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GOVERNANCE APPROACH IN INSTITUTIONAL DECISION-MAKING TOWARDS SUSTAINABLE DEVELOPMENT: A BIBLIOMETRIC ANALYSIS OF GLOBAL PATTERNS AND TRENDS

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ABSTRACT

This bibliometric analysis investigates governance approaches within institutional decision-making for sustainable development. Understanding the global trends, influential actors, and interdisciplinary collaborations shaping this crucial research area is a significant challenge. To address this challenge, a comprehensive bibliometric study was conducted utilizing Scopus and VOSviewer software, analyzing a dataset of 1800 documents published between 2003 and 2023. The analysis examined publication trends, identifying prominent authors and their affiliated institutions and characterizing the subject areas contributing to the field. Further investigations mapped keyword co-occurrence networks to highlight key research themes and explored the geographical distribution of research output to reveal patterns of international collaboration. Results indicate a substantial growth in publications over the past two decades, with a concentration of research in specific geographic regions and a strong emphasis on sustainability, environmental governance, and institutional decision-making processes within the analyzed literature. These findings provide valuable insights into the evolution of research in this critical area, highlighting dominant themes and collaborations and identifying potential areas for future research. The study contributes to a broader understanding of effective governance strategies for achieving sustainable development goals on a global scale.

1. INTRODUCTION

Governance approaches in institutional decision-making towards sustainable development have evolved significantly, particularly with the introduction of the United Nations Sustainable Development Goals (SDGs). The SDGs represent a novel governance strategy characterized by goal-setting rather than traditional rule-making. This inclusive and non-binding approach allows states considerable flexibility in achieving these goals. The success of the SDGs hinges on several institutional factors, including the formalization of commitments by states, the strengthening of global governance arrangements, and the integration of these global ambitions into national policies. Additionally, the role of research communities is crucial in measuring progress, aligning goals with existing governance frameworks, and integrating economic, social, and environmental dimensions (Biermann, Kanie, and Kim, 2017; Kanie *et al.,* 2019; Popescu and Mandru, 2022).

In higher education institutions, governance is pivotal in implementing sustainable development measures. Effective governance in this context involves reliable and accountable policy frameworks, adequate resources, and the integration of sustainability into institutional strategies. Empirical studies have shown that governance influences how these institutions perceive and practice sustainability. Key factors include sustainable development policies, organizational structures, budget allocations, and staff training. Despite varying opinions on the role of governance, it is generally regarded as essential for supporting higher education institutions in embedding sustainability into their operations and decision-making processes (Genus, 2014; Leal Filho *et al.,* 2021; Derk Loorbach, 2010).

2. LITERATURE REVIEW

The governance approach in institutional decision-making is pivotal in achieving sustainable development, as evidenced by recent research highlighting multifaceted relationships between governance structures, stakeholder engagement, and environmental outcomes. The 2030 Agenda posits that democracy, good governance, and the rule of law are critical for sustainable development (Pickering, 2023). The interplay between governance and environmental sustainability shows distinct patterns across various regions, influenced by institutional practices, community engagement, and the convergence of global challenges. Notably, Bahraseman *et al.* argue for a holistic approach to water governance, emphasizing that traditional systems are being overlooked in favor of modern methods, resulting in a potential loss of community resilience (Bahraseman *et al.,* 2024). In this context, the need for multi-actor engagement is underscored, as effective governance frameworks allow diverse stakeholders to participate, ensuring that their voices are considered in decision-making processes. One emerging trend is transitioning from technical fixes to integrative governance frameworks emphasizing local participation and contextual solutions. As Wilson notes, improving waste and resource management globally calls for understanding historical governance practices, which have often needed help to engage communities effectively in policy formulation (Wilson, 2023). Coruhlu and Altas further suggest that employing modern technology such as Geographic Information Systems (GIS) is essential for systematic planning and management of urban infrastructure, which includes promoting sustainable practices in resource allocation (Coruhlu and Altas 2024). The shift towards incorporating technological solutions into governance frameworks demonstrates the potential for better data-

driven decision-making. However, it also poses challenges regarding accessibility and inclusivity for marginalized communities.

The examination of governance approaches reveals both strengths and weaknesses in existing literature. Meanwhile, many studies advocate for collaborative governance to achieve sustainable outcomes. A consistent critique is the ongoing "democratic deficit" present in many institutional frameworks, particularly in the Global South (De la Mora-De la Mora, 2023). The findings illustrate that political structures often fail to engage local populations, leading to a disconnect between policies and the communities they affect. For instance, González-García *et al.* emphasize the importance of governance mechanisms that intertwine local perspectives with broader policy objectives, advocating for a blended strategy that enhances both inclusivity and effectiveness in governance (González-García, Díaz-Pastor, and Moreno-Romero 2023). This recognition of local voices as critical sources of knowledge in sustainability practices points towards a significant gap in the literature concerning stakeholder empowerment. Future research must address the identified gaps regarding applying indigenous knowledge and traditional governance systems in contemporary decision-making processes. Utami and Oue highlighted the importance of traditional values in irrigation management in Indonesia, suggesting that incorporating such perspectives could enhance the viability of modern governance frameworks (Utami and Oue, 2023). Here, the role of educational initiatives aimed at fostering understanding and appreciation of indigenous practices becomes crucial, paving the way for collaborative governance models that harmonize modern and traditional approaches (Singhania *et al.,* 2024). The necessity for such frameworks becomes increasingly apparent in light of climate challenges, as highlighted by Zhang and Bai, where governance that is sensitive to local contexts is paramount for effective climate action (Zhang and Bai, 2023).

In conclusion, the literature surrounding governance approaches in institutional decision-making reveals a growing recognition of the necessity for inclusive, participatory frameworks emphasizing local knowledge and engagement. Meanwhile, significant strides have been made toward integrating such principles into sustainability practices, but systemic issues persist, indicating a pressing need for continued research and innovative policy interventions. Addressing these gaps will enhance the quality of governance and promote sustainable development across diverse contexts.

3. RESEARCH QUESTIONS

Our approach to finding, collecting, and presenting the data is shaped by our research questions, the overall goals of this paper, what we hope to achieve, and who we hope will read it. We are aiming to answer several critical questions in this work:

- What are the trends in governance approach in institutional decision-making towards sustainable development studies according to the year of publication?
- What are the most cited articles?
- What are the popular keywords related to the study during the last twenty years?
- Who and how much has been published in the area with regard to the authors, their affiliated organizations and countries?
- What are co-authorship countries' collaboration?

4. METHODOLOGY

Imagine trying to understand a vast and complex field like sustainable development governance. To make sense of it all, we need a way to organize and analyze the research that's been done. That is where bibliometrics comes in—it is like using a robust magnifying glass and a detailed map to explore the landscape of scientific publications (Alves, Borges, and De Nadae, 2021; Assyakur and Rosa, 2022; Verbeek *et al.,* 2002). We looked at things like which journals published the most articles when the research was done and who the key authors were (Wu and Wu, 2017). It also comprises complex techniques, such as document co-citation analysis. A successful literature review necessitates an iterative process involving the identification of appropriate keywords, a literature search, and a thorough analysis to build a comprehensive bibliography and yield dependable results (Fahimnia, Sarkis, and Davarzani, 2015).

We even used some sophisticated techniques to see how different papers related to each other. To build a solid understanding, we needed a systematic approach, which is identifying the right keywords, searching for relevant articles, and carefully analyzing the results to create a complete picture (Al-Khoury *et al.,* 2022; Khiste and Paithankar, 2017; di Stefano, Peteraf, and Veronay, 2010). We focused on the most influential research published in top academic journals to get the clearest insights into the field's major theoretical developments. To ensure our data was accurate and reliable, we used the Scopus database—a well-respected resource known for its comprehensive coverage—and only included articles rigorously reviewed by experts, leaving out less formal materials like books and lecture notes (Gu *et al.,* 2019). Notably, Elsevier's Scopus, known for its extensive coverage, facilitated the collection of publications spanning from 2003 to December 2023 for subsequent analysis.

4.1 Data search strategy

A data searching strategy in Scopus for bibliometric analysis requires a systematic and carefully planned approach to ensure the retrieval of a comprehensive and relevant dataset for our study. The process isn't simply about typing keywords into the search bar; it's about strategically utilizing Scopus's advanced search features to refine our results and minimize bias. Table 1 and Table 2 show the search string for the bibliometric analysis study. The search aims to identify English-language articles published between 2003 and 2023 that discuss governance or institutions, decision-making, and sustainable development. The use of phrase searching ("decision making," "sustainable development") increases the precision. However, the DOCTYPE filter requires clarification or correction to ensure accurate results. The unexpected DOCTYPE, "ar," requires investigation to determine what document type it inadvertently or correctly selects. A corrected DOCTYPE code, like ar for articles, would be more useful.

Table 1: The search string

Scopus	TITLE-ABS-KEY ((governance* OR institution*) AND ("decision-making") AND ("sustainable development")) AND PUBYEAR > 2002 AND PUBYEAR < 2024 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (DOCTYPE, "ar")).

Table 2: The selection criterion in searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Timeline	2003–2023	< 2003
Literature type	Journal (Article) only	Conference Paper, Book, Review

4.2 Data analysis

Imagine trying to make sense of a huge collection of research papers. It can feel overwhelming! VOSviewer is like having a brilliant research assistant that takes all that complex data and transforms it into clear, easy-to-understand pictures. Developed by researchers at Leiden University, this software is designed to be user-friendly, even for those new to bibliometrics (van Eck and Waltman, 2010, 2017). It creates visual networks that show how different papers, authors, and keywords are connected, making it much easier to spot trends and patterns. Think of it as a powerful tool for exploring the relationships within a field of study. VOSviewer's strength lies in turning complicated data into insightful visuals. It cleverly groups similar items, highlighting key themes and relationships between keywords. Its intuitive interface makes it easy to use, whether for a seasoned researcher or just starting. The software constantly improves, so researchers always have access to the latest tools and features. This makes it incredibly versatile and can analyze different types of networks, such as who collaborates with whom, which papers are most influential, or which keywords appear together most often. It is an indispensable tool for anyone seeking a deeper understanding of their research area.

Datasets comprising information on the publication year, title, author name, journal, citation, and keywords in PlainText format were procured from the Scopus database, spanning the period from 2003 to December 2023. These datasets were then analyzed using VOSviewer software version 1.6.20. Through VOS clustering and mapping techniques, this software facilitated the examination and generation of maps. Offering an alternative to the Multidimensional Scaling (MDS) approach, VOSviewer focuses on situating items within low-dimensional spaces, ensuring that the proximity between any two items accurately reflects their relatedness and similarity (van Eck and Waltman 2010). In this respect, VOSviewer shares a similarity with the MDS approach (Appio, Cesaroni, and Di Minin 2014). Diverging from MDS, which primarily engages in the computation of similarity metrics like cosine and Jaccard indices, VOS utilizes a more fitting method for normalizing co-occurrence frequencies such as the association strength (AS_{ij}), and it is calculated by Equation (1) (Van Eck and Waltman, 2007):

$$AS_{ij} = \frac{C_{ij}}{W_i w_j},$$
(1)

which is "proportional to the ratio between, on the one hand, the observed number of co-occurrences of i and j and on the other hand, the expected number of co-occurrences of i and j under the assumption that co-occurrences of i and j are statistically independent" (Van Eck and Waltman, 2010, p. 531). Hence, with the help of this index, the VOSviewer places items in the form of a map after reducing the weighted sum of the squared distances between all item pairs. According to Appio *et al.*, the LinLog/modularity normalization was implemented. Furthermore, by applying

visualisation techniques through VOSviewer to the data set, patterns built on mathematical relationships were uncovered, and analyses such as keyword co-occurrence, citation analysis, and co-citation analysis were performed (Appio *et al.* 2016).

5. RESULT AND FINDING
This study analyses research trends using bibliometric techniques, revealing key themes, influential actors, and geographical collaboration patterns.

5.1 Research trends according to the year of publication
Figure 1 shows a clear upward trend in the number of documents published from 2003 to 2023, according to Scopus data. In 2003, the number of documents was around 40, gradually increasing to about 80 by 2009. The growth accelerated after 2011, reaching around 100 documents by 2013 and over 200 by 2017.
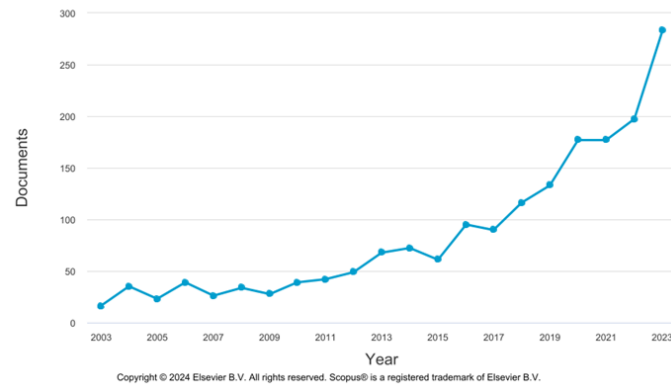
Figure 1: Plotting document publication by years

The most significant increase occurred from 2019 to 2021, with the number of documents growing from around 150 to nearly 300. The latest data point in 2023 indicates a further rise in published documents. The consistent upward trend suggests increasing scholarly interest and research activity in the field of "Governance Approach in Institutional Decision-Making Towards Sustainable Development" over the past two decades. This growth may be attributed to the growing recognition of the importance of sustainable development and the role of governance in institutional decision-making processes.

5.2 The most cited articles
Figure 2 and Table 3 show a bar graph and table of the top 10 prolific authors in this field, along with the number of published documents. The authors with the most publications are Sarkis, J., Söderbaum, P., and Tseng, M.L., with six documents. The most prolific authors are Happaerts, S., and Hugé, J., who have each published five documents. The remaining authors on the list have published four documents.
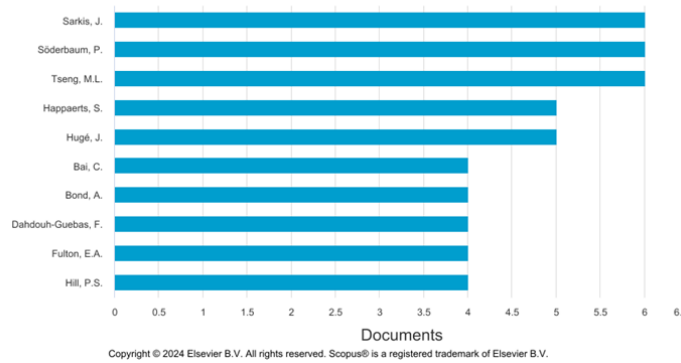
Figure 2: Authors with the most cited articles

Table 3: Authors with the most cited articles

Author Name	Number of Document	Percentage (%)
Sarkis, J.	6	0.33
Söderbaum, P.	6	0.33
Tseng, M.L.	6	0.33
Happaerts, S.	5	0.28
Hugé, J.	5	0.28
Bai, C.	4	0.22
Bond, A.	4	0.22
Dahdouh-Guebas, F.	4	0.22
Fulton, E.A.	4	0.22
Hill, P.S.	4	0.22

The data might suggest active collaboration networks among these authors, potentially indicating partnerships or affiliations that drive research productivity. High document counts can reflect these authors' established influence and expertise in their respective areas, possibly positioning them as thought leaders. Emerging researchers or institutions might consider collaborating with these authors to leverage their insights, enhance their research impact, and capitalize on established networks. Understanding the contributions of each author can facilitate efforts to track significant research developments and identify potential mentors or collaborators in the field.

5.3 Type of documents by subject of research
Figure 3 shows the distribution of documents by subject area for the "Governance Approach in Institutional Decision-Making Towards Sustainable Development" research topic based on Scopus data. The largest share, at 26.9%, is in the "Environmental Science" subject area and suggests a significant focus on the environmental aspects and implications of governance approaches in institutional decision-making related to sustainable development.
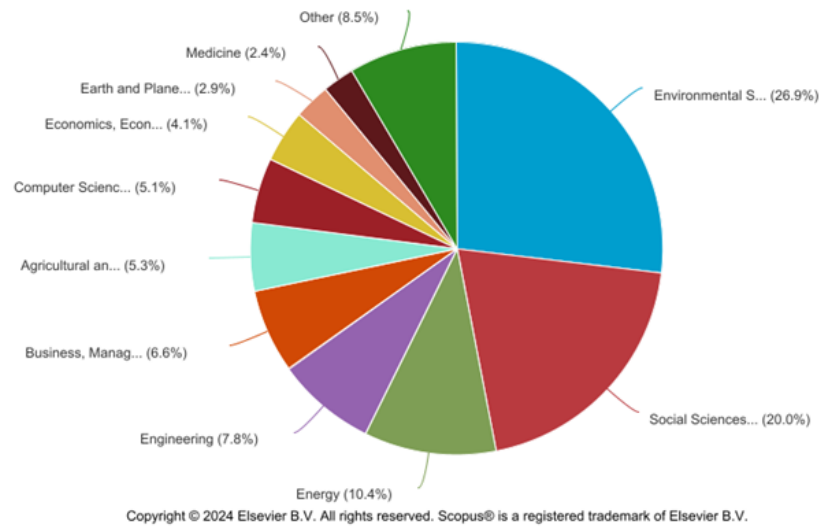
Figure 3: The type of documents by subject of research

The next largest subject areas are "Social Sciences" (20.0%), "Energy" (10.4%), "Engineering" (7.8%), "Business, Management and Accounting" (6.6%), and "Agricultural and Biological Sciences" (5.3%). These areas indicate that the research on this topic spans various disciplines, including social sciences, energy, engineering, business, and agriculture, reflecting the interdisciplinary nature of sustainable development and governance. The remaining subject areas, such as "Computer Science" (5.1%), "Economics, Econometrics and Finance" (4.1%), "Earth and Planetary Sciences" (2.9%), "Medicine" (2.4%), and "Other" (8.5%), account for smaller proportions of the research publications and suggest these areas have a less prominent but still relevant role in the overall research landscape on the given topic. The diverse distribution of subject areas highlights the multidisciplinary nature of the research on "Governance Approach in Institutional Decision-Making Towards Sustainable Development," reflecting the complex and interconnected challenges in achieving sustainable development through effective governance practices.

5.4 The most top authors based on citation by research
Table 4 dataset presents the top ten most-cited governance, decision-making, and sustainable development publications. A clear trend emerges: the most highly cited papers (Cash *et al.,* 2003; Loorbach, 2010; Wise *et al.,* 2014) significantly predate many others, suggesting they established foundational concepts or methodologies widely adopted within the field. The high citation counts for these earlier publications indicate their enduring relevance and continued influence on current research. The relatively lower citation counts for more recent works (e.g., Dietze *et al.,* 2018) may reflect their more recent publication date and the time lag required for scholarly impact to manifest fully. However, even these more recent works still exhibit noteworthy citation numbers, suggesting contributions to specific, emerging areas within sustainable development governance.

Table 4: The top 10 authors based on citation by research

Authors	Title	Year	Source Title	Cited by
Cash D.W.; Clark W.C.; Alcock F.; Dickson N.M.; Eckley N.; Guston D.H.; Jäger J.; Mitchell R.B. (Cash *et al.,* 2003)	Knowledge systems for sustainable development	2003	Proceedings of the National Academy of Sciences of the United States of America	2548
Loorbach D. (D Loorbach 2010)	Transition management for sustainable development: A prescriptive, complexity-based governance framework	2010	Governance	1099
Wise R.M.; Fazey I.; Stafford Smith M.; Park S.E.; Eakin H.C.; Archer Van Garderen E.R.M.; Campbell B. (Wise *et al.,* 2014)	Reconceptualizing adaptation to climate change as part of pathways of change and response	2014	Global Environmental Change	705
Wu Z.; Pagell M. (Wu and Pagell 2011)	Balancing priorities: Decision-making in sustainable supply chain management	2011	Journal of Operations Management	680
Prno J.; Scott Slocombe D. (Prno and Scott Slocombe 2012)	Exploring the origins of 'social license to operate' in the mining sector: Perspectives from governance and sustainability theories	2012	Resources Policy	607
Shen L.-Y.; Jorge Ochoa J.; Shah M.N.; Zhang X. (Shen *et al.,* 2011)	The application of urban sustainability indicators - A comparison between various practices	2011	Habitat International	538
Foley M.M.; Halpern B.S.; Micheli F.; Armsby M.H.; Caldwell M.R.; Crain C.M.; *et al.,* (Foley *et al.,* 2010)	Guiding ecological principles for marine spatial planning	2010	Marine Policy	441
Argyres N.S.; Silverman B.S. (Argyres and Silverman 2004)	R&D, organization structure, and the development of corporate technological knowledge	2004	Strategic Management Journal	413
Kemp R.; Parto S.; Gibson R.B. (Kemp, Parto, and Gibson 2005)	Governance for sustainable development: Moving from theory to practice	2005	International Journal of Sustainable Development	404
Dietze M.C.; Fox A.; Beck-Johnson L.M.; Betancourt J.L.; Hooten M.B.; Jarnevich C.S.; Keitt T.H.; *et al.,* (Dietze *et al.,* 2018)	Iterative near-term ecological forecasting: Needs, opportunities, and challenges	2018	Proceedings of the National Academy of Sciences of the United States of America	396

The diversity of journal sources (Proceedings of the National Academy of Sciences, Governance, Global Environmental Change, etc.) highlights the field's interdisciplinary nature, drawing on insights from ecology, management, operations research, and political science. The papers cover a broad spectrum of topics, including knowledge systems for sustainability, transition management frameworks, climate change adaptation, supply chain decision-making, and ecological forecasting. The

high citation counts suggest these publications provide crucial theoretical underpinnings, practical methodologies, or significant empirical evidence used across various sustainable development governance research subfields. The distribution of publication years highlights the evolving research agenda, with some foundational works establishing long-lasting impacts while newer publications address more contemporary challenges.

5.5 Popular keywords related to the study

The bibliometric analysis in Figure 4 reveals a strong emphasis on sustainability and its related concepts within the literature on governance approaches to institutional decision-making. Keywords like "sustainable development" (163 occurrences, 198 total link strength), "sustainability" (136 occurrences, 150 total link strength), and "governance" (75 occurrences, 114 total link strength) dominate the dataset, highlighting the central theme of the research area. The high link strength of these keywords suggests a strong interconnectedness between these concepts within the analyzed publications. It indicates a robust body of research focusing on the intersection of sustainability and governance.

Figure 4: Network visualization map of keywords' governance, decision-making, and sustainable development

Much of the research also focuses on environmental management and policy aspects. Terms like "environmental management" (6 occurrences, 11 link strength), "environmental governance" (9 occurrences, nine link strength), and "environmental impact assessment" (8 occurrences, nine link strength) appear frequently, suggesting a concentration on the environmental dimensions of sustainable development. The presence of keywords such as "climate change" (24 occurrences, 50 link strength) and "adaptation" (13 occurrences, 22 link strength) underscores the growing concern with climate change impacts and the need for adaptive governance strategies. Furthermore, the inclusion of keywords like "risk assessment" (7 occurrences, eight link strength) and "risk management" (6 occurrences, seven link strength) indicates that the management of uncertainties and risks is a crucial consideration within the field.

The data also reflects a focus on institutional aspects and decision-making processes. Keywords such as "decision-making" (31 occurrences, 53 link strength),

"institutions" (13 occurrences, 18 link strength), and "institutional theory" (9 occurrences, six link strength) are notable. It suggests a strong interest in understanding how institutional structures and decision-making processes influence the implementation of sustainable development goals. The high frequency of "governance" and its related terms highlights the critical role of governance structures and mechanisms in navigating complex challenges and achieving sustainability objectives. The analysis provides valuable insights into the field's dominant themes and research priorities.

5.6 Co-authorship countries' collaboration

Figure 5 provides a geographical distribution of publications on governance approaches to institutional decision-making for sustainable development. The United States (158 documents, 14047 citations, 222 total link strength) and the United Kingdom (171 documents, 10643 citations, 275 total link strength) are clear leaders, indicating significant research concentration in these countries. Other high-performing nations include Canada, Germany, and the Netherlands, suggesting a strong presence of research activity in North America and Western Europe. The total link strength, representing the interconnectedness of publications within each country, also reveals variations across regions, with some countries having a higher internal research network level than others.
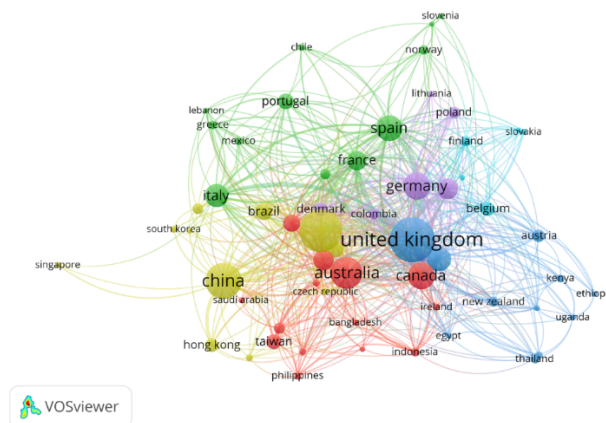

Figure 5: The countries whose authors collaborate on governance decision-making towards sustainable development

Meanwhile, some developed nations dominate the research output, and several developing countries also show a notable presence, although at a smaller scale. Countries such as India, China, and Brazil demonstrate substantial contributions (47, 120, and 36 documents), reflecting the increasing global interest in governance and sustainable development challenges in diverse contexts. It suggests that research is expanding beyond traditionally dominant regions and incorporating diverse perspectives from emerging economies where the impacts of unsustainable practices are often acutely felt. The presence of these countries indicates a growing recognition of the global relevance of sustainable development and the crucial role of effective governance.

The disparity in document counts and total link strength across countries highlights the uneven distribution of research capacity and resources globally. Further analysis could explore potential reasons for these differences, including funding

availability, institutional support for research, and access to relevant information and technologies. Future research could also investigate the specific focuses within each country's research output to understand if priorities differ based on geopolitical and socio-economic contexts. This geographic disparity warrants attention to ensure more equitable and representative research efforts, contributing to a more holistic understanding of effective governance approaches for sustainable development worldwide.

5.7 Network mapping based on co-authorship by countries
Figure 6 illustrates the geographic distribution of research output on governance approaches within institutional decision-making for sustainable development. The United States and the United Kingdom exhibit substantially higher numbers of documents and citations, along with significantly greater total link strength, than other nations, and this suggests a concentration of research activity and established networks in these two countries. Other Western European nations and Canada also show a relatively strong presence. Several developing nations demonstrate a notable, albeit comparatively smaller, research contribution. Countries like China, India, and Brazil have produced many documents highlighting a growing global interest in applying governance approaches to sustainable development challenges in diverse settings. However, their lower total link strength compared to leading nations suggests a less developed internal research network, potentially indicating opportunities for greater collaboration within these regions.
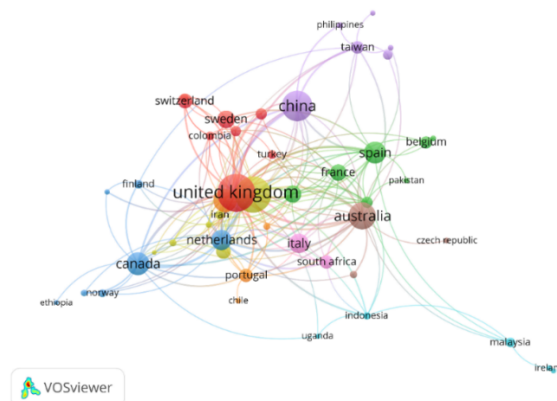

Figure 6: The network mapping based on co-authorship by countries

The variations in document counts, citations, and especially total link strength across nations reveal global inequalities in research capacity. Factors such as research funding, institutional support structures, and accessibility to information and technology are likely to contribute to these disparities. Further research could investigate these contributing factors and explore strategies for promoting more equitable global research collaborations to expand knowledge and facilitate the application of practical governance approaches for achieving sustainable development worldwide.

6. CONCLUSION
A study of governance approaches in institutional decision-making for sustainable development reveals a substantial increase in published scholarly works from 2003 to 2023. This expanding body of knowledge reflects a rising global awareness of the

importance of sustainable development and the crucial role of governance in achieving it. The accelerated growth after 2011 suggests a developing focus on this complex area. Research contributions are diverse, with environmental science dominating (26.9%), followed by social sciences (20%). Other significant areas include energy, engineering, business and accounting, and agricultural and biological sciences. This interdisciplinary nature highlights the multifaceted challenges of sustainable development and governance. The high number of publications from specific authors and institutions suggests established networks and expertise within the field, offering potential for collaborative research. Analysis of keywords reveals a vital research focus on sustainability, governance, and environmental issues within institutional decision-making. High-frequency and strong linkage of terms such as "sustainable development," "sustainability," and "governance" indicate a robust research base centered on the interplay between these concepts. Additionally, the prominence of keywords related to environmental management and policy, coupled with including terms such as "climate change" and "risk management," signifies a growing concern for environmental sustainability and the need for adaptive governance strategies. The geographic distribution of publications shows a concentration of research output in developed nations, particularly the United States and the United Kingdom. However, a noticeable contribution from developing economies, such as India, China, and Brazil, also exists, demonstrating expanding global interest in this area. Disparities in research output highlight existing global inequalities in research capacity and resources, emphasizing the need for more inclusive and representative research efforts to ensure a comprehensive understanding of global governance approaches for sustainable development.

The study's keyword analysis reveals a strong focus on sustainability and governance within institutional decision-making for sustainable development. High-occurrence and link strength for terms like "sustainable development," "sustainability," and "governance" confirm the research area's core themes. The prominence of environmental keywords highlights concerns about environmental sustainability and the need for adaptive governance approaches to address challenges such as climate change. Furthermore, emphasis on terms related to decision-making and institutional structures underscores the importance of understanding how these factors influence the implementation of sustainable development goals. Analysis of co-authorship reveals a concentration of research activity in developed nations, particularly the United States and the United Kingdom. Meanwhile, developing countries such as China, India, and Brazil show substantial contributions, but significant disparities exist in research output and network strength. This uneven distribution likely reflects variations in research resources and capacity. Addressing this inequality requires fostering more inclusive global research collaborations to facilitate a more comprehensive understanding of governance for sustainable development across diverse contexts.

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REFERENCES

Al-Khoury, A., Hussein, S. A., Abdulwhab, M., Aljuboori, Z. M., Haddad, H., Ali, M. A., Abed, I. A., & Flayyih, H. H. (2022). Intellectual Capital History and Trends: A Bibliometric Analysis Using Scopus Database. *Sustainability (Switzerland)*, *14*(18). https://doi.org/10.3390/su141811615

Alves, J. L., Borges, I. B., & De Nadae, J. (2021). Sustainability in complex projects of civil construction: Bibliometric and bibliographic review. *Gestao e Producao*, *28*(4). https://doi.org/10.1590/1806-9649-2020v28e5389

Appio, F. P., Cesaroni, F., & Di Minin, A. (2014). Visualizing the structure and bridges of the intellectual property management and strategy literature: a document co-citation analysis. *Scientometrics*, *101*(1), 623–661. https://doi.org/10.1007/s11192-014-1329-0

Appio, F. P., Martini, A., Massa, S., & Testa, S. (2016). Unveiling the intellectual origins of Social Media-based innovation: insights from a bibliometric approach. *Scientometrics*. https://doi.org/10.1007/s11192-016-1955-9

Argyres, N. S., & Silverman, B. S. (2004). R&D, organization structure, and the development of corporate technological knowledge. *Strategic Management Journal*, *25*(8–9), 929–958. https://doi.org/10.1002/smj.387

Assyakur, D. S., & Rosa, E. M. (2022). Spiritual Leadership in Healthcare: A Bibliometric Analysis. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*. https://doi.org/10.30604/jika.v7i2.914

Bahraseman, S. E., Firoozzare, A., Zhang, C., Yousefian, N., Skominas, R., Barati, R., & Azadi, H. (2024). Reviving the forgotten legacy: Strategies for reviving qanats as sustainable solutions for agricultural water supply in arid and semi-arid regions. *Water Research*, *265*. https://doi.org/10.1016/j.watres.2024.122138

Biermann, F., Kanie, N., & Kim, R. E. (2017). Global governance by goal-setting: the novel approach of the UN Sustainable Development Goals. In *Current Opinion in Environmental Sustainability*. https://doi.org/10.1016/j.cosust.2017.01.010

Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Jäger, J., & Mitchell, R. B. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences of the United States of America*, *100*(14), 8086–8091. https://doi.org/10.1073/pnas.1231332100

Coruhlu, Y. E., & Altas, S. S. (2024). Establishing a Geo-Database for Drinking Water and Its Delivery and Storage Components with an Object-Based Approach. *Water (Switzerland)*, *16*(12). https://doi.org/10.3390/w16121753

De la Mora-De la Mora, G. (2023). Correction to: Conceptual and Analytical Diversity of Environmental Governance in Latin America: A Systematic Review (Environmental Management, (2023), 71, 4, (847-866), 10.1007/s00267-022-01739-z). *Environmental Management*, *72*(1), 219. https://doi.org/10.1007/s00267-023-01830-z

di Stefano, G., Peteraf, M., & Veronay, G. (2010). Dynamic capabilities deconstructed: A bibliographic investigation into the origins, development, and future directions of the research domain. *Industrial and Corporate Change*, *19*(4), 1187–1204. https://doi.org/10.1093/icc/dtq027

Dietze, M. C., Fox, A., Beck-Johnson, L. M., Betancourt, J. L., Hooten, M. B., Jarnevich, C. S., Keitt, T. H., Kenney, M. A., Laney, C. M., Larsen, L. G., Loescher, H. W., Lunch, C. K., Pijanowski, B. C., Randerson, J. T., Read, E. K., Tredennick, A. T., Vargas, R., Weathers, K. C., & White, E. P. (2018). Iterative near-term ecological forecasting: Needs, opportunities, and challenges. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(7), 1424–1432. https://doi.org/10.1073/pnas.1710231115

Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. In *International Journal of Production Economics* (Vol. 162, pp. 101–114). https://doi.org/10.1016/j.ijpe.2015.01.003

Foley, M. M., Halpern, B. S., Micheli, F., Armsby, M. H., Caldwell, M. R., Crain, C. M., Prahler, E., Rohr, N., Sivas, D., Beck, M. W., Carr, M. H., Crowder, L. B., Emmett Duffy, J., Hacker, S. D., McLeod, K. L., Palumbi, S. R., Peterson, C. H., Regan, H. M., Ruckelshaus, M. H., … Steneck, R. S. (2010). Guiding ecological principles for marine spatial planning. *Marine Policy*, *34*(5), 955–966. https://doi.org/10.1016/j.marpol.2010.02.001

Genus, A. (2014). Governing sustainability: A discourse-institutional approach. *Sustainability (Switzerland)*. https://doi.org/10.3390/su6010283

González-García, A., Díaz-Pastor, S. J., & Moreno-Romero, A. (2023). A Comprehensive Approach to the Governance of Universal Access to Sustainable Energy. *Sustainability (Switzerland)*, *15*(22). https://doi.org/10.3390/su152215813

Gu, D., Li, T., Wang, X., Yang, X., & Yu, Z. (2019). Visualizing the intellectual structure and evolution of electronic health and telemedicine research. *International Journal of Medical Informatics*. https://doi.org/10.1016/j.ijmedinf.2019.08.007

Kanie, N., Griggs, D., Young, O., Waddell, S., Shrivastava, P., Haas, P. M., Broadgate, W., Gaffney, O., & Kőrösi, C. (2019). Rules to goals: emergence of new governance strategies for sustainable development. *Sustainability Science*. https://doi.org/10.1007/s11625-019-00729-1

Kemp, R., Parto, S., & Gibson, R. B. (2005). Governance for sustainable development: moving from theory to practice. *International Journal of Sustainable Development*, *8*, 12–30. https://doi.org/10.1504/IJSD.2005.007372

Khiste, G. P., & Paithankar, R. R. (2017). Analysis of Bibliometric term in Scopus. *International Research Journal*, *01*(32), 78–83.

Leal Filho, W., Salvia, A. L., Frankenberger, F., Akib, N. A. M., Sen, S. K., Sivapalan, S., Novo-Corti, I., Venkatesan, M., & Emblen-Perry, K. (2021). Governance and sustainable development at higher education institutions. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-020-00859-y

Loorbach, D. (2010a). Transition management for sustainable development: A prescriptive, complexity-based governance framework. *Governance*. https://doi.org/10.1111/j.1468-0491.2009.01471.x

Loorbach, D. (2010b). Transition management for sustainable development: A prescriptive, complexity-based governance framework. *Governance*, *23*, 161–183. https://doi.org/10.1111/J.1468-0491.2009.01471.X

Pickering, J. (2023). Can democracy accelerate sustainability transformations? Policy coherence for participatory co-existence. *International Environmental Agreements: Politics, Law and Economics*. https://doi.org/10.1007/s10784-023-09609-7

Popescu, M., & Mandru, L. (2022). A Model for a Process Approach in the Governance System for Sustainable Development. *Sustainability (Switzerland)*. https://doi.org/10.3390/su14126996

Prno, J., & Scott Slocombe, D. (2012). Exploring the origins of "social license to operate" in the mining sector: Perspectives from governance and sustainability theories. *Resources Policy*, *37*(3), 346–357. https://doi.org/10.1016/j.resourpol.2012.04.002

Shen, L.-Y., Jorge Ochoa, J., Shah, M. N., & Zhang, X. (2011). The application of urban sustainability indicators - A comparison between various practices. *Habitat International*, *35*(1), 17–29. https://doi.org/10.1016/j.habitatint.2010.03.006

Singhania, M., Saini, N., Shri, C., & Bhatia, S. (2024). Cross-country comparative trend analysis in ESG regulatory framework across developed and developing nations. *Management of Environmental Quality: An International Journal*, *35*(1), 61–100. https://doi.org/10.1108/MEQ-02-2023-0056

Utami, A. S., & Oue, H. (2023). Traditional value and its function in managing modern irrigation system in West Sumatra Indonesia. *Sustainable Water Resources Management*, *9*(2). https://doi.org/10.1007/s40899-023-00830-5

Van Eck, N. J., & Waltman, L. (2007). Bibliometric mapping of the computational intelligence field. *International Journal of Uncertainty, Fuzziness and Knowldege-Based Systems*. https://doi.org/10.1142/S0218488507004911

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2017). Citation-based clustering of publications using CitNetExplorer and VOSviewer. *Scientometrics*. https://doi.org/10.1007/s11192-017-2300-7

Verbeek, A., Debackere, K., Luwel, M., & Zimmermann, E. (2002). Measuring progress and evolution in science and technology - I: The multiple uses of bibliometric indicators. *International Journal of Management Reviews*, *4*(2), 179–211. https://doi.org/10.1111/1468-2370.00083

Wilson, D. C. (2023). Learning from the past to plan for the future: An historical review of the evolution of waste and resource management 1970–2020 and reflections on priorities 2020–2030 – The perspective of an involved witness. *Waste Management and Research*, *41*(12), 1754–1813. https://doi.org/10.1177/0734242X231178025

Wise, R. M., Fazey, I., Stafford Smith, M., Park, S. E., Eakin, H. C., Archer Van Garderen, E. R. M., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change*, *28*, 325–336. https://doi.org/10.1016/j.gloenvcha.2013.12.002

Wu, Y. C. J., & Wu, T. (2017). A decade of entrepreneurship education in the Asia Pacific for future directions in theory and practice. In *Management Decision* (Vol. 55, Issue 7, pp. 1333–1350). https://doi.org/10.1108/MD-05-2017-0518

Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, *29*(6), 577–590. https://doi.org/10.1016/j.jom.2010.10.001

Zhang, L., & Bai, E. (2023). The Regime Complexes for Global Climate Governance. *Sustainability (Switzerland)*. https://doi.org/10.3390/su15119077