

SCIENTOMETRIC AND EMPIRIC ANALYSIS: LOOKING BACK TO THE FUTURE STRENGTHENING LAW AND GOVERNANCE

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Abstract

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This study analyzes trends in strengthening law and governance using a scientometric approach to provide a data-driven overview of its evolution over the past decade. The methodology employed involves collecting data from leading academic databases, with 854 articles using the search keywords “strengthening law and governance” in the Web of Science (WoS) database. Additionally, bibliometric analysis software was used to map publications, researcher collaborations, and key research topics from 2013 to 2023. The study reveals a significant rise in publications on strengthening law and governance, increasing from 157 (2013–2016) to 301 (2017–2020), and 416 (2021–2023). Network visualization identifies key research clusters in environmental studies, law, and economics, with leading researchers and institutions mainly in the U.S. and U.K. Emerging trends focus on global and international health. The study highlights the need for institutional and international collaboration to address global challenges in legal strengthening and governance. The practical implications of this research provide guidance for policymakers and academics to direct research and policy development that is more targeted and evidence-based.

Keywords: Scientometrics, Strengthening Law, Governance

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1. INTRODUCTION

Law strengthening in governance plays a crucial role in ensuring the stability and effectiveness of public administration (Podgórecki, 2023; Rosenbloom et al., 2022). A strong and consistently enforced law

is the foundation of transparent governance (Erkkilä, 2020; Pozen, 2020), accountable (Overman & Schillemans, 2022), and responsive to the needs of society. However, in practice, challenges such as non-compliance, abuse of power (Delmas, 2020), still frequently arise, hindering the performance of good

governance. In the digital era and globalization, the government can design governance systems according to the needs (Esko & Koulu, 2023; Sidorenko & von Arx, 2020), the strengthening of law becomes increasingly complex with the emergence of new dynamics in regulation and oversight. Therefore, research and literature related to law strengthening in governance continue to evolve.

Law strengthening encompasses not only the enforcement of existing rules but also the implementation of legal reforms that are adaptive to changing times, as well as the enhancement of the capacity and integrity of state officials. Several experts have made significant strides in the field of law strengthening by analyzing it from various perspectives. Some researchers focus on measuring and evaluating the effectiveness of laws. For example, they propose participatory evaluation methods that involve the community in assessing legal performance, while also highlighting the need for both quantitative and qualitative data-driven evaluation models to assess the effectiveness of regulation implementation.

In addition, research on the impact of law strengthening on local development has also become a focus of study for many experts. They have introduced models for analyzing the impact of legal frameworks on improving community welfare (Banushi, 2019), they have developed an evolving network model to analyze the impact of legal implementation on economic resilience (Çerkini & Podvorica, 2024; Paçarizi-Osmani & Osmani, 2024; Sahiti & Dalipi, 2024) and social resilience within communities (Elsheikh et al., 2024). Furthermore, some researchers tend to integrate legal studies with specific real-world contexts. For example, they examine how laws interact with and are analyzed within economic conditions (Sulistyaningsih et al., 2024) and local social conditions (Boboy et al., 2020; Habibie et al., 2021; van der Berg & Pieterse, 2024), environment (Hanifah et al., 2019), efficiency (Noaman et al., 2018) in the government sector.

Most experts in this field are professionals, but differing personal backgrounds and subjective preferences have led to a lack of quantitative analysis in the literature. This gap indicates that much of the existing research relies on qualitative approaches, lacking comprehensive data-driven insights that could provide a more objective and systematic understanding of legal structures. In other words, despite the abundance of publications related to law, few are able to accurately grasp the overall structure of the legal knowledge landscape. Therefore, legal studies aided by quantitative analysis tools, such as CiteSpace, are needed. CiteSpace is a Java-based information measurement software designed to clarify the evolutionary structure of knowledge and detect emerging trends and transient patterns in scientific literature. CiteSpace has been widely used to identify hot topics. To date, CiteSpace is popular among academics, but it is not widely known that CiteSpace has been used to analyze relevant literature in the field of law strengthening and governance.

To provide a systematic and objective description of knowledge development, this study utilizes CiteSpace software to analyze 874 articles from the Web of Science (WoS) between 2013 and 2023. This approach addresses the existing gap in the literature by incorporating a data-driven method to map the legal knowledge landscape of law strengthening and governance, offering a more

structured and quantifiable perspective. The findings of this study contribute to both academic research and practical applications by identifying key trends, influential works, and emerging topics in the field of law. By enhancing the understanding of knowledge evolution in this domain, the study provides valuable insights for researchers, policymakers, and legal practitioners, facilitating more informed decision-making and future research directions of law strengthening and governance. The objectives of this study are as follows:

1) To understand the collaboration relationships between authors, institutions, and countries in the research area of law strengthening and governance;

2) To identify the most cited and most influential references, authors, and journals;

3) To clarify the knowledge development structure and emerging trends in this field of study.

The article is divided into several sections. Section 1 outlines the importance of strengthening law and governance as a crucial factor in legal and institutional development. Section 2 explores the theoretical foundations related to law strengthening and governance, while also highlighting key debates and gaps in the existing literature. Section 3 employs the scientometric approach by collecting data from major academic databases, particularly the WoS. Section 4 provides the research results and discussion. Section 5 synthesizes the key findings from the analysis and provides a deeper understanding of the strengths and weaknesses of the current research landscape in law and governance.

2. LITERATURE REVIEW

Observing the development of studies on strengthening law and governance, researchers examine how the study of legal and governmental strengthening has evolved from various perspectives. First, in the aspect of strengthening the legal framework and law enforcement, several studies indicate that the application of administrative law principles has led to increased transparency and accountability in public administration. However, there are significant challenges regarding the consistent implementation and comprehensive understanding of these principles at various levels of government. The effective application of administrative law principles requires a strong commitment from all stakeholders involved (Mudhoffar et al., 2024). Furthermore, studies on a strong administrative legal framework significantly enhance governance by promoting transparency, accountability, and public participation. Sustainable legal reforms and capacity-building initiatives are essential to addressing existing gaps and challenges in governance, including the provision of structured mechanisms for oversight and accountability (Latifa et al., 2024). Additionally, other research identifies an incomplete legal foundation for collaborative governance as a significant barrier, necessitating the promotion of a more comprehensive legal framework. This study develops a theoretical framework that emphasizes enhancing predictability, accessibility, supremacy, and equality before the law in key areas of collaborative governance. Improving legal accessibility is crucial to ensuring the involvement of all legitimate stakeholders in the collaboration process (Qi, 2019).

Second, good governance, several studies discuss the need for relevant policy research to be integrated into the regulatory and policy systems of developing countries. Additionally, research highlights how the government plays a crucial role in maintaining state stability (Minogue, 2002). Good governance is essential for strengthening the rule of law, as it encompasses principles such as accountability, transparency, and the supremacy of law (Purnaweni et al., 2022). Furthermore, other studies have found that good governance is not only flexible and adaptable but also serves as a normative framework that can be positively regulated by government institutions. Strengthening the legal system enhances good governance by ensuring that legal principles are upheld, thereby promoting accountability, transparency, and effective administration. This relationship underscores the importance of a strong legal framework in achieving good governance outcomes (Susanto et al., 2024).

Third, democracy and public participation, several studies discuss how democracy relies on public participation to strengthen the rule of law, ensuring that legislation reflects the general will of the people (Sianipar et al., 2022). Additionally, research highlights that public participation, particularly from disadvantaged groups, is essential for a more inclusive democracy and effective legal reforms (Nheu & McDonald, 2010). Moreover, social participation plays a crucial role in reinforcing democracy and the legal system, as it enhances representation and fosters transparency in governance (Neves et al., 2024). Another study emphasizes that engaging in the legal reform process is vital for democracy and public participation, as it allows individuals and groups to influence the laws that govern their lives (Muir, 2013).

Fourth, law-based development, several studies discuss the transformation of governance in advanced democratic countries and theoretical approaches to law in relation to governance, as explored by Commaille (2010). Additionally, development law is considered crucial in strengthening the legal framework by addressing power asymmetry, agency, accountability, and human rights in development governance (Dann, 2023). Furthermore, research highlights that an effective legal framework is essential in mitigating the negative impacts of development initiatives on individuals. It emphasizes that both donors and recipient countries face challenges in promoting a strong legal system, as failure to do so may lead to unrealistic expectations regarding the promotion of law and legal institutions (Giovanni, 2016).

Based on the literature review conducted, strengthening the legal framework and law enforcement, good governance, democracy and public participation, as well as law-based development are essential components in establishing a state founded on the principles of justice, transparency, and accountability. Studies indicate that strengthening the legal framework is necessary to create regulations that are responsive to social, economic, and political dynamics. This is supported by policies that reinforce the supremacy of law and enhance the effectiveness of legislative implementation.

Meanwhile, fair and transparent law enforcement contributes to increasing public trust in legal and governmental institutions. In the context

of good governance, the literature emphasizes the importance of good governance principles such as accountability, efficiency, and public participation in state administration. Furthermore, literature on democracy and public participation highlights that public involvement in policymaking is a crucial element in an inclusive governance system. Active participation through democratic mechanisms such as elections, freedom of expression, and access to public information plays a role in strengthening political and social stability. Finally, law-based development ensures that economic growth, social development, and environmental policies are implemented within a legal framework that guarantees justice and sustainability. Legal literacy and guarantees of protection for vulnerable groups serve as supporting factors in achieving sustainable and inclusive development. Therefore, the findings of this literature review confirm that the integration of law, governance, democracy, and development are interrelated factors in creating a stable and progressive state. Further research is needed to explore how these studies continue to evolve.

3. METHODOLOGY AND STATUS OF RESEARCH

Bibliometric analysis is an analytical approach widely employed in scientific studies to measure and evaluate research trends based on academic publications (Judijanto et al., 2024). This method is extensively used to comprehend the evolution of a discipline, citation patterns, and the relationships among researchers, journals, and academic institutions (Song et al., 2024). By utilizing formal and quantitative data, bibliometric analysis provides insights into research productivity, academic impact, and scientific collaboration (Kumar, 2025). The primary advantage of this method lies in its ability to identify publication and citation patterns, revealing how a concept or theory evolves over time (Esh, 2024).

In practice, bibliometric analysis is often associated with various other metric concepts, such as scientometric (Saputro et al., 2023), webometric (Dubey et al., 2023), cybernetics (Nica, 2024), and altmetric (Guechairi, 2024). Scientometric focuses on the quantitative study of science and its impact, while webometric examines relationships and scientific activities in the digital domain, particularly on the internet. Cybermetric has a broader scope than webometric (Sen, 2004), encompassing the study of the entire digital ecosystem in knowledge production. Altmetric, on the other hand, assesses academic impact based on social media, news, and scientific blogs, whereas infometric provides a more general study of information measurement across various disciplines. With these diverse metric concepts, bibliometric analysis is frequently employed across multiple fields to obtain a more comprehensive understanding of research dissemination and influence. One of the key features of bibliometric analysis is the use of visualization software such as VOSviewer, CiteSpace, and Bibliometric (Kumar, 2025). Additionally, bibliometric analysis aids in identifying research gaps and predicting the future trajectory of scientific development. As a result, this method serves as an invaluable tool in academic research planning and evidence-based policymaking across diverse disciplines.

The objective of this study is to conduct a scientometric analysis of research on law strengthening and governance. Relevant literature data was obtained through a literature search method (including titles, abstracts, subject terms, keywords, and references, etc.), which will serve as the knowledge mapping database. Selecting a reliable and comprehensive bibliographic database is crucial to provide a large volume of high-quality articles as a reliable source. The data chosen for this study is sourced from the Science Citation Index Expanded (SCIE) and the Social Sciences Citation Index (SSCI) within the core collection of the WoS. These databases are relatively comprehensive, and the exported data can be directly identified by CiteSpace.

Furthermore, determining the appropriate keywords to select articles from the bibliographic database is essential. This process should focus on the representativeness and validity of the keywords. The research period for law strengthening and governance spans from 2013 to 2023. The main reason for choosing this period is that 10 years of literature data is highly representative, and there will be no situations that affect the efficiency of the software due to an excessive amount of data. The specific details are summarized as follows:

- Topic: Strengthening law and governance;
- Time: 2013-2023;
- Databases: SCIE and SSCI.

A total of 874 related articles were published with the terms “law strengthening” and “governance” in the titles, indexes, or abstracts from 2013 to 2023. The number of publications per year is shown in Figure 1. An overall increasing trend can be observed. The number of research publications on law strengthening and governance over the last 10 years has significantly increased, reaching 874 publications, indicating that research on this topic is gradually gaining the attention of scholars.

The division of data into three periods reveals that the 2021-2023 period has a significantly higher number of publications compared to the previous two periods. This indicates an increase in publication activity in recent years, with a peak in 2022. Based on the trend observed in Figure 1, the data can be divided into three periods:

1) Period 2013-2016: During this period, the number of publications showed a relatively stable increase. In 2013, there were 31 publications (3.547% of the total 874 publications), which increased to 41 publications (4.691%) in 2014. The number slightly decreased in 2015 to 34 publications (3.89%), but then significantly increased in 2016 with 51 publications (5.835%). The total number of publications during this period was 157, representing 17.962% of the total publications.

2) Period 2017-2020: This period began with an increase in the number of publications, from 61 publications in 2017 (6.979%) to 59 publications in 2018 (6.751%). The trend showed a very significant increase in 2019 with 105 publications (12.014%), before experiencing a decline to 76 publications in 2020 (8.696%). This decline was likely due to the COVID-19 pandemic, which affected many aspects of life, including research activities and scientific publications. The total number of publications during this period was 301, representing 34.44% of the total publications.

3) Period 2021-2023: This period shows a very significant upward trend in the number of publications. In 2021, there were 122 publications (13.959%), which increased to 151 publications in 2022 (17.277%), marking the highest number of publications during this analysis period. Although there was a slight decline in 2023 with 143 publications (16.362%), this number remained high compared to previous years. The total number of publications during this period was 416, representing 47.598% of the total publications.

There are several reasons why the study of legal empowerment continues to be a compelling topic. First, there is the awareness that empowerment can address injustice, poverty, and inequality (Fauzi et al., 2023; Sepúlveda Carmona & Donald, 2015), legal empowerment can enhance governance (Rosenbloom, 2022; Sidiq et al., 2024). Additionally, eight different types of documents comprise all research on law strengthening and governance, such as articles, proceedings papers, editorial materials, reviews, meeting abstracts, book chapters, book reviews, and corrections. The detailed types of documents are shown in Figure 2. Generally, studies with the mentioned keywords are dominated by articles.

Figure 1. Number of publications from 2013 to 2023

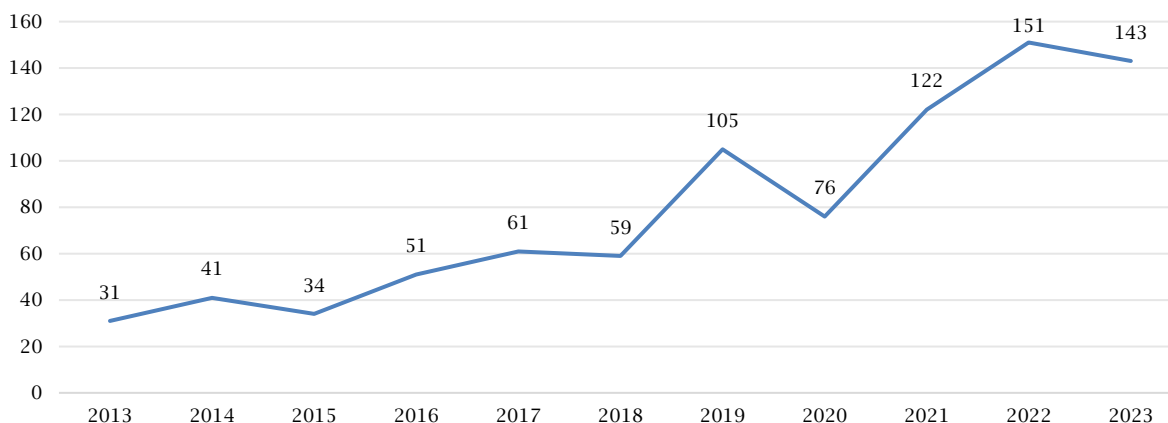
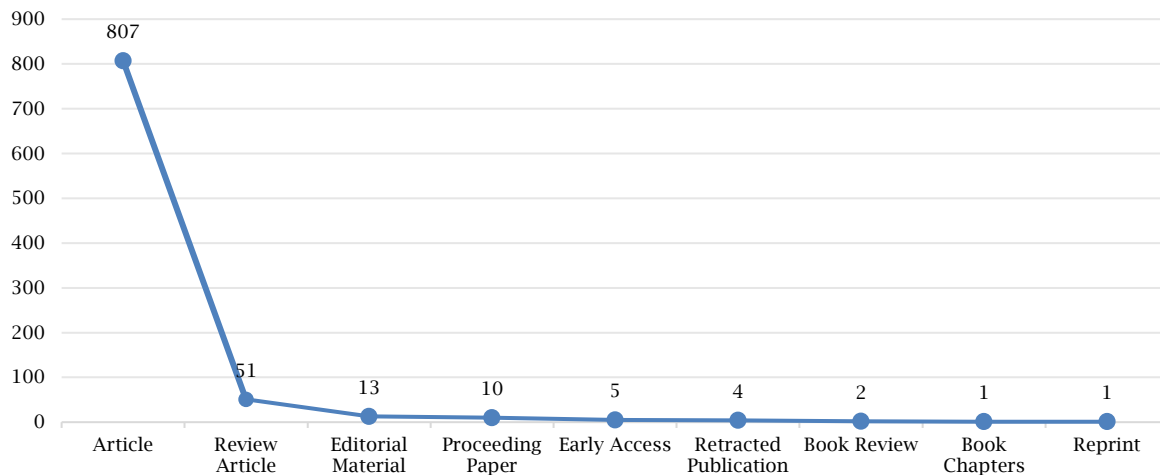


Figure 2. Number of documents by type from 2013 to 2023

Research on law strengthening and governance has become multidisciplinary, as reflected in the distribution of categories. Figure 3 presents a broad summary of the top 10 categories in this research area. In this study, the top 10 subject categories in the WoS have been identified based on the number of records. The Environmental Studies category has the highest number of publications, with 171 publications, accounting for 19.565% of the total 874 publications. This indicates a strong focus on environmental studies in the analyzed publications. The Law category is also highly dominant, with 168 publications, or 19.222% of the total, indicating significant attention to legal issues in the research. The Environmental Sciences category has 128 publications, representing 14.645% of the total, showing substantial interest in environmental sciences. In the field of economics, there are 106 publications in the Economics category, equivalent to 12.128% of the total publications, indicating a strong interest in the economic field. The Political Science category recorded 90 publications, representing 10.297% of the total publications, highlighting the importance of political studies in the analyzed research. The International Relations category recorded 69 publications, accounting for 7.895% of the total, showing significant involvement in international studies. In the Public Environmental Occupational Health category, there are 64 publications, or 7.323%

of the total, indicating attention to environmental health in the workplace.

Finally, the Green Sustainable Science Technology category recorded 57 publications, accounting for 6.522% of the total, indicating a focus on environmentally sustainable science and technology.

Overall, this distribution of publications reflects a wide range of research focuses, with significant dominance in environmental and legal studies. Several studies reinforce the findings on law strengthening and governance in environmental and legal studies, such as the integration of environmental, social, and governance (ESG) impacts on corporate sustainability performance (de Souza Barbosa et al., 2023), policy implications on the complexity of water scarcity (Borgias, 2024), international governance standards, such as sustainability principles and intergovernmental cooperation, can help address the challenges of water resource management (McIntyre, 2024), the legal framework can influence the process of submitting and implementing mining permits to prevent abuse of power (Noverizky & Hikmah, 2024), other categories also show significant contributions, reflecting the broad scope of research within this dataset.

Compared to Figure 4, it was found that some of these categories align with the research directions.

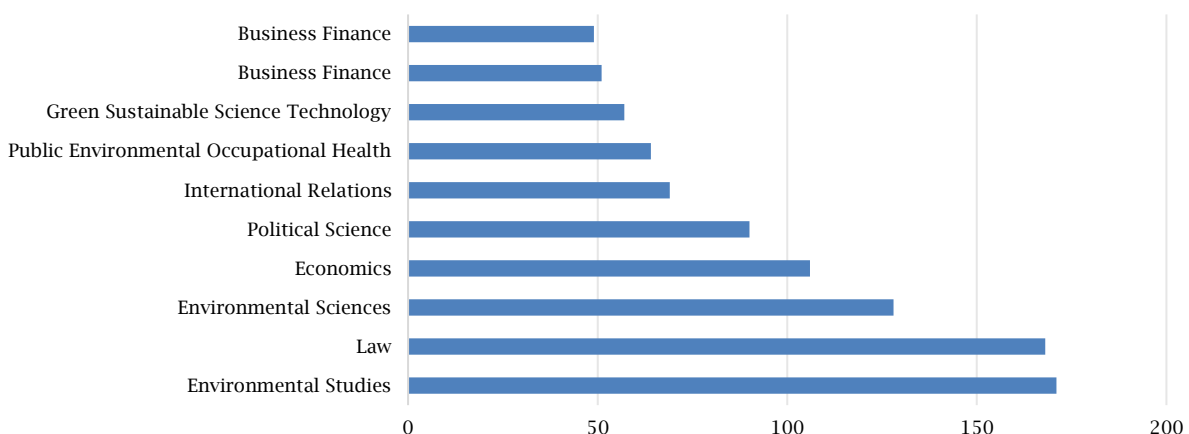
Figure 3. Top 10 subject categories based on WoS from 2013 to 2023

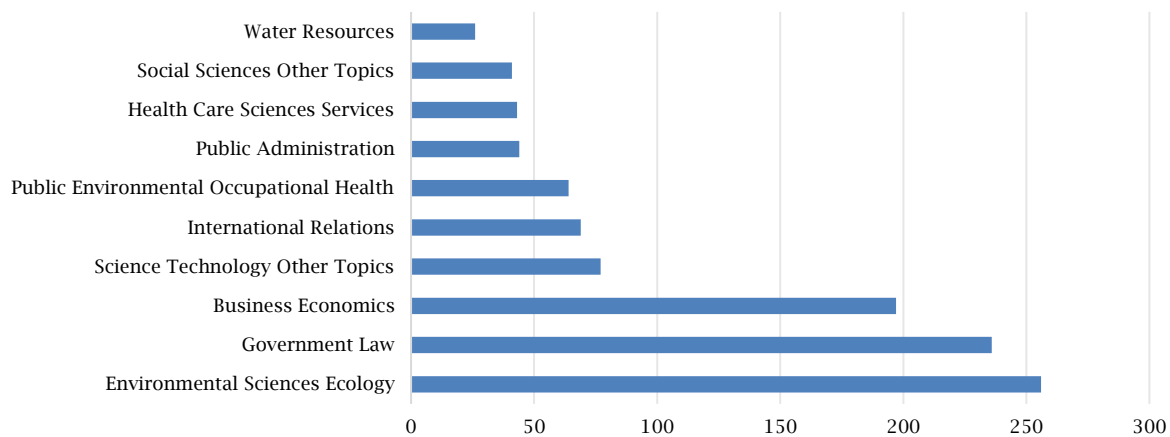
Figure 4. Top 10 research directions of WoS from 2013 to 2023

Figure 4 shows the top 10 research directions in law strengthening and governance. Among these directions, the highest are Environmental Sciences Ecology with 256 publications (29.291%), Government Law with 236 publications (27.002%), Business Economics with 197 publications (22.540%), and Science Technology Other Topics with 77 publications (8.810%). The Environmental Sciences Ecology field focuses on ecology and environmental conservation, while Government Law encompasses governmental law and public policy. Business Economics covers business economics and market analysis, while Science Technology Other Topics includes various topics related to science and technology.

Scientometric analysis (Darko et al., 2020; Zhong et al., 2019) (citation analysis, co-citation analysis, and co-occurrence analysis) can visually depict the structure of scientific knowledge (Borgohain et al., 2024; Sadabadi et al., 2022). The relationship between research frontiers and foundational knowledge can be established through the analysis of a series of visual maps (collaboration networks, co-citation networks, and co-occurrence networks) generated using CiteSpace software. It is important to note that input data must be processed with the “remove duplicates” function of CiteSpace before analysis. Ultimately, the total data retained amounts to 854 records. To illustrate this process logically, a workflow diagram is provided in Figure 5.

Figure 5. Framework for data collection and CiteSpace operation

Source: Authors' elaboration.

4. RESULTS AND DISCUSSION

4.1. Citation analysis in law strengthening and governance

To address more complex scientific issues and foster innovative thinking, collaboration between countries, institutions, and academics across various

research fields is necessary (Baas et al., 2020). This study has mapped collaboration networks (author collaboration networks, institutional collaboration networks, country collaboration networks, and geographic collaboration networks) based on the collected literature data, which will help identify noteworthy researchers, institutions, and countries, as well as their social relationships.

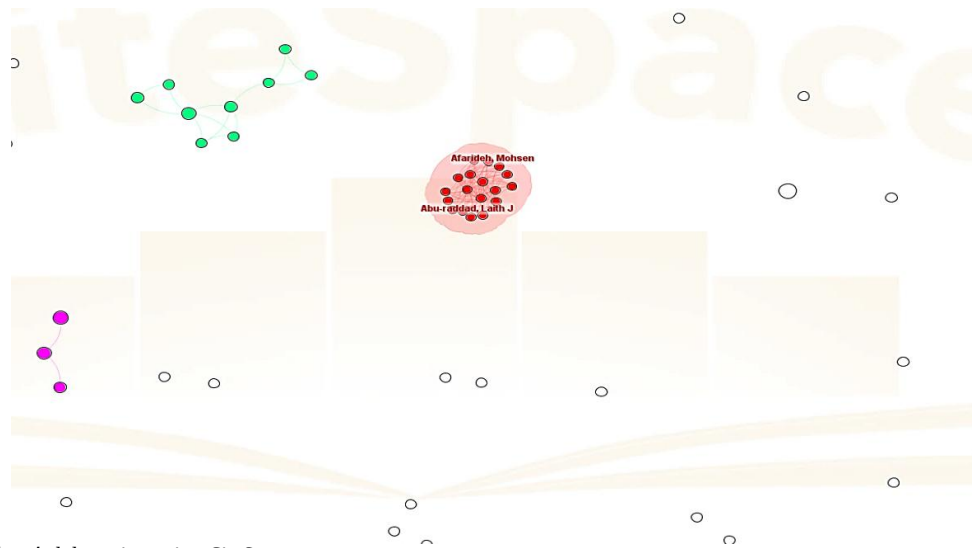
4.1.1. Author network analysis in law strengthening and governance

The author collaboration network can assess the strength of cooperation and mutual relationships between different authors, as shown in Figure 6. There are 172 nodes and 287 links, where each node represents an author. The size of the nodes indicates the number of citations received by the author, while the width of the lines represents the number of collaborative articles. The overall network density is only 0.0195, indicating that this network diagram is not very dense. This could

suggest that there are many nodes in the network with few connections to other nodes, possibly indicating low interconnectivity or specialization in certain sub-sections of the network.

The most prominent cluster is the red cluster, which includes authors such as Afarijeh, Mohsen and Abu-raddad Laith J. This cluster indicates a close relationship among these authors, meaning their works significantly reference each other. The green and purple nodes represent other authors in the citation network who have fewer connections compared to the main red cluster.

Figure 6. Author network in strengthening law and governance from 2013 to 2023

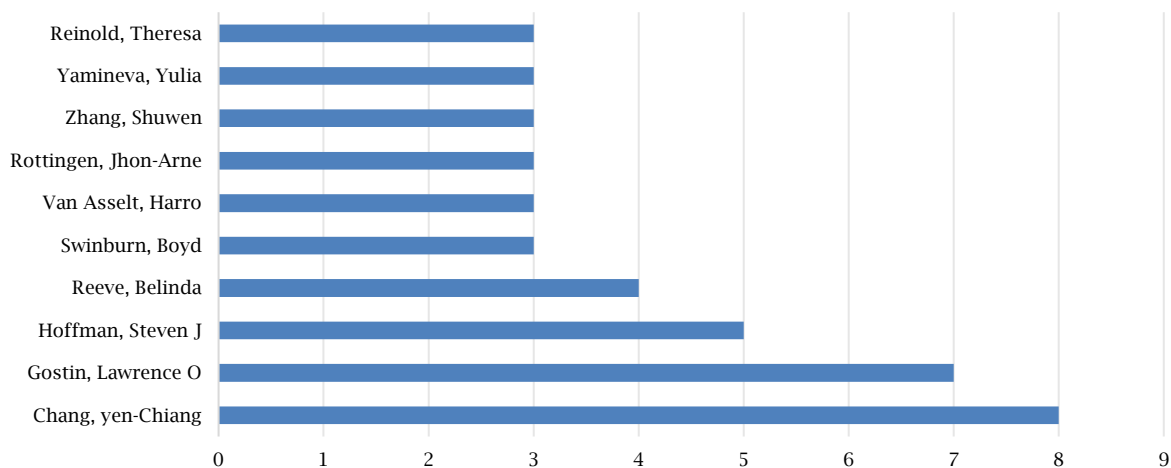


Source: Authors' elaboration using CiteSpace.

Additionally, some data highlights the most productive authors. Figure 7 provides a clear overview of the research contributions from various authors over several years. Yen-Chiang Chang stands out as the most productive author in this dataset,

followed by other prominent researchers such as Lawrence O. Gostin and Steven J. Hoffman. The centrality scores indicate that although there are many publications, they may not be significantly interconnected within this dataset.

Figure 7. Top 10 productive authors with the keywords strengthening law and governance from 2013 to 2023



Next, it is also important to examine the strength of articles through citation analysis. Table 1 presents the results of citation analysis using CiteSpace, covering the period from 2013 to 2023. Table 1 includes several key elements such as

the author's name, year of publication, citation strength, the start and end year of citation impact, and a timeline that shows the intensity and duration of citations during that period. The listed authors, such as John-Arne Rottingen and Lawrence O. Gostin,

have varying citation strengths, indicating the extent to which their works have influenced a particular field. High citation strength indicates that their works are frequently referenced and have a significant impact.

The timeline displayed with red and blue bars provides a visual representation of the period and intensity of citation impact. Red bars indicate periods of high citation activity, while blue bars

show the overall duration of that citation impact. For example, John-Arne Rottingen shows a citation strength of 1.68 from 2013 to 2016, with high citation activity occurring during those years. These citation trends also indicate when a specific topic or author becomes highly influential. Authors like Theresa Reinold and Yen-Chiang Chang have more recent citation periods, showing that their work has begun to receive more attention in recent years.

Table 1. Top 13 authors with the strongest citation bursts from 2013 to 2023

Authors	Year	Strength	Begin	End	2013-2023
Rottingen, John-Arne	2013	1.65	2013	2016	
Gostin, Lawrence O.	2015	1.57	2015	2020	
Hoffman, Steven J.	2013	1.4	2013	2016	
Magnosson, R.	2015	1.3	2015	2016	
Reeve, B.	2015	1.3	2015	2016	
Reinold, Tereza	2019	1.91	2019	2020	
Chang, Yen-Chiang	2017	1.72	2017	2020	
Lin, Ching-Fu	2017	1.28	2017	2020	
Yumineva, Yulia	2017	1.28	2017	2020	
Ratner, Blake D.	2017	1.26	2017	2020	
Nwoke, Uchechukwu	2019	1.26	2019	2020	
Tangcharoensathien, Viroj	2017	1.26	2017	2020	
Reeve, Belinda	2022	1.28	2022	2023	

Source: Authors' elaboration using CiteSpace.

Overall, this analysis helps identify the most influential authors and works, understand citation trends within a specific period, and recognize topics that have received significant attention from 2013 to 2023.

4.1.2. Institutional collaboration network analysis in law strengthening and governance

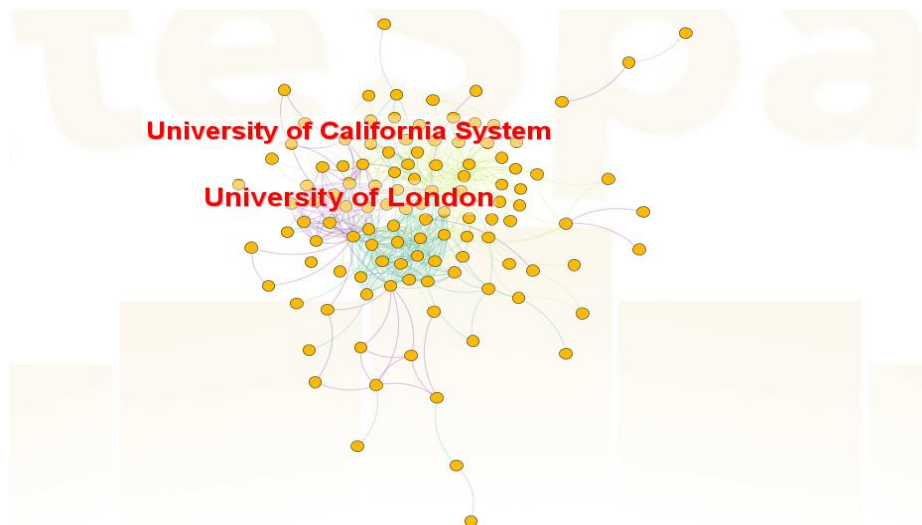
The generated network consists of 189 nodes and 585 links, with a network density of 0.0329. The largest nodes include 115 labeled nodes (60%), providing significant indications of the distribution of influence within this network. Figure 8 is a visualization of the institutional network generated using CiteSpace for the period from 2013 to 2023. This analysis highlights two institutions with the most significant influence in the research

network: the University of California and the University of London.

The University of California and the University of London emerge as the largest and most prominent nodes in this network, indicating that they have the highest number of collaborations or citations with other institutions in the network. The network density of 0.0329 suggests that although there are many connections between institutions, not all are closely linked. This could indicate the presence of separate research groups or sub-networks that significantly interact with key institutions.

Moreover, the influence of the University of California and the University of London is not only evident in their high number of collaborations or citations but also in their role as central hubs in this network. This underscores their central role in the dissemination of knowledge and influence within the analyzed research field.

Figure 8. Visualization of collaboration institution network



Source: Authors' elaboration using CiteSpace.

This analysis reveals the collaboration structure and institutional influence within the research network over the past decade. The University of California and the University of London emerge as the most influential institutions, with extensive and significant collaboration networks. This visualization helps in understanding the dynamics of global research collaboration and the crucial roles played by key institutions

4.1.3. Country collaboration network analysis in law strengthening and governance

The country collaboration network is composed of 130 nodes and 661 links that connect these nodes, illustrating the collaborative or citation relationships between them. These nodes represent entities like authors or institutions within the analysis. The network has a density of 0.0788, indicating that although there are numerous connections, not all nodes are interconnected. This relatively low density suggests the existence of several sub-networks or

research groups that are strongly connected internally but have limited external connections.

The nodes represent countries or regions, as depicted in Figure 9, which visualizes the international collaboration network in research from 2013 to 2023 using CiteSpace. Figure 9 shows the involvement of various countries in research collaborations and their connections with one another. Countries like the People's Republic of China, the United States, Germany, the United Kingdom, and Australia stand out as the most influential, evidenced by the large node size and prominent labels. These countries have the highest number of collaborations or citations with other countries in the network, indicating their central role in global research. The network's modularity score of 0.6155 suggests that the network has a modular structure, meaning that there are several communities or clusters of countries that are more closely connected internally. A silhouette score of 1 indicates that these clusters have a well-defined and distinct structure within the network.

Figure 9. Visualization of collaboration countries network



Source: Authors' elaboration using CiteSpace.

This analysis illustrates how countries have collaborated in global research over the past decade. Countries like the People's Republic of China, the United States, and Germany emerge as key hubs within this collaboration network, underscoring their crucial roles in the dissemination of knowledge and their influence in global research. This visualization helps to clarify the dynamics of international

collaboration and the significant roles played by leading countries in the research landscape.

In terms of citation burst analysis in countries, Table 2 highlights the top 10 countries that experienced the strongest citation bursts in research from 2013 to 2023. Each country is represented with its burst strength, along with the start and end years of its citation surge.

Table 2. Citation bursts by country from 2013 to 2023

Authors	Year	Strength	Begin	End	2013-2023
USA	2013	5.35	2013	2020	
Australia	2013	2.5	2013	2016	
Japan	2015	2.16	2015	2020	
Netherlands	2013	1.81	2013	2016	
Switzerland	2013	1.45	2013	2020	
Denmark	2013	1.3	2013	2020	
Thailand	2017	1.83	2017	2020	
Finland	2014	1.55	2017	2020	
Chile	2018	1.55	2021	2023	
Singapore	2018	1.25	2021	2023	

Source: Authors' elaboration using CiteSpace.

The United States exhibited the strongest citation burst, with a strength of 5.35, lasting seven years from 2013 to 2020. This indicates that research from the USA was highly influential and frequently cited during that period. Following the United States, Australia experienced a citation burst with a strength of 2.5 from 2013 to 2016, reflecting significant influence during that time. Japan ranked next, with a citation burst strength of 2.16, spanning from 2015 to 2020, showing an increase in the influence of Japanese research over those five years. The Netherlands also demonstrated a notable citation burst with a strength of 1.81 from 2013 to 2016.

This analysis reveals that the United States had the greatest impact in global research with the strongest citation burst. Countries like Australia, Japan, and the Netherlands also made significant contributions during the analyzed period. The citation bursts in these countries reflect their substantial influence and the relevance of their research in the international academic community over the past decade.

4.2. Co-citation analysis in law strengthening and governance research

Co-citation analysis can reveal the internal relationships within scientific literature and illustrate the dynamic structure of scientific development. Co-citation refers to the fact that two documents are linked to one or more other documents and can be used to explore document relationships, literature retrieval, and the structure of the literature. For two documents that share a co-citation relationship, the co-citation characteristic indicates that they are always in a passive position; their relationship is contingent upon being cited by another document. Therefore, this method is more suitable for studying subjects that have continuously evolving and dynamic characteristics.

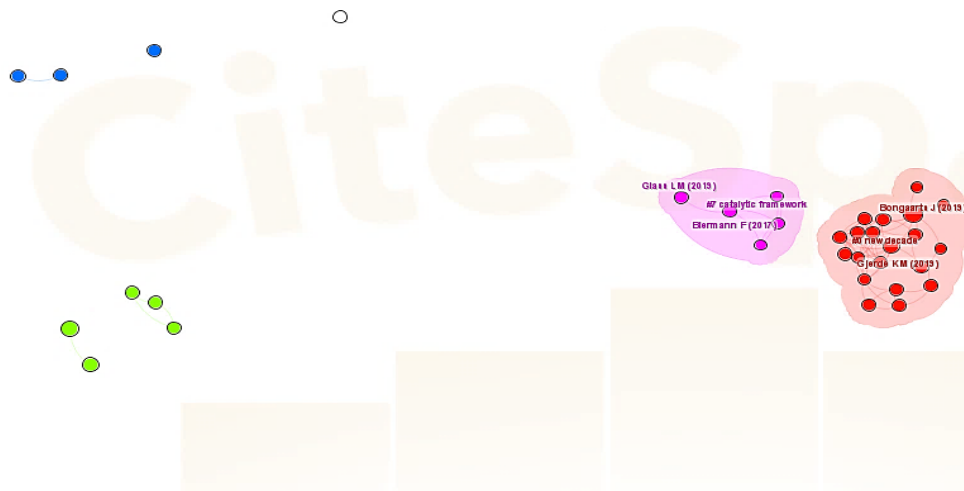
Research in law strengthening and governance is a dynamic field of science that is constantly changing. This article has conducted a co-citation analysis on documents, authors, and journals to investigate the pathways of research development. We aim to understand the knowledge base and identify the key players in this field.

4.2.1. Analysis of document co-citation networks in law strengthening and governance research

Traditional document reviews, based on narrative, are qualitative and rely heavily on individual judgments and explanations. In contrast, CiteSpace software facilitates co-citation analysis of documents, which can visualize non-descriptive assessments and complement traditional methods, making them more robust and persuasive. Co-citation analysis helps identify key literature in the field of strengthening law and governance. Figure 10 presents the overall document co-citation network, consisting of 178 nodes and 354 links, with a network density of 0.0225. This low network density indicates that while there are connections between nodes, the network is not very dense.

The modularity value (modularity Q) of 0.7978 suggests that the network has a good community structure, with groups of nodes being more closely connected to each other than to nodes outside their group. The weighted mean silhouette S value of 0.9949 indicates that the clusters within the network are well-defined, with nodes within each cluster being more similar to each other compared to nodes from other clusters. This is supported by the harmonic mean (Q, S) of 0.8855, which shows a good balance between modularity and cluster cohesion. No nodes were pruned or excluded from the analysis, ensuring that all elements within the network were considered in these results.

Figure 10. Visualization of collaboration co-citation network



Source: Authors' elaboration using CiteSpace.

Based on the visualization provided by the software, the network diagram reveals several distinct clusters of nodes with clearly defined relationships within each cluster. Figure 10 displays the distribution of nodes representing citation references in the identified research literature. Nodes colored in red, green, and blue indicate primary clusters formed based on similar citation

references. For instance, the dominant red cluster, with densely packed nodes, signifies a highly interconnected community of references, indicating research topics or themes that are frequently cited and hold significant relevance in the literature. Names like Bongaarts J. (2019) appear as central nodes, reflecting that this work is frequently cited in related research.

Nodes colored green and blue also represent other reference groups, but with lower levels of connectivity compared to the red cluster. This suggests more specific or less frequently cited research topics compared to those in the red cluster. Purple nodes highlight focused topics with works such as Glass L. M. (2019) and Biermann F. (2012), which are also significant references in their

respective fields. Overall, this network analysis illustrates citation patterns within the identified research literature, showcasing dominant research topics or themes and the relevance of specific references within the academic community. It aids in understanding the structure of the literature and identifying key works in the field of study.

Figure 11. A timeline map of the references in the research on strengthening law and governance



Source: Authors' elaboration using CiteSpace.

Based on the temporal network visualization from CiteSpace software shown in Figure 11, we can observe the evolution of citation relationships from 2013 to 2023. The network comprises 124 nodes and 195 links, with a network density of 0.0195. These nodes represent references in the identified literature, with node size indicating citation frequency. The links between nodes illustrate the citation relationships among references. Three main topics identified within this network are “usa” (#0), “international health” (#4), and “global health” (#7). Each of these topics plays a significant role in the literature on global and international health. Larger and more connected nodes indicate more frequently cited references and serve as central points in the network, highlighting their significant contributions to the research field.

The main nodes in the “usa” (#0) cluster include references such as Brownell KD and Fryar CD. This cluster represents a focus on health policy and obesity research in the United States. In the “international health” (#4) cluster, references like WHO and Moon S are central, emphasizing the importance of reports and studies conducted by the World Health Organization (WHO) in international health literature. This cluster reflects research focused on global health policy and responses to pandemics. The “global health” (#7) cluster, featuring references like Biermann F and Frenk J, highlights a focus on broader global health issues, including environmental health policies and global health system reforms. These nodes show strong inter-references, indicating that research within this cluster is interrelated and forms a significant knowledge base in global health.

The network's modularity (modularity Q) of 0.8573 indicates a well-structured community with references grouped according to specific themes or topics. The weighted mean silhouette S value of 0.9787 suggests that the clusters are well-defined, with nodes within each cluster being more similar to each other than to those in other clusters. The harmonic mean (Q, S) of 0.9139 indicates a good balance between modularity and cluster cohesion. Overall, this analysis illustrates how key topics in global and international health have developed and interconnected over the analyzed period, with certain references emerging as central in

the literature. This aids in understanding the evolution of research and major contributions in the field.

4.2.2. Analysis of author co-citation network in strengthening law and governance

Analyzing author co-citation, we can identify influential figures in the field of strengthening law and governance, as well as provide references for recognizing talent in specific institutions. This network includes 266 nodes and 833 links, with a network density of 0.0236. The network identifies references in the literature from 2013 to 2023. Based on the data presented, the top 10 authors with the strongest citation strengths from 2013 to 2023 reveal several interesting patterns.

Slaughter AM (2014) shows the strongest citation strength with a strength of 4.21 from 2014 to 2017, followed by Gompers P (2014) with a strength of 3.7 during the same period. Raustiala K (2013) and Bernstein S (2014) each experienced citation strengths with strengths of 3.37 and 2.95 from 2013 to 2017. Habermas J (2014) also received significant attention in the literature from 2014 to 2017 with a strength of 3.27.

Majone Giandomenico (2013) and the European Commission (2013) experienced citation strengths starting in 2013 and ending in 2017, with strengths of 2.9 and 2.64, respectively, indicating significant attention to documents published by the European Commission. The United Nations (2018) saw a citation strength starting in 2018 and continuing through 2023 with a strength of 3.12, highlighting the relevance of their reports and publications during this period. LaPorta R (2020) experienced a significant citation strength from 2020 to 2022 with a strength of 2.94, showing increased attention to his work over these two years.

Finally, Bongaarts J (2021) had a strong citation strength from 2021 to 2023 with a strength of 2.76, indicating that his work received considerable attention in the most recent period. These authors show different periods of citation strengths, with some receiving significant attention in the same periods, reflecting the relevance and impact of their works within the scholarly community during specific times.

Table 3. Top 10 authors with citation strength

Authors	Year	Strength	Begin	End	2013-2023
Slaughter, A.M.	2014	4.21	2014	2017	
Gompers, P.	2014	3.7	2014	2017	
Raustiala, K.	2013	3.37	2013	2017	
Habermas, J.	2014	3.27	2014	2017	
Bernstein, S.	2013	2.95	2013	2017	
Majone, Glandomenico	2013	2.9	2013	2017	
European Commission	2013	2.64	2013	2017	
United Nations	2013	3.12	2018	2023	
Laporta, R.	2020	2.94	2020	2022	
Bongaarts, J.	2021	2.76	2021	2023	

Source: Authors' elaboration using CiteSpace.

Overall, the red line indicates the periods during which each author experienced significant citation strengths, while the blue line represents periods without significant citation increases. These periods reflect the times when the authors' works garnered substantial attention within the scientific community, particularly in research published in 2013 and 2021, demonstrating that this trend continues to the present day.

4.2.3. Analysis of journal co-citation network in strengthening law and governance

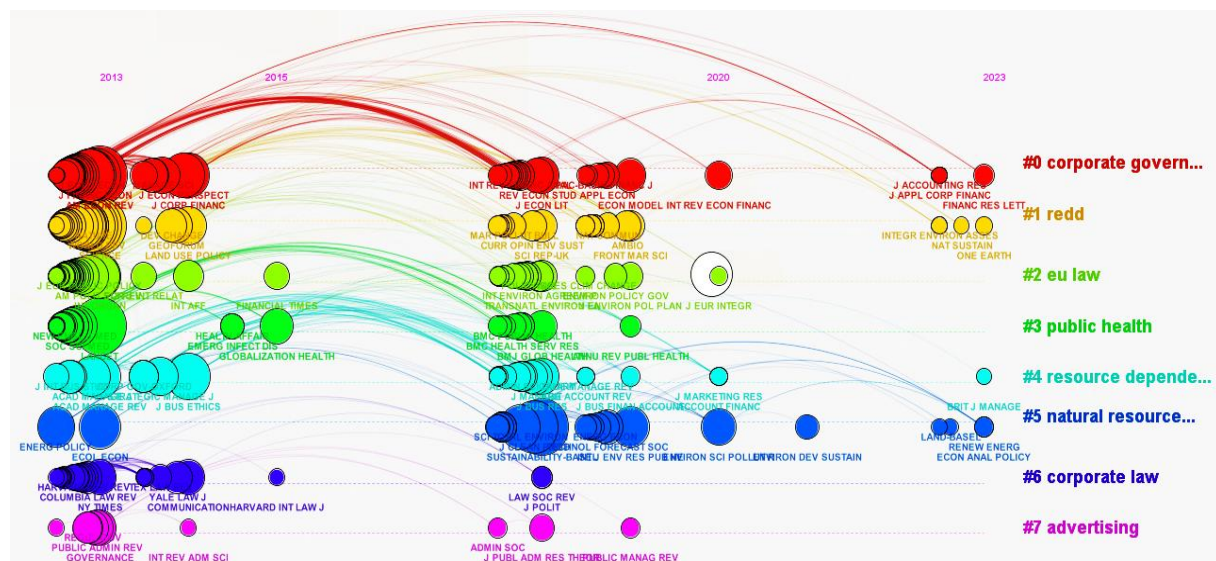
The research literature on strengthening law and governance originates from various journals. Understanding the distribution of core journals in this field can help provide a valid foundation for literature collection. The main journal clusters in the research on strengthening law and governance were revealed within the analyzed literature network, covering the period from 2013 to 2023, comprising a total of 285 nodes and 1079 links, indicating a network density of 0.0267. The largest cluster consists of 253 nodes (88% of the total nodes), signifying a significant concentration within a particular theme or topic.

The visualization shows the literature network from 2013 to 2023, with various topic clusters marked in different colors. Each node represents a journal or article interconnected by citations, with the node size reflecting the citation frequency. The red cluster (#0), focused on "corporate governance", is the largest and most dominant

cluster, indicating that this topic has garnered significant attention in the literature. The yellow cluster (#1) focuses on "redd" (reducing emissions from deforestation and forest degradation), highlighting the importance of research related to climate change and environmental policy. The green cluster (#2) includes "eu law", signaling significant attention to European Union law in research. The light green cluster (#3) focuses on "public health", reflecting the attention to public health in scientific literature. The cyan cluster (#4) relates to "resource dependence", indicating the relationship between resource dependence and various economic or social factors.

The blue cluster (#5) focuses on "natural resource management", emphasizing research related to the management of natural resources. The purple cluster (#6) includes "corporate law", indicating attention to corporate law. The pink cluster (#7) is related to "advertising", showing the relevance of research in the field of advertising. Each cluster illustrates how these topics have evolved and interconnected with one another in the scientific literature over the past decade. Overall, this visualization provides a comprehensive overview of the research landscape in various fields, highlighting key topics and how they are connected through citations in scientific literature. This analysis helps to understand the structure and dynamics of research during the analyzed period, showing which topics are most prominent and how they interact with each other.

Figure 12. An overlay of the cited journals in strengthening law and governance research



Source: Authors' elaboration using CiteSpace.

5. CONCLUSION

This article provides a scientific review of 854 articles on strengthening law and governance based on the WoS data from 2013 to 2023, using CiteSpace software. Several useful conclusions have been drawn through citation analysis, co-citation analysis, and co-occurrence analysis. By identifying major clusters, the strongest citation bursts, and citation patterns, we can discern the most prominent and relevant topics in the literature and how they are interconnected. The Environmental Studies category has the highest number of publications, with 171 publications, accounting for 19.565% of the total 874 publications, indicating a strong focus on environmental studies in the analyzed publications. The Law category is also highly dominant, with 167 publications or 19.108%. The main research directions in strengthening law and governance are Environmental Sciences Ecology with 256 (29.291%), Government Law with 235 (26.888%), and Business Economics with 196 (22.426%). In the institutional collaboration network analysis, the University of California and University of London emerged as the largest and most prominent nodes in the network. Regarding research collaboration and their interconnections, the People's Republic of China, the United States, Germany, the United Kingdom, and Australia are the countries with the most significant influence. Based on the cited reference results, three main topics identified in this network are "usa" (#0), "international health" (#4), and "global health" (#7). This analysis is highly valuable for researchers and academics in identifying research trends, influential authors, and key topics that should be considered in future research.

In summary, scientometric analysis is crucial for identifying potential relationships between literature and exploring the evolution of knowledge in strengthening law and governance research. However, it should be noted that there are still some limitations in this study. For instance, keywords were not comprehensive when searching for data, which may have led to the omission of some data. To verify the accuracy of the research results and broaden the scope, data collection using different related terms, conducting specific research on one or more core journals in this field based on CiteSpace, or using other scientometric tools for analysis is recommended in further studies.

The research findings emphasize the growing academic interest in law strengthening and governance, the comprehensive network visualization, particularly through citation analysis and co-citation networks, reveals a dynamic landscape of scholarly collaboration and knowledge dissemination. The interconnectedness of authors, institutions, and countries underscores the global nature of legal research, highlighting the need for transnational cooperation in strengthening governance frameworks, furthermore, the identification of emerging research trends, particularly in global and international health, underscores the interdisciplinary nature of law and governance studies. This convergence of fields suggests that future research should integrate legal, social, and public health perspectives to create more comprehensive policies. These findings contribute significantly to legal policymaking by providing empirical evidence that can guide institutional reforms and international governance strategies.

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