of Big Data on democratic processes, arguing that the use of Big Data in politics

can have both benefits and challenges and that it is important to understand how it affects democratic institutions. Some of the issues discussed include data privacy and security, transparency in using Big Data, and how it can affect political decision making. In [69–72] also, the authors explore the use of Big Data analytics in governance to improve public service delivery and achieve sustainable development goals, these papers provide valuable insights into how governments can harness the power of Big Data to improve their services and strengthen their relationship with citizens.

By investigating the history of this research topic, through systematic mapping, the future of Big Data in democratic governance shows great potential for practical development. Its benefits, or potential impact, include improving decision making, optimizing public services, and identifying patterns and trends to make more informed and evidence-based decisions. In addition, the importance of ensuring data protection and security and establishing ethical policies and systems is emphasized; the above articles agree on the importance of addressing the challenges and risks associated with using Big Data, such as politicization and protecting individual rights and privacy. At the same time, it is recognized that this technology can positively influence political decision making and strengthen the relationship between government and citizens while promoting ethical and accountable governance.

However, there is an absence of solutions oriented to democratic governance and Big Data for its subsequent application or implementation, as well as a lack of mechanisms for measuring Big Data implementation in democratic governance. While our work is merely exploratory, there is no doubt that this research marks the starting point for appropriately addressing the ethical and practical challenges associated with implementing Big Data in democratic governance to maximize its positive impact.

4. Materials and Methods

The bibliographic review of the existing literature is based on Petersen's systematic mapping technique [29], which identifies, classifies, and analyzes the existing literature related to a given research topic, thus generating an inquiry and literature search. This method is often employed to systematically address one or more research inquiries. Below, we outline the steps according to the protocol for executing systematic mappings, modifying the steps illustrated in Figure 1.
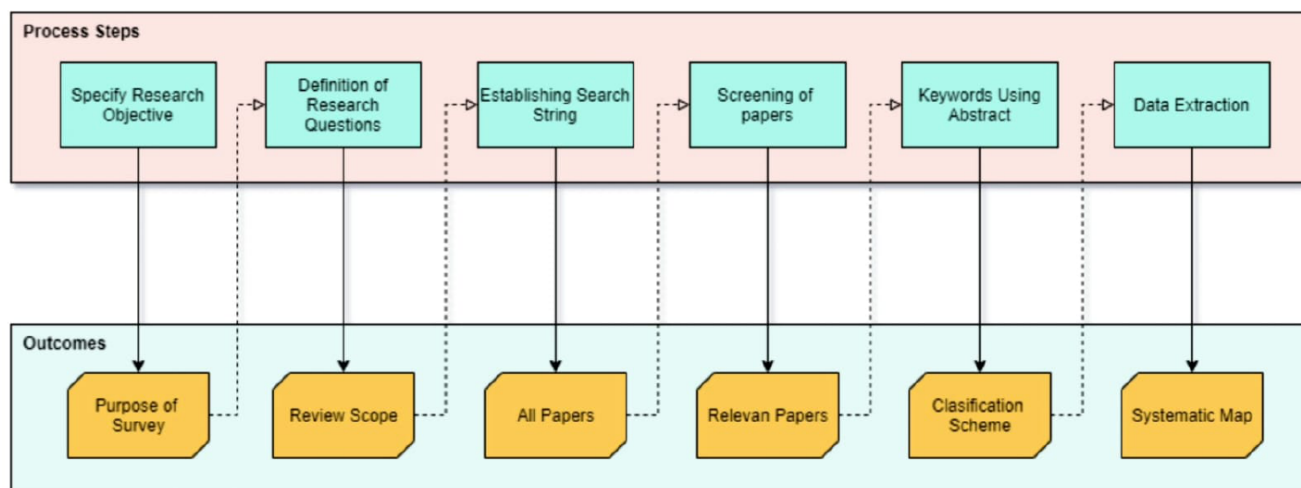

Figure 1. Stages of the systematic mapping process.

The stages of the systematic mapping process are described in the following sections.

4.1. Goal and Research Questions

The goal of this systematic mapping is to locate articles that engage in discussions, such as proposals for using Big Data and democratic governance. To gather relevant

literature and identify trends related to the research topic, we formulated specific research questions. These questions are detailed in Table 1 and are related to scientific publications in Table 2. With the help of these questions, we hope to gain a more complete and detailed understanding of the topic, enabling us to address it more effectively and meaningfully.

Table 1. Research questions to be applied.

Research Questions	
Research Question	**Motivation**
RQ1: Within the democratic governance and Big Data writings found, what types of papers have been presented in the literature?	Understand the different approaches and trends in the literature related to the intersection between democracy, governance, and technology. It is expected to broaden the understanding of democratic governance and Big Data and explore new ways of applying technology to improve democratic governance.
RQ2: Of the initiatives encountered, in what context has the work been developed?	Identify patterns and emerging trends that will guide future research and explore new ways to apply technology to improve democratic governance.
RQ3: How many democratic governance initiatives have been implemented in different nations using Big Data?	Knowing the number of democratic governance initiatives that have used Big Data in different countries is key to understanding the relevance of the technology in this area and identifying patterns and trends that can improve the implementation of future projects.
RQ4: Of the systems presented, how many feature Big Data architectures?	Identify how many feature Big Data architectures, which may indicate an emerging trend in applying technology in democratic governance. Identify patterns and trends that allow a better understanding of how these technologies are applied in democratic governance, along with contributing to informing future democratic governance projects using Big Data technologies.
RQ5: Of the architectures presented, which ones comply with Big Data architectures according to the authors?	In investigating the architectures presented, it is necessary to identify which meet the criteria to be considered true Big Data architectures. In doing so, it is possible to identify emerging trends in the use of Big Data technologies in democratic governance and limitations and challenges in implementing these technologies.
RQ6: What are the results of new methods or models for ensuring security in secure software development?	Identify what types of technologies are being used in their development. By doing so, one can identify the most effective and efficient tools for developing future projects and the limitations and challenges associated with their implementation. In addition, by comparing the technologies used in different systems, patterns and emerging trends in applying Big Data technologies in democratic governance can be identified. Contribute to informing and improving the implementation of future democratic governance projects using Big Data technologies.
RQ7: What are the current challenges of democratic governance using Big Data?	Identify the limitations and challenges of implementing Big Data technologies in this area. By understanding these challenges, more effective solutions and approaches can be developed to address these problems. This research can help inform and improve the implementation of future democratic governance projects that use Big Data technologies ethically and effectively.

Table 2. Research publications to be applied.

Publication Questions	
Research Question	**Motivation**
PQ1: What are the sources in which democratic governance initiatives using Big Data have been published?	Academic publications, government reports, and other sources relevant to the field can be identified. In doing so, emerging trends and best practices in applying Big Data technologies in democratic governance can be identified. In addition, by exploring these sources, opportunities for future research and collaborations can be identified.
PQ2: How have these initiatives emerged and evolved over the years?	To identify emerging trends and changes in the technologies and tools used in applying Big Data to democratic governance. Furthermore, by doing so, emerging challenges and opportunities in this field can be identified, as well as the impacts and effects of these initiatives on democratic governance. Ultimately, this research can help inform and improve the implementation of future democratic governance projects using Big Data technologies.
PQ3: Which are the countries with the highest concentration of publications in the area of democratic governance	Knowing which countries have the most publications in the area of democratic governance can help to recognize countries on which to focus research in non-academic sources, as well as to look for future patterns associated with good democratic governance through the use of Big Data.

4.2. Research Questions to Be Applied

We conducted a comprehensive search of data sources using search strings consisting of study specific keywords to answer the research questions. The PICO (Population, Intervention, Comparison, and Outcome) strategy indicated by [29] was used, and articles were searched using the search string described in Table 3.

Table 3. Search String.

Main Concepts	democratic governance, democratic government, democracy governance, democracy government, democracy, e-democracy, e democracy, edemocracy, Big Data.
Groups of terms	("democratic governance" OR "democratic government" OR "democracy governance" OR "democracy government" OR "democracy" OR "e-democracy" OR "e democracy" OR "edemocracy"). "big data".
Search String	("democratic governance" OR "democratic government" OR "democracy governance" OR "democracy government" OR "democracy" OR "e-democracy" OR "e democracy" OR "edemocracy") AND "big data")

4.3. Data Extraction

To conduct a comprehensive and robust search and data extraction to support the present study, the strategy of selecting three digital data sources was adopted: Web of Science (WoS), Scopus, and Google Scholar . These sources were chosen to obtain a wide variety of articles related to the research topic. The use of these three sources allowed access to a considerable amount of relevant academic and scientific literature, enriching the knowledge base for our analysis. In addition, to optimize the accuracy of the searches, search criteria were established with a particular focus on the analysis of document titles and abstracts. The decision to take advantage of this functionality available in all the databases consulted was key, as it facilitated the identification of academic and scientific papers more relevant to the objectives of our research.

4.4. Inclusion and Exclusion Criteria

The inclusion/exclusion criteria used to select the articles found through the afore-mentioned data sources are as follows:

4.4.1. Inclusion Criteria

- Articles published in English from journals and conferences.
- Full articles considering democratic governance and Big Data.
- Studies as of 2010.

4.4.2. Exclusion Criteria

- Articles not in English.
- Articles before 2010.
- Articles that do not include topics related to democratic governance and Big Data.
- Duplicate studies in different databases.
- Incomplete items.
- Articles that are not in Journals or Conferences.
- Articles that are not available (open access).
- Items not relevant in the search string.
- Reviews (can be used in Related Works).
- Gray literature articles that are not in official government sources.

4.5. Search Execution

The chosen search term was used in the designated sources, resulting in a primary set of 293 related papers (see Table 4). The data were collected using the export functions of each digital library. After eliminating instances of duplicate articles, the count was reduced to 132. The exclusion and inclusion criteria agreed upon by the authors were then applied. The concordance in Cohen's kappa coefficient between reviewers was 0.89, which was considered acceptable [73]. To determine this agreement, 15 papers were randomly selected and reviewed by the reviewers for agreement. The papers were marked with the YES/NO/DUDE categories, and those that presented doubts were discussed as a group. After a review of the abstract, 46 papers were selected, and then the results and conclusions were reviewed, filtering down to the final count of 28 papers (see summary in Figure 2).

Table 4. Search result by source.

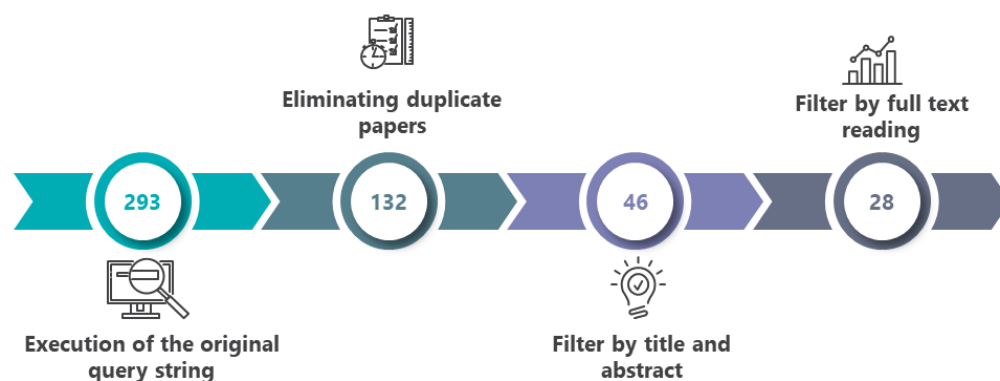| Data Source	Abstract Selection
Web of Science	55
Scopus	146
Google Scholar	92
Total	293

Figure 2. Search execution and filtering summary.

4.6. Classification Scheme

The 28 selected articles were categorized according to three aspects: chronology, category, and type of article. The temporal dimension categorizes the papers based on their publication year, taking into account that we have chosen papers published from 2010 forward.

The category dimension corresponds to the context in which the research was conducted, namely these scenarios: Big Data in personalized marketing, artificial intelligence, journalistic practice, use of Big Data technologies, privacy threats, politics, Big Data methodologies, political campaigns, human-technology complex in society, smart city technologies, municipal Big Data initiatives, deepfakes, sentiment mining, data literacy, urban governance, modern democracy, political theories, environmental governance. Articles may be categorized in more than one category.

The article type dimension classifies works into:

- Analysis: We refer to papers describing analyses and comparisons of the literature on democratic governance and Big Data.
- Use: Corresponds to studies or work related to democratic governance and Big Data for further application.
- Implementation: Proposed solutions for democratic governance and Big Data. Articles can be classified into more than one article type.

4.7. Map Construction

As a product of the process of systematic mapping, a map was created, a tool that simplifies the representation and analysis of the data collected. In the following results section, we present the map obtained as a result of this process. This map provides a visual and structured representation of the categories generated among the studies included in the mapping, which facilitates a clearer and more concise understanding of the thematic distribution of our research.

5. Results

In this section, we present the results obtained through the process of classification and analysis of the selected studies, which we have thoroughly examined and evaluated through the literature review relevant to our study. The results presented in this section provide a substantial overview of the academic and scientific literature related to our research topic (Table A1 of the Appendix A).

5.1. Overall Analysis by Characteristics

This segment will display the findings derived from the categorization and examination of the chosen studies.

Two-thirds of the articles in the study were published in different journals (18 articles), representing 64% of the total number of papers found. The article databases for these journals include Web of Science and Scopus. Conversely, the articles published as Book Chapters account for 21%, i.e., 6 papers correspond to Book Chapter. As for Conference papers, they represent only 11% (3 articles) of the total analyzed and only 4% (1 related paper) in Book (Figure 3). This allows us to indicate which publication type is more attractive to security researchers.

Another element of the classification zeroes in on the origins of the principal published studies, aiding us in determining which databases are most active in the fields of Democratic Governance and Big Data. As per the results, the research community shows a predilection for publishing in journals indexed by Scopus, contributing to 68% of the total selected papers, with the remaining 32% being published in journals indexed by WoS (Web of Science).
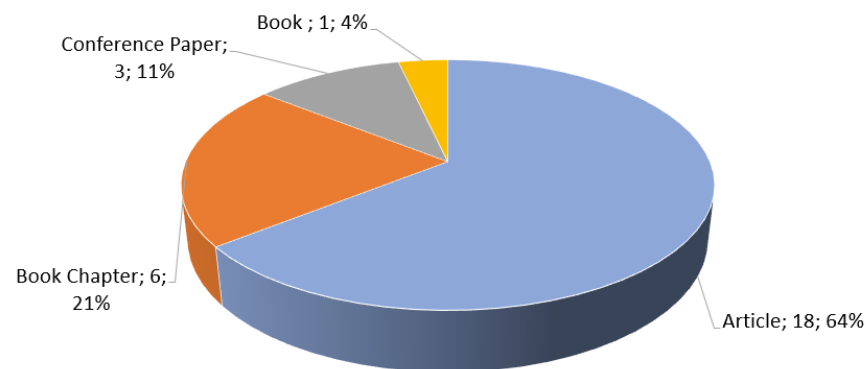
Figure 3. Articles published.

Concerning the years of publication of the selected articles, Figure 4 shows the distribution of studies according to their year of publication. Very few studies have been conducted since 2010–2015, probably because the research line is still in its infancy. In the later year ranges 2016–2017, 2018–2019, 2020–2021, 2022, and 2023, constant work can be seen, but contributions to the area are still low. It is relevant to consider that the search was carried out in March 2023, suggesting the possibility of new publications in the research field towards the end of the year.
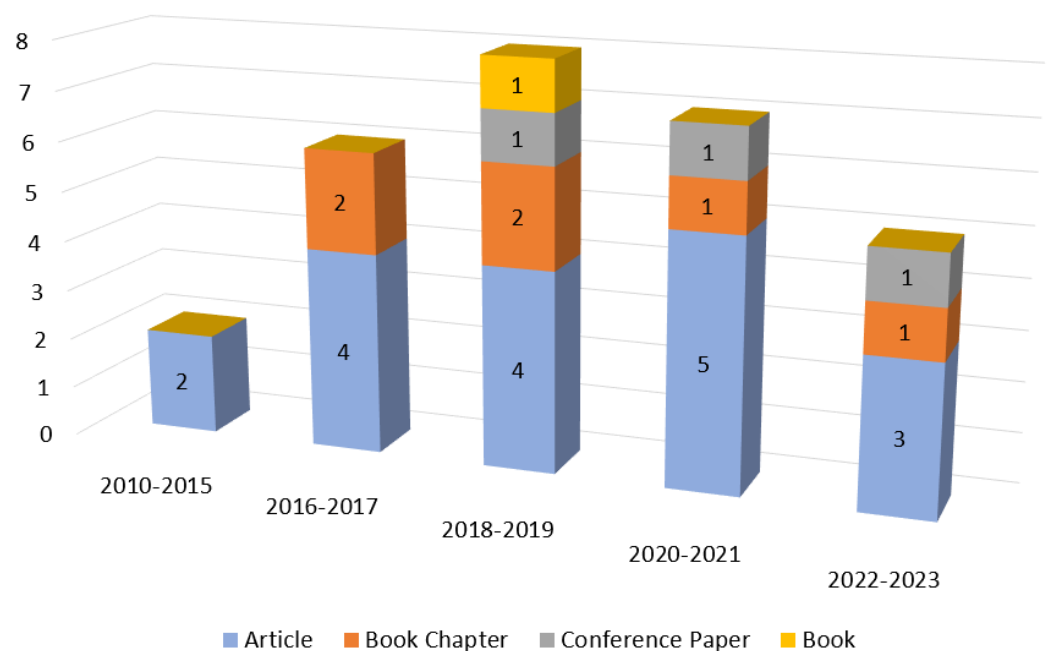

Figure 4. Distribution of the articles published.

Another aspect of meriting exploration, which will offer perspectives to address the research questions, pertains to the percentage of articles contributing to the research theme, explicitly focusing on utilizing Big Data and data management in political and governmental decision making. It can also explore how new technologies and social networks are changing the way politics is conducted and how governments can adapt to these changes to improve the quality of democracy.

The classification of articles was carried out considering (see Figure 5):

- Articles describing analyses and comparisons of the literature on democratic governance and big data.
- Articles that use proposals in democratic governance and big data for further application.

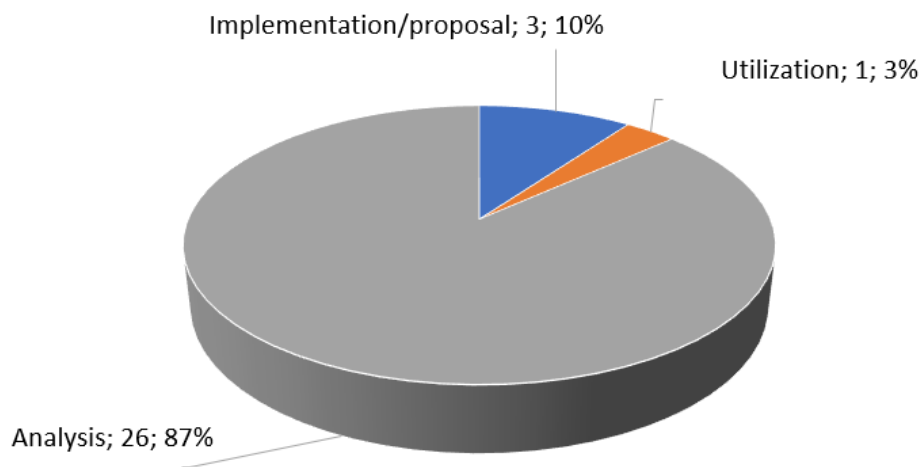- Articles that propose solutions for democratic governance and big data.

Figure 5. Publications of articles studying Democratic Governance and Big Data.

From the articles reviewed, it can be observed that almost all the articles analyzed, i.e., 26 out of 28, which corresponds to 93% of the papers, analyze, describe, discuss, or make comparisons of the literature on democratic governance and big data; but very few papers (only 3) focus on the use of big data technologies, and a further 3 on Artificial Intelligence. Only 1 article (3%) uses proposed solutions oriented to democratic governance and big data for their subsequent application. On the other hand, when the article focuses on privacy threats, we find 10 articles but none of them crosses over with analysis or technology proposals in democratic governance and big data.

5.2. Systematic Mapping

We have designed a map to illustrate and evaluate the selected pieces of work. Figure 6 presents these works, sorted into the three dimensions. Documents categorized into implementation, use, and analysis are represented. On the left side of the figure, documents are grouped by type of article. In the middle column, the categories are presented, and on the right side of the figure, the classifications of the publications by year ranges are represented.

The map allows us to obtain an overview of the works related to democratic governance and Big Data. It allows us to visualize three dimensions that we have decided to classify by time, by categories, and by type of article. It also allows us to observe the distribution of the classifications of the papers and in which years they have been published.

The primary aim of this study is to establish a methodological approach for combining democratic governance and Big Data.

To achieve this, a three-phase research design was defined. The first pertains to the current study, which aims to recognize all the formal literature available, highlighting the strengths and drawbacks of the current proposals. The 28 articles chosen were sorted based on three aspects: time, category, and the nature of the work. From the 28 papers, it is possible to answer the research and publication questions defined.
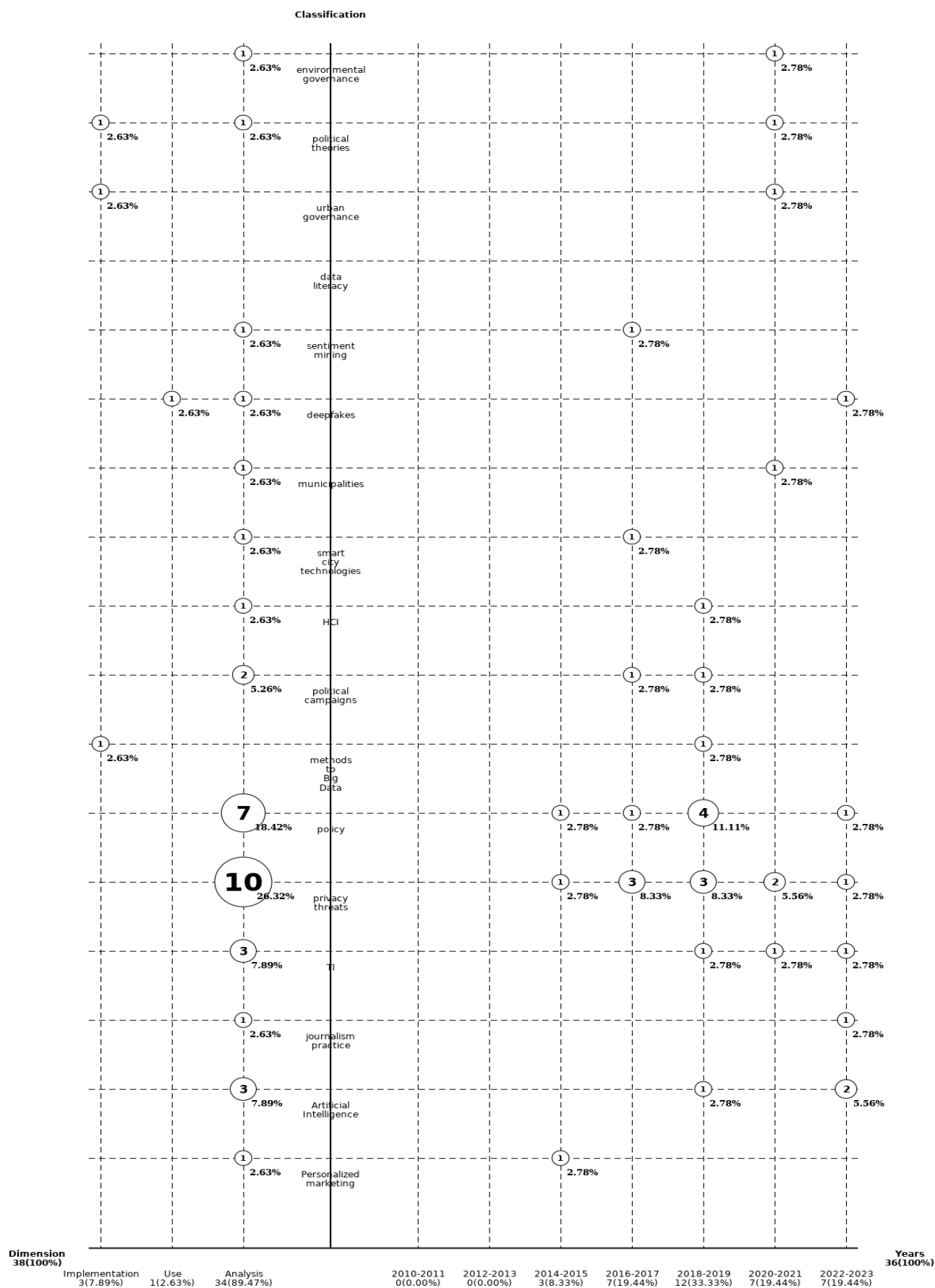
Classification

Figure 6. Publication of articles studying democratic governance and Big Data.

5.2.1. Responding to Research Questions

RQ1: Within the democratic governance and Big Data literature, what types of papers have been presented in the literature?

In the previous sections, we have made a general analysis by characteristics, allowing us to answer this question by looking at Figure 3. We have also presented a mapping to visualize the main related works on democratic governance and Big Data. Of the 28 selected papers, 3 (10%) propose implementations in democratic governance and Big Data. Only 1 (3%) uses a study for its implementation, and 26 (93%) are studies that highlight analyses in general.

RQ2: Of the initiatives encountered, in what context has the work been carried out?

We have found 17 different contexts on which the selected articles focus. These contexts or scenarios are Big Data in personalized marketing, artificial intelligence, journalism practice, use of Big Data technologies, privacy threats, policy, methods of Big Data, political campaigns, human-technological complex in society, smart city technologies, municipal Big Data initiatives, deepfakes, sentiment mining, data literacy, urban governance, political theories, and environmental governance. The two main contexts of studies focus on privacy threats and policy and are also studies analyzing or discussing theories and definitions.

RQ3: How many democratic governance initiatives have been implemented in different nations using Big Data?

We have found only one article that addresses an implementation proposal. In [74], the authors highlight that using Big Data as a source for official statistics can be beneficial to produce more relevant, frequent, and richer information. However, ethical and statistical challenges also need to be addressed. One of the main challenges is self-selection bias, which can affect data quality and the accuracy of statistical inferences.

To address this problem, the authors propose using random samples from National Statistical Offices to adjust for self-selection bias. Other methods to correct for self-selection bias, such as the use of pseudo-random weights and dynamic super population models, are also discussed.

Overall, the article highlights the important role of National Statistical Offices in addressing these challenges and taking advantage of the opportunities offered by Big Data to produce more relevant and accurate official statistics.

RQ4: Of the systems presented, how many feature Big Data architectures?

Of the 29 articles found, 27 focus on analyzing and discussing various literature-related topics. These analyses and discussions may cover topics such as literary criticism, literary theory, the analysis of literary genres, and the study of specific literary works, among others. In addition, these articles may also include recommendations for future research in the field of literature.

RQ5: Of the architectures presented, which ones comply as Big Data architectures according to the authors?

We found no related work for these two questions, so we have considered the following definition of Big Data architecture.

Big Data architectures, like the concept itself, tend to encompass not only data processing but also all related stages from data ingestion to visualization [75]. The components for the different stages are likely to vary. The general components can be grouped into the same sets for the different areas:

Data source: Referencing the provenance of the data itself before it is stored or processed. Storage: The data is stored within the architecture itself, either raw or passed through a stage known as pre-processing, which may or may not be found and performs, as its name suggests, a layer of processing to the data sources before storage per se. Processing: This layer is responsible for extracting value from unprocessed data, filtering/enriching or classifying it for further analysis. Analysis: The "intelligent" layer of Big Data systems is

seen in this stage. Whether using data mining, machine learning, or other techniques, the aim is to perform analysis, predictions, or modeling concerning the previously processed data to obtain the maximum value according to the situation required. Visualization: Stage associated with the display of data to the user so that he/she can make decisions associated with those delivered by the system itself.

RQ6: What kind of technologies are used in the development of Big Data systems associated with democratic governance?

Most of the articles selected for analysis in the study focused on examining or comparing the literature on the relationship between democratic governance and the use of Big Data. Of the selected articles, 93% focused on this particular topic. Although some of the articles (five articles) examined how Big Data technology has been used in the context of democratic governance and some also (three articles) mentioned artificial intelligence, the study did not find any concrete proposals explaining how to implement Big Data in democratic governance. In other words, although the studies examined the relationship between Big Data and democratic governance, they did not provide clear guidance on how Big Data technology could be applied in the field of democratic governance effectively and concretely.

RQ7: What are the current challenges of democratic governance using Big Data?

The issues we found focusing on using Big Data and algorithms for major decision making present several challenges, ranging from the need for greater transparency and accountability in their use to ethical questions about data control and privacy. In addition, there is a mismatch between traditional research standards and the realities of Big Data, raising questions about the fairness of access to data and selection bias.

The management of Big Data, therefore, requires addressing these challenges to ensure that it is used responsibly and ethically for the benefit of society.

5.2.2. Answers to Publication Questions

PQ1: What are the sources in which democratic governance initiatives using Big Data have been published?

Most of these sources are located in England and the United States, such as Taylor & Francis, International Journal of Communication, PS: Political Science & Politics, Elsevier, SAGE Publications, Edward Elgar Publishing Ltd., Routledge, Oxford University Press, MIT Press (MA, USA), and CRC Press, but there are also Springer, Emerald Publishing Limited, Hindawi Limited, Frontiers Media S.A., MDPI AG, Revista de Derecho Politico, Statistical Journal of the IAOS, Review of Policy Research, and Inderscience Publishers.

PQ2: How have these initiatives emerged and evolved over the years?

Figure 7 shows that in recent years there has been an increase in the implementation and analysis of initiatives related to democratic governance, the use of Big Data, and sustainable development. From 2010 to 2015, there was a growing interest in understanding and addressing these issues, but no actual implementation or use was reported. From 2016 to 2017, the analysis of initiatives increased, but no implementation or practical application in this regard was written either. From 2018 to 2019, the analysis and implementation of these initiatives increased, showing increased awareness of their importance and concrete steps taken to promote their adoption. In 2020 and 2021, the analysis continues, and the implementation of these measures has increased compared to previous years. Between 2022 and 2023, although the number of analyses and implementation of initiatives decreased, their actual use was not reported during this period. Overall, the data show that interest in and awareness of the importance of these initiatives has been growing over the years, but it is essential to remember that these data do not provide information on the actual use of these initiatives, which is a crucial aspect for assessing their real impact.
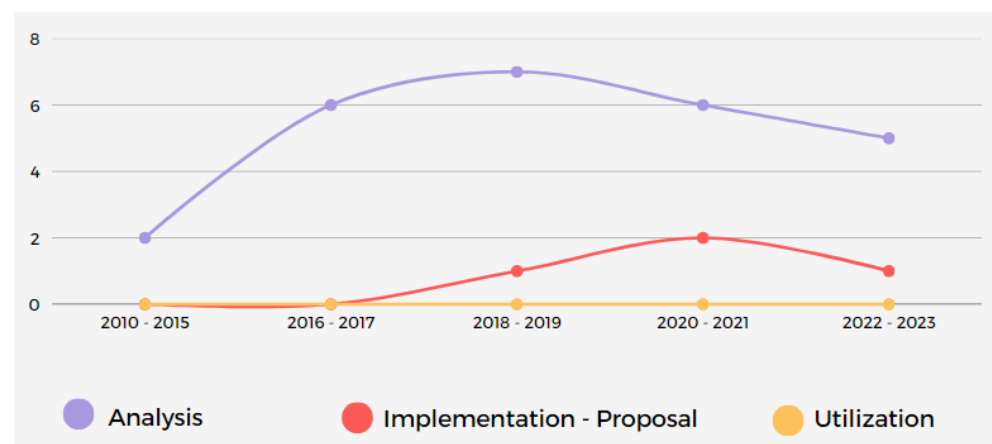
Figure 7. Publications of articles by year range.

PQ3: Which countries have the highest concentration of publications in the area of democratic governance?

According to Figure 8, the countries with the highest concentration of publications in the area are the United States and the United Kingdom, with Greece, China, and Australia in second place. There is a pattern of large countries, which may be associated with the difficulty of allowing citizens to participate in policy formulation and have greater control over government due to the complexity and scale of the political system.
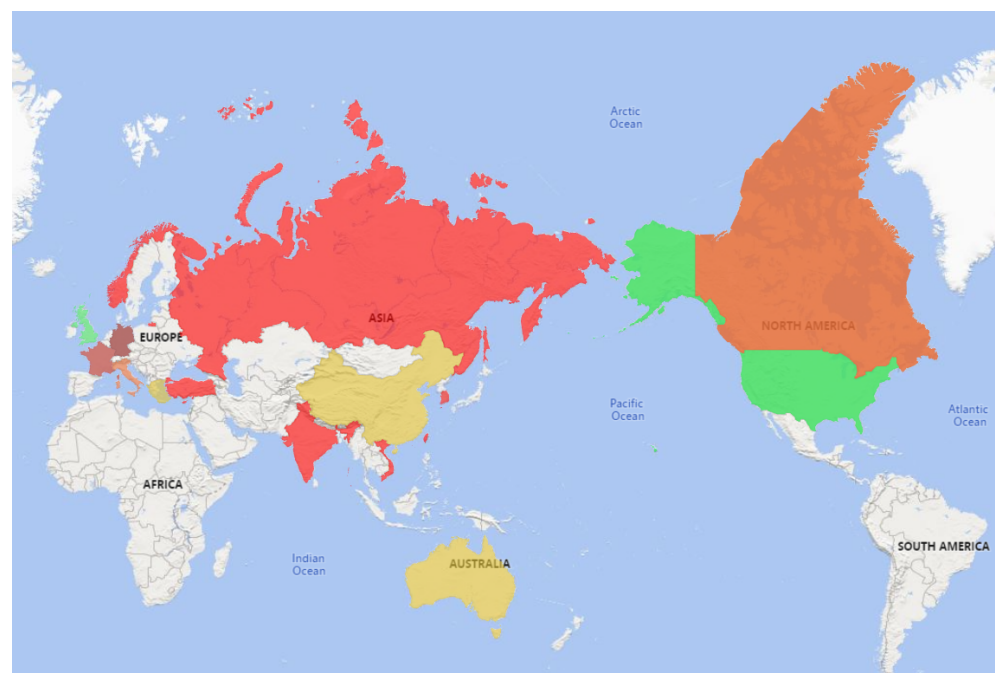

Figure 8. World map considering the authors of the studied papers, the number of papers is represented in a color scale from red (one paper) to green (the most quantity of papers).

6. Discussion

This article highlights the importance of addressing ethical, transparency, and accountability challenges in the use of Big Data in democratic governance. The future of Big Data in democratic governance has excellent potential for practical development. Its benefits and potential impact include improving decision making, optimizing public services, and identifying patterns and trends for more informed evidence-based decisions. In the article, we mention studies and papers related to the issue; for example, publications that discuss corruption and ethics in the context of governance and Big Data. We mention a report

on corruption in Latin America, a case study on Odebrecht, and a paper on assessing the privacy impact of Big Data. We also mention a study on the digital revolution in the tourism industry, a paper on the crisis of governance and representative democracy in the context of globalization, and a study on the ethical and legal challenges related to data privacy in the era of Big Data. In addition, the importance of protecting and securing data, as well as establishing ethical policies and systems, is highlighted. The articles reviewed agree on the need to address the challenges and risks associated with the use of Big Data, such as politicization and the protection of individual rights and privacy; however, the lack of solutions focused on democratic governance and Big Data for its subsequent application and implementation is noted, as well as the absence of mechanisms to measure the implementation of Big Data in democratic governance. Although this work is mainly exploratory, it is undeniable that this research marks the starting point to properly address the ethical and practical challenges related to the implementation of Big Data in democratic governance, to maximize its positive impact.

Research Gap

From the literature review, we identified that there are several gaps in the current research. Most of the works we found in the literature, especially regarding democratic governance and Big Data, focus on theoretical proposals and discussions, and the proposed methods have not been empirically validated in real governance contexts.

The articles studied in this paper illustrate, discuss, or compare the literature concerning democratic governance and Big Data. Even so, there is a perceived lack of proposals focused on the application or implementation of democratic governance and Big Data. Similarly, there do not seem to be measures to evaluate the implementation of Big Data in the context of democratic governance.

There is a need to effectively integrate Big Data practices with democratic governance processes without sacrificing the effectiveness of decisions taken. Agility is key in this context, as it facilitates adaptation to the changing needs and expectations of citizens. The alignment of citizens' requirements with decision-making procedures and data security needs have not been sufficiently tackled and necessitate deeper investigation. These components are crucial to develop a democratic governance approach from a Big Data standpoint.

7. Proposal

It is clear that the implementation of Big Data in democratic governance is an area of growing importance, but it still lacks a standardized framework for its assessment and improvement. In this context, a maturity model could provide a valuable tool to measure the level of implementation of Big Data and democratic governance, identify areas for improvement, and guide future development [76,77].

A maturity model serves as a guide for an organization to adopt and implement optimal practices, providing a starting point for implementing best practices [27,78], and describes an evolutionary improvement path from inconsistent to mature organizational processes [79]. It enables the evaluation of the progression state of an organization or a business procedure, to explicitly delineate strategies for enhancement in order to meet set goals and to pinpoint areas where the organization should concentrate its improvement efforts [80,81]. A maturity model would allow organizations to assess their current level of Big Data implementation, identify gaps and areas for improvement, and set clear goals for the future. It would also provide a framework for continuous improvement, enabling organizations to systematically move towards higher maturity levels.

It can also help protect data by creating clear guidelines, privacy policies, informed consent mechanisms, and robust security measures. The maturity model provides a structured guide to assess and improve data protection in applying Big Data in democratic governance. It helps to set clear objectives, identify gaps and deficiencies, and develop an action plan to improve data protection at each process stage. This helps to ensure privacy, legality, and trust in using Big Data in public administration. The development phase

promotes a culture of data protection and implements stronger practices to ensure the secure use of data and respect the rights of individuals.

In order to address this issue, the development of a maturity model for assessing the application of Big Data in democratic governance is proposed as a future direction. This model should be flexible enough to adapt to different contexts and needs and rigorous enough to provide a meaningful and useful assessment. In addition, it should include mechanisms for regular review and updating to ensure that it remains relevant and useful as Big Data and democratic governance practices evolve. Figure 9 depicts the scheme we intend to implement, which is divided into the following phases:

Phase 1: We employ a systematic literature review methodology to delve into the challenges of Big Data and democratic governance and spot present security shortcomings. This review will enable us to thoroughly analyze current information in the discipline and lay a robust foundation for our work.

Phase 2: To authenticate the conclusions drawn from the systematic literature review and pinpoint potential further challenges related to Big Data and democratic governance, we will conduct ontological studies of democratic governance and Big Data. This approach will allow us to gather information on the nature and relationships of the concepts and entities in this domain.

Phase 3: In this phase, we will develop a proposed maturity model to measure the level of implementation of Big Data and democratic governance. We will use a validated methodology for maturity model generation.
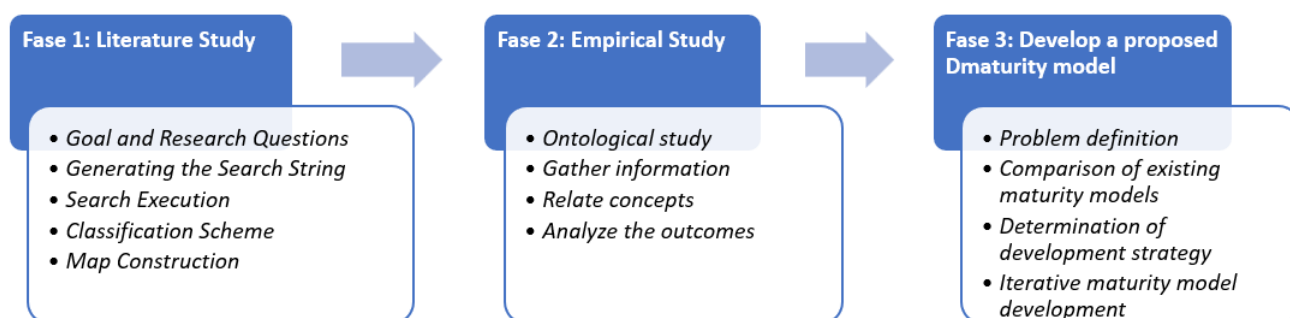

Figure 9. Research design.

Generating a maturity model to assess the implementation of Big Data in democratic governance offers several advantages. First, it allows establishing a clear and objective baseline for measuring the progress and effectiveness of Big Data implementation in democratic processes. In addition, it provides a structured framework that facilitates the identification of areas for improvement and the implementation of specific strategies to strengthen democratic governance based on the use of data. Furthermore, the maturity model helps identify the necessary technical and human resources to ensure a successful implementation. Finally, assessing the maturity level encourages a continuous focus on improving and adapting the integration of Big Data in democratic governance, thus promoting greater transparency, citizen participation, and informed decision making.

8. Limitations of the Study

We detected four categories of risks that could compromise the validity of the study, factors of great importance in any research since total impartiality in a study is unattainable. These threats pose fundamental challenges that must be addressed and understood to ensure the integrity of the results obtained.

8.1. Potential Threats

Systematic mapping can be compromised by structural threats relevant to the selected studies' classification. A search string has been created to address these threats using WoS, Scopus, and Google Scholar databases due to their broad coverage of publications indexing

various scientific journals, conferences, books, and other types of publications relevant to the research topic. In addition, these databases offer advanced search functions and reference management tools, allowing for precise and customized searches and a more rigorous selection of studies to be included in the systematic mapping.

While using additional data sources can provide additional information on studies, such as citations and bibliometric analyses, opting for WoS and Scopus can ensure the completeness and accuracy of systematic mappings. This, in turn, contributes to increasing the validity and reliability of the results obtained.

To avoid overlooking important studies, exhaustive searches for articles related to the use, studies, and/or evaluations of works related to democratic governance and Big Data were carried out. This ensured the inclusion of studies relevant to the research topic.

As for our proposal, we hope that it will serve as a basis for governments to have a strategy for implementing democratic governance through Big Data . However, it is crucial to remember that the proposal might be generic and not consider the specific challenges each government entity faces. The need to implement democratic governance and Big Data in governments and government entities may differ significantly among them, limiting the applicability of the proposed prioritization strategy.

8.2. Internal Validity

The internal validity of a study is a fundamental factor to consider when conducting rigorous and reliable research. In our study, we have ensured its internal validity through reviewing and selecting the papers included in the sample by two independent reviewers. Inclusion and exclusion criteria were previously applied, which ensured that only the most relevant and highest-quality papers were included in our analysis.

To ensure the internal validity of our study, two independent reviewers carried out a process of review and selection of papers in the sample. To ensure the inclusion of the most relevant and high-quality papers, predefined inclusion and exclusion criteria were applied. In addition, Cohen's kappa coefficient was used to measure the consistency and reliability of the reviewers' selection criteria. This statistical measure assesses the concordance in the classification of papers among reviewers and helps to consolidate the selection criteria, thus improving our study's reliability and internal validity.

The use of Cohen's kappa index to consolidate the selection criteria of the reviewed and selected papers is a crucial measure to ensure the internal validity of our study. By employing this statistical tool, we ensure that only the most relevant and high-quality papers are included in our analysis, which gives us accurate and reliable results. As a result, we can have full confidence in the findings of our study.

8.3. External Validity

It is important to note that the methodology used in the study was scientific and rigorous. This means that specific procedures and standards were followed to ensure accurate and reliable results.

The methodological approach was evidence-based, meaning that empirical data and observations guided the research process. This ensured that the study was based on hard facts and not on conjecture or assumptions.

In addition, specific and well-defined steps in the methodology were implemented to ensure the quality and accuracy of the study. These steps may have included carefully selecting the research sample, clearly defining the variables being studied, and using accurate and validated measurement instruments.

Validation and verification techniques were applied to ensure the integrity and consistency of the results obtained. This may have included repeating measurements or tests to ensure that the results were consistent or comparing those obtained with those of similar studies.

8.4. Accuracy and Validity

In all scientific research, there is a risk of errors in interpreting the findings and results, which could lead to erroneous or unclear conclusions. For this reason, measures were taken to minimize the possibility of errors in the data interpretation and study results.

One of the measures taken was validating the data and results by multiple researchers. This cross-checking of the findings ensured that the results were verified from different perspectives and criteria, allowing possible errors or inconsistencies to be detected and corrected.

In addition, visual tools were used based on the data and results obtained, allowing for a better understanding and analysis of the information. These visual tools facilitated the identification of patterns and relationships that might have gone unnoticed in a manual review of the data.

Measures were taken to minimize the possibility of errors in the interpretation of the data and results of the study, such as validation by multiple researchers and the use of visual aids to improve the understanding and analysis of the information.

9. Conclusions

In this study, work has been identified regarding democratic governance and Big Data. To this end, analyses, discussions, and reviews of existing literature, comparisons, and proposals have been proposed. Through these activities, we have sought to deepen the understanding of how Big Data can improve democratic governance in different contexts and situations. The results of this study can be of great value to researchers, practitioners, and policy makers interested in this evolving topic.

To provide an overview, we conducted a systematic mapping. We obtained 293 related papers by applying a search string. The results were limited to studies from 2010 to March 2023. Inclusion and exclusion criteria were applied to select 28 articles for our study. We classified the 28 selected articles into three dimensions for analysis: article type, context, and timeline.

An important finding was that almost all of the articles (93%) selected correspond to analyses, reflections, and discussions; 10% to works that used another as a basis for study; and 3% to a single article that generates a proposal.

We have reviewed various initiatives and proposals that address the challenges linked to Big Data in the policy and governance domains. These challenges include establishing ethical policies and systems, ensuring data protection and security, and fostering collaboration between public sector organizations. Related studies have provided a critical and reflective perspective on implementing Big Data in policy and governance. They have also highlighted the relevance of addressing the challenges and risks inherent in its use, thus fostering ethical and responsible management. In conclusion, addressing the issue of Big Data implementation in democratic governance requires a comprehensive and prospective approach. Therefore, creating a maturity model to effectively measure the level of Big Data implementation in this area is proposed as future work.

This model should be designed flexibly to adapt to different contexts and the specific needs of each country or region. At the same time, it must be rigorous in its structure and evaluation criteria to provide a meaningful and helpful assessment of the degree of adoption of Big Data in democratic governance.

A key feature of the maturity model is the inclusion of mechanisms for periodic review and updating. This will allow the model to remain relevant and effective as both Big Data practices and the dynamics and challenges of democratic governance evolve.

By implementing this maturity model, decision-makers and government leaders will be able to identify areas for improvement, set realistic goals, and develop strategies to strengthen the integration of Big Data into democratic processes. In this way, the benefits of this technology can be fully harnessed to make more informed and transparent decisions, promoting sound and efficient democratic governance. There is a significant gap in the current literature on democratic governance and Big Data. Much of the existing work

focuses on theoretical discussions and proposals, but lacks empirical validation in real contexts. This suggests more research is required that applies and evaluates methods and approaches in practical situations.

Ethical challenges, such as data control and privacy and data access equity challenges, are critical areas that must be addressed. It is important that governance policies and practices consider these challenges and work towards solutions that respect the rights and privacy of individuals and promote fairness in data access and use.

There is a mismatch between traditional research standards and the realities of Big Data. This raises the need to develop new standards and approaches that are aligned with the capabilities and challenges of Big Data, while ensuring the integrity and quality of research in the field of democratic governance.

We stress the importance of addressing ethical, transparency, and accountability challenges in using Big Data in democratic governance, as well as the need for more empirical research and the adaptation of research standards to the realities of Big Data.

As future work, it is hoped that this study will be an input for future research that aims to contribute to the generation of strategies for implementing democratic governance through Big Data. However, it is crucial to recognize that this recommendation may be general and not address the particular challenges that each government agency may face. The need for implementing democratic governance and Big Data in governments and government agencies may vary significantly, which could restrict the usefulness of the suggested prioritization strategy.

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Appendix A

Table A1. Articles used to analysis and results of systematic mapping.

Num.	Article	Cite	Brief Description
1	'Hypernudge': Big Data as a Mode of Regulation by Design	[82]	The concept of "Hypernudge" as a form of regulation based on the use of Big Data to guide algorithmic decisions is discussed. The pros and cons of this approach to regulation are discussed, including privacy, transparency, and accountability concerns. The importance of policy makers establishing ethical regulation to protect individual rights is emphasized.
2	Advertising, Big Data, and the Clearance of the Public Realm: Marketers' New Approaches to the Content Subsidy	[83]	It discusses how the targeting of consumers for advertising and the new data capture industry can affect the subsidy of media content production and erode the civic sphere, which has consequences for democracy. The importance of maintaining democracy in this context is highlighted.
3	Artificial Intelligence and Data Governance for Precision ePolicy Cycle	[84]	An AI can transform the public policy cycle, enabling precision policies and accelerating decision making. This would improve democracy by enabling the use of Big Data, giving rise to a new digital public policy cycle and qualifying democracy and administration as precision democracy.

Table A1. *Cont.*

Num.	Article	Cite	Brief Description
4	Asian Newsrooms in Transition: A Study of Data Journalism Forms and Functions in Singapore's State-Mediated Press System	[85]	It looks at data journalism in Asian newsrooms, where it seeks to enhance the public's experience as a consumer and political data stories transcend national boundaries. Data stories do not need investigative elements or watchdog papers to be exceptional; they can be informative in a less adversarial way.
5	Big Data Analytics in E-Government and E-Democracy Applications: Privacy Threats, Implications and Mitigation	[86]	The text discusses the benefits and threats of the use of Big Data in democratic processes and its implications for privacy and democracy. There are different ways to mitigate threats to privacy while benefiting from the use of Big Data.
6	Big Data Analytics: From Threatening Privacy to Challenging Democracy	[87]	Political scientists face challenges and opportunities due to the large volume of data generated on the Internet, and the use of business intelligence and analytics tools for political purposes, which may raise privacy concerns. The lack of privacy-focused studies on the practice of targeting voters with personalized messages is highlighted.
7	Big Data and Dahl's Challenge of Democratic Governance	[71]	The text analyzes the impact of Big Data on democratic governance in three policy areas, using Robert Dahl's dimensions of control and autonomy and highlighting their potential tensions. Although Big Data applications in the public sector have great transformative potential, most theory is narrowly focused on technocratic objectives.
8	Big Data and Democracy: Facts and Values	[88]	It should shift the ethical debate in political science towards a collective framework of democratic values and examines the production of data in social networks, highlighting the need for political scientists to be aware of democratic values when working with them. Overall, it argues for a broader debate on the democratization of data.
9	Big Data and the Phantom Public: Walter Lippmann and the Fallacy of Data Privacy Self-Management	[89]	The text analyzes the fallacy of self-management of data privacy in the context of Big Data and the digital citizen. Drawing on Walter Lippmann's theory, the author opines that data privacy perpetuates problems in a number of areas. He offers a critical perspective on current policies related to data privacy.
10	Big Data Ethics and Selection-Bias: An Official Statistician's Perspective	[74]	The use of Big Data as a source of official statistics is explored, highlighting ethical and statistical concerns, and suggests that it could be a cost-effective solution. The importance of seeking new ways to produce relevant and frequent statistical information is highlighted, and it is made clear that the views are those of the authors and do not necessarily represent the views of the Australian Bureau of Statistics or other organizations.
11	Big Data Governance and Representative Democracy [Gobernanza de los Macrodatos y Democracia Representativa]	[90]	The text discusses the relationship between Big Data governance and representative democracy, highlighting the importance of an ethical framework that protects democratic values. It emphasizes the need to consider privacy and civil liberties when using this data and the importance of values such as transparency, accountability, and participation in the development of such an ethical framework.
12	Big Data in Political Communication	[91]	The use of Big Data is transforming political communication through political marketing and microtargeting. However, political campaigns cannot rely exclusively on data and Big Data consultants to be effective. It highlights the limits and democratic concerns associated with its use.
13	Big Data, Algorithmic Regulation, and the History of the Cybersyn Project in Chile, 1971–1973	[92]	The Cybersyn project was a technology system that addressed issues similar to algorithmic regulation and Big Data. There are several potential benefits of dynamic data-driven regulation, but there are also concerns about data storage and centralization.
14	Campaign Strategies, Media, and Voters: The Fourth Era of Political Communication	[93]	The discussion includes examples from political campaigns in different contexts, demonstrating the increasing sophistication of strategists in using online tools to collect voter data, manage campaign resources, mobilize voters, generate new information, and improve the effectiveness of political communication.

Table A1. *Cont.*

Num.	Article	Cite	Brief Description
15	Cape Town as a Smart and Safe City: Implications for Governance and Data Privacy	[94]	Case study of Cape Town's "smart and safe" cities program, where the implications of using "smart city" technologies for data governance and privacy are explored. Cape Town's overall smart city framework and its role in achieving the UN Sustainable Development Goals are analyzed.
16	Constructing a Public Narrative of Regulations for Big Data and Analytics: Results From a Community-Driven Discussion	[95]	Community perspectives on the regulation of municipally-led Big Data initiatives. While data analytics holds great promise, its mythologized nature can lead to blind faith in empirical results, which can result in the omission or misrepresentation of marginalized populations.
17	Data Politics: Worlds, Subjects, Rights	[96]	Data has become a social and political issue because of its ability to reshape the relationships between states, subjects, and citizens. Data and politics are now inseparable; data are not only shaping our social relations, preferences, and life chances, but also our democracies themselves. Without understanding these conditions of possibility, it is impossible to intervene in or shape the politics of data.
18	Data-Driven Authoritarianism: Non-Democracies and Big Data	[97]	This chapter examines how authoritarian regimes use Big Data to maintain political and social control. These regimes also use advanced propaganda techniques, such as audience segmentation and message personalization, to influence public opinion and perpetuate their regime.
19	Datatrust: Or, the Political Quest for Numerical Evidence and the Epistemologies of Big Data	[98]	The current trend of evidence-based policy making through the use of Big Data is what is discussed in this article. It highlights the dependence of data exaggeration on specific forms of trust, truth, and objectivity; the analysis of the historical roots of the current Big Data phenomenon; and its relationship to the ideal of mechanical objectivity.
20	Deep Learning for Deepfakes Creation and Detection: A Survey	[99]	Deepfakes are created using machine learning algorithms to generate realistic images or videos that can be used to spread misinformation or mislead people. Detecting deepfakes is not a straightforward issue and there are various techniques such as using machine learning algorithms to analyze the content and identify inconsistencies.
21	Democracy Under Attack: Challenges of Addressing Ethical Issues of AI and Big Data for More Democratic Digital Media and Societies	[100]	The paper examines the ethical implications of digital media, Big Data, and artificial intelligence on democracy and human rights. Challenges include reconciling heterogeneous perspectives on ethics, increasing polarization and populism, and engineers' lack of critical self-reflection.
22	Digital Politics, GDPR, and AI	[101]	Here we examine how the European Union has addressed the impact of artificial intelligence on policy, economics, and law, and how the EU General Data Protection Regulation affects the collection and use of data in digital policy.
23	Paradigm Shifts from E-Governance to S-Governance	[102]	This article describes the paradigm shift in e-governance from a technology-centered approach to a people-centered approach. It argues that e-governance must evolve towards social governance to ensure a more inclusive and effective participation of citizens in political decision making.
24	The Innovative State	[103]	Big data can increase the epistemic and sensory capacity of agencies, allowing them to gain a more detailed understanding of conditions on the ground with the participation of a more diverse audience.
25	The Organizational Structure and Operational Logic of an Urban Smart Governance Information Platform: Discussion on the Background of Urban Governance Transformation in China	[104]	The research analyzing the organizational structure and operational logic of a smart urban governance information platform in China aims to identify the trends of urban governance transformation in China and design a governance organizational structure based on the smart urban governance information platform.
26	Towards a Political Theory of Data Justice: A Public Good Perspective	[105]	Interdisciplinary study proposing a political theory of data justice from a public good perspective. The study connects three political theories of the public good with empirical studies on the functions of big data to guide and constrain state data practices that aim to minimize political abuse of data power.

Table A1. *Cont.*

Num.	Article	Cite	Brief Description
27	Towards Better Environmental Governance in Taiwan	[106]	The chapter highlights the importance of an integrated approach to address environmental challenges, involving government, markets, and civil society. It emphasizes the use of new technologies, such as IoT and geographic information systems, for innovation. This approach is illustrated with two concrete examples: greenhouse gas emissions reduction and solid waste management.
28	Visualization Practice and Government: Strategic Investments for More Democratic Governance	[107]	Data visualization has great potential to illuminate complex challenges and create collective knowledge. It can be used to efficiently share information and show the results of meetings and data analysis. In the public sector, its ability to describe and analyze complex challenges, monitor social networks, and communicate information to leaders and the general public is highlighted.

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