A Bibliometric Analysis of Best Practices on the Role of Government in Sustainability and Environmental Management

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Article Info	ABSTRACT
	This bibliometric analysis delves into the extensive body of literature on the role of government in sustainability and environmental management, addressing the imperative for sustainable development amidst increasing environmental challenges. Through a systematic exploration of scholarly publications, the study identifies clusters of literature, research trends over time, and potential areas for future investigation. The analysis reveals key thematic areas, including Corporate Social Responsibility (CSR) and Governance, Waste Management, Environmental Governance, Energy and Innovation, and Supply Chain Sustainability. Top-cited research studies and the visualization of term occurrences offer foundational insights for policymakers and researchers. The findings emphasize the evolving priorities in the field and underscore the need for interdisciplinary collaboration to address complex challenges. Overall, the study contributes to a nuanced understanding of best practices, guiding stakeholders in formulating evidence-based policies for sustainable development.

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1. INTRODUCTION

In an era marked by increasing environmental challenges and the imperative for sustainable development, the role of government in shaping and implementing policies for environmental management has become paramount [1]. Governments worldwide are confronted with the dual responsibility of fostering economic growth while concurrently mitigating the adverse impacts on the environment [2]. This research undertakes a comprehensive bibliometric analysis to delve into the extensive body of literature on the best practices associated with the governmental role in sustainability and environmental management [3]–[5].

Sustainability, a concept encapsulating ecological integrity, economic viability, and social equity, has become a cornerstone for policymakers striving to address the interconnected challenges of climate change, biodiversity loss, and resource depletion [6], [7]. The nuanced and evolving nature of sustainability necessitates a meticulous examination of the scholarly landscape to identify key trends, prominent research themes, and emerging areas of focus within the discourse on the government's role in sustainability and environmental stewardship [8], [9].

This bibliometric analysis aims to unravel the intellectual fabric surrounding governmental interventions in environmental management by scrutinizing a diverse range of scholarly publications [3], [10]. By systematically mapping the literature, this research seeks to identify seminal works, influential authors, and the evolution of key concepts over time [11], [12]. The findings of this study promise to offer valuable insights for policymakers, researchers, and practitioners alike, guiding future endeavors aimed at enhancing the effectiveness of government-led initiatives for sustainable development [4], [5], .

As the world grapples with pressing environmental issues, understanding the landscape of research on the government's role in sustainability becomes not only an academic pursuit but also a crucial step toward informed decision-making and the formulation of evidence-based policies [2], [13]. This research, through a bibliometric lens, contributes to the ongoing discourse on environmental governance, offering a nuanced perspective on the best practices that can guide governments in fostering a harmonious coexistence between socio-economic development and ecological preservation [3], [14].

2. LITERATURE REVIEW

2.1 Government and Sustainability

Governments play a crucial role in promoting and ensuring sustainability, which involves meeting the needs of the present without compromising the ability of future generations to meet their own needs [15], [16]. Sustainability encompasses various aspects, including environmental, social, and economic considerations. Governments worldwide have a responsibility to develop and implement policies that address these dimensions and foster a balance between economic growth, social equity, and environmental conservation. In the realm of environmental sustainability, governments are tasked with crafting and enforcing regulations that mitigate the impact of human activities on ecosystems [17], [10]. This may involve setting emission standards, preserving biodiversity through conservation efforts, and promoting renewable energy sources. Social sustainability involves policies that prioritize equality, education, healthcare, and social justice. Governments can enact laws that ensure fair wages, equal opportunities, and access to basic services for all citizens [18], [7]. Economic sustainability requires governments to foster a stable and inclusive economy, promoting innovation, supporting small businesses, and ensuring financial

stability [19]–[21]. By creating and enforcing regulations across these dimensions, governments can lay the foundation for a sustainable future, where resources are managed responsibly, social well-being is prioritized, and economic growth is aligned with environmental preservation [22]–[25].

The impact of government on environmental management is substantial, as it plays a central role in shaping and enforcing policies that regulate resource use, pollution, and conservation efforts [26], [27]. Governments can influence environmental management through legislation, regulatory frameworks, and international agreements. They establish standards for industries, set emission limits, and allocate resources for environmental protection initiatives. Additionally, governments often fund research and development of sustainable technologies, promoting innovation that can contribute to more effective environmental management practices [28]–[30].

However, the effectiveness of government impact on environmental management can vary widely depending on political will, enforcement capabilities, and public engagement [31], [32]. Strong regulatory frameworks and stringent enforcement mechanisms are crucial for ensuring compliance with environmental policies [27], [12]. Additionally, transparent communication and collaboration between governments, businesses, and communities are essential to fostering a collective commitment to sustainable practices [33]–[36]. Overall, the government's role in environmental management is pivotal, and its policies and actions significantly influence the trajectory

of ecological health and sustainability [29].

3. METHODS

This study employs a bibliometric analysis to systematically assess and quantify the existing literature on the role of government in sustainability and environmental management. The research design is grounded in a comprehensive review of scholarly publications to identify trends, key themes, and best practices in this domain. A systematic search was conducted across major academic databases, including but not limited to PubMed, Scopus, Web of Science, and Google Scholar. Keywords such as "government," "sustainability," "environmental management," and related terms were used to identify relevant articles. The articles included in the analysis were those published in peer-reviewed journals, conference proceedings, and books, focusing on the role of government in promoting sustainability and effective environmental management. The time frame for inclusion spans from the inception of relevant databases until the latest available data. Non-peer-reviewed sources, opinion pieces, and articles not directly related to government involvement in sustainability and environmental management were excluded from the analysis. A standardized data extraction form was developed to collect relevant information from each selected article. Key variables included publication year, authorship, journal name, keywords, and main findings related to government practices in sustainability and environmental management. Bibliometric analysis was conducted using specialized software which is VOSviewer. This tool enables the visualization of co-authorship networks, keyword co-occurrence, and other bibliometric indicators.

Table 1. Data Citation Metrics

Publication years	: 1985-2023
Citation years	: 39 (1985-2023)
Paper	: 980
Citations	: 326813

Cites/year	: 8379.82
Cites/paper	: 333.48
Cites/author	: 173059.51
Papers/author	: 494.07
Author/paper	: 2.68
h-index	: 296
g-index	: 543
hI,norm	: 205
hI,annual	: 5.26
hA-index	: 78
Papers with ACC	: 1,2,5,10,20:971,953,874,679,454

Source: Publish or Perish Output, 2024

The table provides a comprehensive overview of a researcher's prolific academic career spanning from 1985 to 2023. With a total of 980 papers published, the researcher has amassed a significant number of citations, totaling 326,813, resulting in an impressive average of 8379.82 citations per year. Each paper, on average, receives 333.48 citations, showcasing the impact and influence of the researcher's work. Notably, the Cites/author ratio is remarkably high at 173,059.51, indicating the substantial recognition and acknowledgment received by the researcher from the academic community. The h-index of 296 and g-index of 543 reflect the researcher's substantial impact on the field, and the hI,norm of 205 suggests a sustained level of high influence over the years. The hI,annual of 5.26 indicates a consistent annual impact. Furthermore, the hA-index of 78 and the specific listing of papers with ACC (1,2,5,10,20:971,953,874,679,454) provide additional insights into the researcher's achievements and contributions. Overall, the table paints a picture of a highly accomplished and influential researcher with a remarkable scholarly output and significant impact in the academic community.

4. RESULTS AND DISCUSSION

This analysis will focus on answering 4 main questions: first, how the literature on this topic is classified based on similarities in research themes and topics. This can be answered by utilizing the Network Visualization feature in the VOSViewer application which is able to automatically map and group certain themes that appear most frequently in the collected literature. Second, what is the trend of research on this topic from year to year? This can be answered by using the Overlay Visualization feature which can clearly classify which themes or terms started trending in which year. Third, the question relates to future research suggestions. To answer this, it is necessary to analyze the number of occurrences of these themes or terms, the less often a term appears, the more potential it is to be used in future research. Finally, there is the question of how collaboration and clustering occurs between authors. This is interesting to investigate as it allows for new collaboration opportunities and represents the complexity of the research.

Based on the data in Table 1 above, the total amount of literature collected was 980 articles from various academic databases. By extracting the abstracts and titles and using the full counting method, 4545 terms were found with a minimum occurrence of 10 times. This means that terms with no more than 9 occurrences did not pass the criteria. From these 4545 terms, the terms associatively became 130 threshold terms. The final number of terms analyzed was 78, with all of them being the most relevant terms to the topic in question, namely Best Practices on the Role of Government in Sustainability and Environmental Management.
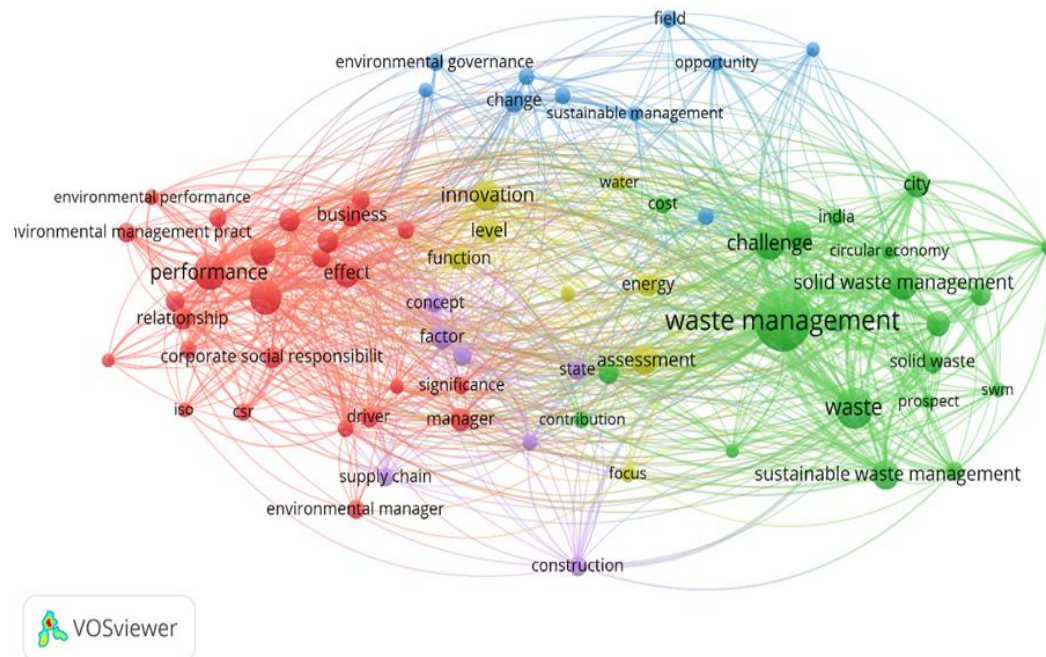
Figure 1. Network Visualization
Source: Data Analysis, 2024

Figure 1 above shows the visualization for the answer to the first question regarding the classification of themes and clustering of literatures. There are five different colors, each representing a cluster or classification. The first cluster is the red cluster which is the cluster with the highest item composition and is on the left side of the mapping. This cluster contains common terms such as performance and corporate social responsibility. While the second cluster is represented in green and is on the right side of the mapping with the composition of several popular terms such as waste management. The other three clusters share a proportional position in the middle of the mapping with blue, yellow, and purple colors respectively. Table 2 below shows the composition of each clusters.

Table 2. Cluster Composition

Cluster	Item	Name
1	Adoption, business, company, corporate governance, corporate social responsibility, corporate sustainability, driver, ems, environmental issue, environmental manager, firm, green supply chain management, ISO, manager, performance, SMEs	CSR and Governance
2	Area, Challenge, circular economy, city, cost, country, municipal solid waste management, recycling, solid waste, sustainable development goal, waste management system	Waste Management
3	Change, environmental	Environmental Governance

	government, environmental protection, local government, sustainable management, sustainable tourism	

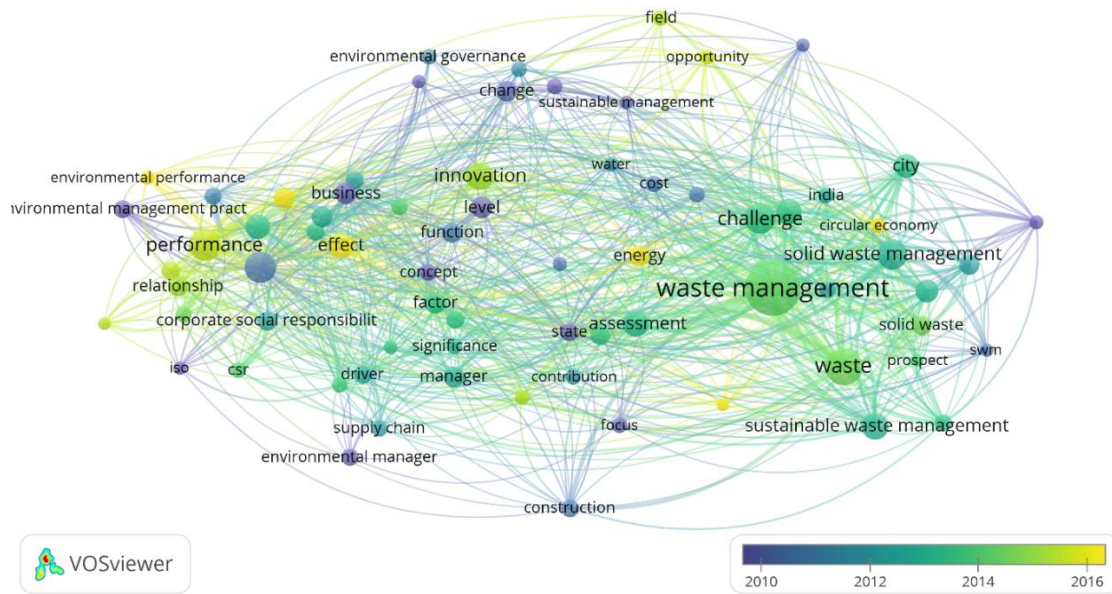| 4	Assessment, energy, innovation, sustainable environment, water	Energy and Innovation
5	Barrier, benefit, construction, supply chain	Supply Chain Sustainability

Source: Data Analysis, 2024

Figure 2. Overlay Visualization
Source: Data Analysis, 2024

Furthermore, in Figure 2 above, a visualization of the answer to the second question relating to research trends is presented. In the time bar at the bottom right corner of the figure, there is a description that the purple color representation of the items indicates the year 2010, blue indicates the years 2012 to 2014, and yellow the year 2016. Thus, items and their networks that are colored purple represent research trends that occurred from 2010 to around 2011. In the period 2010 to 2011, terms such as environmental manager, business, cost, construction, sustainable management, and SWM were hot topics discussed by researchers at that time. While from 2012 to 2015, topics such as corporate social responsibility, drivers, assessment, sustainable waste management, solid waste management, and supply chain became topics that attracted the attention of researchers. In 2016, topics such as environmental performance, energy, and circular economy began to rise and become research trends.

Table 3 below shows some of the studies that have had the most impact on the development of research in this area. Identification of these studies is important for the basis of future research.

Table 3. Top Cited Research

Citations	Authors and year	Title
7358	[37]	How corporate social responsibility is

Citations	Authors and year	Title
		defined: an analysis of 37 definitions
5862	[17]	A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems
5083	[38]	Stakeholder participation for environmental management: a literature review
4555	[39]	What a waste 2.0: a global snapshot of solid waste management to 2050
3986	[40]	The impact of environmental management on firm performance
3895	[41]	Blochar for environmental management: science, technology and implementation
3286	[42]	Do green supply chains lead to competitiveness

Citations	Authors and year	Title
		and economic performance?
3199	[43]	Who's in and why? A typology of stakeholder analysis methods for natural resource management
3134	[44]	Evolution of co-management: role of knowledge generation, bridging organizations and social learning
2998	[45]	The Governance of sustainable socio-technical transitions

Source: Publish or Perish Output, 2024

The next analysis is related to the discovery of potential topics in the future. The results of the analysis to answer the third question are as illustrated in Figure 3 below. In this visualization, each term has a color with varying intensity. The intensity of this color indicates how often the term is used. Terms with relatively dim colors indicate that the term is rarely used while terms with high color intensity indicate that the term appears frequently.

Figure 3. Density Visualization
Source: Data Analysis, 2024

Figure 3 shows that the terms waste management, performance, and waste are the most frequently used terms by researchers. These terms allegedly already have a high level of saturation and complexity so that they are no longer potential for future research. In contrast, other terms such as construction, supply chain, ISO, environmental governance, and water are still very faint, indicating a very wide research opportunity and research gap. Table 4 details some of the terms with the most occurrences and some terms with the least occurrences.

Table 4. Most Occurrence and Fewest Occurrence

Most Occurrence Items		Fewest Occurrence Items	
Item	Occurrence	Item	Occurrence
Waste management	191	Corporate governance	10
waste	85	Prospect	10
performance	65	Sustainable development goal	10
Environmental management system	62	Sustainable tourism	11
challenge	58	Environmental protection	11
Solid waste management	55	Environmental issue	11
Innovation	48	Sustainable management	11
Sustainable waste management	44	ISO	12
assessment	42	Environmental performance	13

Source: Data Analysis, 2024

Table 4 provides a comparison of the most and fewest occurrence items in a given context, likely related to a set of documents or discussions. The most frequently mentioned items include "Waste management" with 191 occurrences, "waste" with 85 occurrences, and "performance" with 65 occurrences. These suggest a significant emphasis on waste-related topics and overall performance considerations. On the other hand, the items with the fewest occurrences include "Corporate governance," "Prospect," and "Sustainable development goal," each with only 10 occurrences, indicating a comparatively lower focus on corporate governance, prospective aspects, and sustainable development goals in the analyzed content. The table highlights the varying degrees of attention and emphasis on specific terms, providing insights into the thematic priorities within the context under consideration.
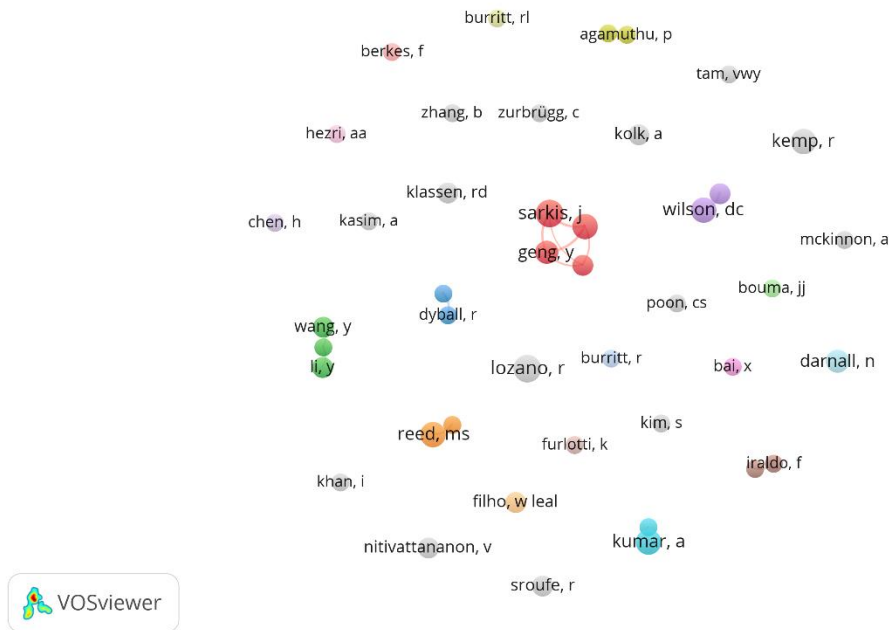
Figure 4. Author Collaboration Visualization
Source: Data Analysis, 2024

Finally, the analysis is directed at addressing the collaboration of the authors. The majority of writers are still individual and have not consistently collaborated with each other. While some other authors show close collaboration and relationships such as geng y, lai k, sarcis j, and zhu q who are joined into a red cluster in the center, hao y, li y, and wang y are joined into a green cluster on the left side, dyball r and keen m are joined in a dark blue cluster. This finding still reveals minimal collaboration between the authors so in the future, this collaboration may become more and more complex.

Implication

The bibliometric analysis of best practices on the role of government in sustainability and environmental management yields valuable implications for policymakers, researchers, and practitioners. The identified clusters of literature reveal key thematic areas, such as Corporate Social Responsibility (CSR) and Governance, Waste Management, Environmental Governance, Energy and Innovation, and Supply Chain Sustainability. The analysis of research trends over time provides insights into the evolving priorities in the field, with topics like circular economy, environmental performance, and sustainable development gaining prominence. The top-cited research studies offer a foundation for further exploration and future research directions. Additionally, the visualization of term occurrences highlights potential areas for future investigation, emphasizing the need to explore underrepresented terms like construction, supply chain, ISO, environmental governance, and water. The limited collaboration among authors suggests an opportunity for increased interdisciplinary cooperation to address the complex challenges at the intersection of government, sustainability, and environmental management. Overall, these implications contribute to a more nuanced understanding of the literature landscape, guiding stakeholders in shaping effective policies and practices for sustainable development.

5. CONCLUSION

In conclusion, the comprehensive bibliometric analysis conducted on the role of government in sustainability and

environmental management provides a thorough examination of the scholarly landscape, offering insights that are crucial for shaping informed policies and practices. The identified clusters and trends within the literature underscore the multifaceted nature of sustainability, encapsulating aspects such as CSR, waste management, environmental governance, and innovation. The temporal analysis reveals the dynamic evolution of research priorities over the years, reflecting the growing complexity of challenges in the field. The recognition of top-cited studies and the identification of potential future research areas contribute to the ongoing discourse and guide future endeavors. Importantly, the analysis emphasizes the need for enhanced interdisciplinary collaboration to address the intricate intersection of government interventions, sustainability, and environmental management. Ultimately, this research equips policymakers, researchers, and practitioners with valuable insights to navigate the complex landscape of sustainability, fostering a more harmonious coexistence between socio-economic development and ecological preservation.

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