








# “Green accounting research: A comparative bibliometric analysis of global and Indonesian studies”

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# GREEN ACCOUNTING RESEARCH: A COMPARATIVE BIBLIOMETRIC ANALYSIS OF GLOBAL AND INDONESIAN STUDIES

## Abstract

Green accounting has become an increasingly crucial research field due to its significance in addressing climate change. While global studies in this field have expanded extensively, contributions from Indonesia-affiliated researchers remain relatively underexplored, much to Indonesia's detriment, given its vast natural resources and existing environmental challenges. This study employs a bibliometric analysis to explore trends, impact, and collaboration patterns in green accounting studies globally, with a specific comparison of Indonesia-affiliated publications. A comprehensive analysis utilizing the retrieved dataset from the Scopus database was conducted to identify key research clusters and to highlight relevant topics such as carbon accounting, sustainability, environmental performance, and the integration of the environmental, social, and governance (ESG) factors into corporate policies. Network visualizations using VosViewer were constructed to examine the landscape of green accounting both globally and within Indonesia-affiliated research, aiming to compare global research with that linked to Indonesia. Global research covers broader topics surrounding carbon accounting, sustainability, environmental performance, the integration of ESG factors into corporate policies, and life cycle assessment. Meanwhile, Indonesia-affiliated research is more concentrated, focusing on topics such as financial/environmental performance and forestry issues. This study suggests that Indonesia-affiliated research would benefit from diversifying its focus toward globally emerging or established topics such as sustainable practices, carbon management, and the global sustainability reporting standards to enhance its academic visibility and relevance.

## Keywords

green accounting, carbon accounting, sustainability accounting, bibliometric analysis, Indonesia

## JEL Classification

M41, Q56, Q01

## INTRODUCTION

Over the years, environmental sustainability has become an increasingly important focus in global economic policies, which has led to the emergence of green accounting as a crucial research field (Asiaei et al., 2022). Green accounting, also known as environmental accounting, integrates ecological and economic dimensions to link the environmental impact of economic activities (Al Frijat et al., 2025). The aforementioned concept began to gain the attention of scholars and institutions in the late 20<sup>th</sup> century, where they advocated the inclusion of environmental aspects in government and corporate financial reports (Ahad, 2023). The role of green accounting over contemporary economic analysis itself was further strengthened after the introduction of the United Nations' System of Environmental-Economic Accounting (SEEA) and other sustainability reporting standards, including the Global Reporting Initiative (GRI) (Sisaye, 2021).

The development of green accounting studies has been on the rise, particularly over the past decade, due to the urgency of climate change, corporate social responsibility, and the growing alignment with the United Nations' Sustainable Development Goals (SDGs), particularly Goal 12: Responsible Consumption and Production (Setiawan et al., 2023; Glavič, 2021; Wiredu et al., 2023). Recent development also included the studies on carbon footprint analysis (Yan et al., 2022), biodiversity accounting (Rizki & Perdana, 2024), and the role of accounting ecological indicators in streamlined input-output environmental assessments (Ahmed et al., 2022; Wang et al., 2022). The evolution of green accounting studies has also been influenced by the advancement in data analysis, artificial intelligence, and blockchain technology, which contributed to the improvement of transparency over environmental and social impact reporting (Cardinael et al., 2021; Kshetri, 2021; Ostroski et al., 2022).

Despite the global rise of green accounting studies, the extent of contributions from Indonesian-affiliated researchers remains relatively underexplored, which is quite unexpected given the country's vast natural resources and the growing concern over environmental challenges caused by economic policies. As one of the world's largest economies, rich in biodiversity, Indonesia is expected to play an important role in sustainability discussions, particularly over the issues of deforestation, industrial pollution, and carbon emissions (Nursulistyo et al., 2023; Aryapratama & Pauliuk, 2022). These factors naturally position Indonesia as one of the key players in the advancement of green accounting studies. However, despite its potential, the volume and impact of Indonesia-affiliated publications in this field remain relatively limited, raising questions over the visibility, lack of collaborations among researchers locally or globally, and influence of its publications on the global stage (Wahyuningrum et al., 2023).

As the field continues to grow, it is crucial to review the current progress of green accounting studies to identify Indonesia's position within the global research landscape.

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## 1. LITERATURE REVIEW

Green accounting seeks to revise conventional national accounting systems by incorporating environmental costs, including resource depletion and degradation, into economic metrics. The conventional accounting system used by governments often masks unsustainable practices as economic growth. This system attempts to advocate for the inclusion of environmental "satellite accounts" to reflect true net income, yet it manages to exclude gains from natural capital depletion, which inherently puts the environmental aspect aside (Serafy, 1997). Green accounting exists not only to serve as an environmental tool but also to correct the economic mechanism that tends to overlook the sustainability aspect of a policy. It ensures that income calculations reflect capital sustainability, which, in this context, includes natural capital (Cairns, 2000). The notion of green accounting is greatly critical for developing countries where economic prosperity relies on or is closely related to the exploitation of natural resources.

The early development of environmental accounting practices has been crucial to address global and national environmental challenges. With the concept gaining popularity over the years, most prominent studies on the issue revolved around the importance to standardizing environmental degradation measurement as well as environmental accounting research (Gray & Bebbington, 2004; Boyd & Banzhaf, 2007) or the technical challenges of environmental and carbon accounting, such as the technologies to quantify environmental changes on wood density and forest management projects (Chave et al., 2006; Masera et al., 2003), improvement to the accuracy of carbon estimates in relation to forest biomass (Mokany et al., 2006; Toan et al., 2011). Other notable studies in association with the carbon sequestration in croplands highlighted the potential for improved agricultural management aiming to decrease carbon flux to the atmosphere (Smith et al., 2012) and on soil organic carbon storage in temperate and tropical regions (Ogle et al., 2005). Other studies conducted during the same period as the aforementioned ones involved the corporate sphere, examining the motivations and ef-

fectiveness of corporate environmental disclosures. These disclosures were used by companies as a tool for legitimacy and often seen as positive information to offset poorer environmental performance (Cho & Patten, 2007), thus leading to the finding that such metrics need to be standardized and value-based for them to prove useful to investors and policymakers (Kolk et al., 2008).

Recent global studies on green accounting are increasingly tied to international policy frameworks, particularly on the discussions on environmental accounting in achieving the United Nations Sustainable Development Goals (SDGs) and other initiatives. Such frameworks served as the context to revitalize accounting's role in sustainable development debates by enhancing the understanding and critique of accounting policy (Bebbington & Unermann, 2018). Despite the effort, these measures faced challenges, with critics arguing that the focus on value for investors would appear to neglect broader sustainability goals and does not appeal to the benefit of society (Flower, 2015). Further, the green accounting research involved the complexity of international policy, such as the rising research areas, including the contribution of agroforestry to global carbon budgets, in continuation of the previous studies on forest sequestration (Zomer et al., 2016) and financial development. Here, the implementation of accounting ecological footprint (EF) indicators allows assessments of input-output environmental assessment, aiming to determine environmental degradation and to support a sustainable environment through immediate intervention measures reducing ecological deterioration (Saud et al., 2020).

As a country of rich natural capital, the adoption of green accounting in Indonesia has been motivated by both concerns from global environmental bodies and ecological local degradations found within the country. Despite remaining underdeveloped, green accounting is a growing interest among the academic, governmental, and corporate circles (Solojida & Latan, 2017; Shahib, 2021). Especially for corporates, the failure to raise eco-labeling standards has led Indonesian industries to face environmental scrutiny. The implementation of green accounting is intended to bridge the gap between environmental responsibility and financial performance. However, several concerns in Indonesia, including but not limited to low public awareness, an outdated eco-

nomic mindset focused solely on profit, and inadequate regulatory enforcement by governing bodies, remain unresolved (Sukoharsono, 2007). Initiatives were made to internalize environmental costs as well as to align with global sustainability norms. Examples are the introduction of international environmental management policies to Indonesian corporations, such as ISO 14000 as international environmental management standards, EMS, and other integrated global frameworks defined by IPCC (DeFries et al., 2007; Smith et al., 2012; Lisnawati et al., 2024). At the corporate level, Indonesia-affiliated studies explored the influence of the adoption of environmental accounting within the country, particularly within small and medium enterprises (Susanto & Meiryani, 2019). This issue led to the conceptual model addressing limitations in corporate environmental accounting systems, such as perceived environmental uncertainty, the sophistication of information technology, and errors in measuring environmental costs on Indonesian enterprises (Meiryani et al., 2019).

Furthermore, efforts in Indonesia-affiliated green accounting studies appear to attempt to highlight the significant role of remote sensing in monitoring deforestation and carbon emissions, which appears to be acceptable considering the fluctuation of the forest clearing rate in the country (Hansen et al., 2009). Studies utilizing LiDAR managed to quantify the carbon released from peat fires that occurred in Central Kalimantan, deemed as a significant yet often unaccounted cause of greenhouse gas emissions (Ballhorn et al., 2009), with a similar approach conducted earlier on quantifying the forest above-ground carbon content (Patenaude et al., 2004). Efforts were also made in the context of agriculture, where research on land use transitions and management change of soil carbon could be used to address issues on bioenergy and biofuel sustainability (Smith et al., 2012) and on agroforestry systems, where biased standard accounting methods occurred due to changes in bulk density (Hairiah et al., 2020).

Bibliometric analysis offers a quantitative point of view in examining the evolution of publications on certain research fields, by assessing the publication trends over a certain period of time, key authors publishing the research, influential journals, and the thematic shifts in the themed literature over time (Verma & Gustafsson, 2020; Berniak-

Woźny & Rataj, 2023). Mappings and clustering are also employed to analyze the co-keywords and co-citations found within the research. The use of bibliometric analysis is an emerging attempt to further understand how a certain field is growing, and such a method spans disciplines, from the natural sciences to social sciences, and is also especially valuable to identify dominant research themes, influential contributors, and recently emerging research subthemes (Donthu et al., 2021). As academic interest in interdisciplinary and impact-driven research continues to grow, bibliometric techniques may prove vital in evaluating scholarly influence and serve as a strategic guide in decision-making regarding research development and relevant policy-making. Attempts at bibliometric analysis on green accounting, particularly environmental management, have been conducted. Several cases include the utilizations of drones in agriculture (Rejeb et al., 2022), green innovation as a strategic firm resource such as issues related to supply chain management, product design and corporate environmental responsibility (Khanra et al., 2021), and the role of technological intelligence in operational environment for social and corporate status, including sustainable supply chain and sustainable development (Dhamija & Bag, 2020).

The development of global green accounting studies has evolved from early exploration on environmental cost integration and carbon accounting to sustainability and environmental degradation, while Indonesia's affiliated studies remain limited despite its pressing environmental concerns. Therefore, this study aims to conduct further bibliometric analysis on the overall green accounting research and its comparison to studies from country-specific affiliations. Addressing the progression and gap of respective affiliated studies requires a combination of performance analysis and mapping to identify emerging research trends and their thematic clusters, which may allow for mapping on global research trends and evaluation of Indonesia's position in the green accounting landscape.

## 2. METHODS

This study utilized bibliometric analysis to examine the evolution of green accounting studies, as

well as identify contributions from Indonesia-affiliated researchers within the global research landscape. The use of the bibliometric approach was based on previous reports (Iqhrammullah et al., 2023; Chiari et al., 2024). The bibliometric data were retrieved from the Scopus database, one of the globally recognized sources of peer-reviewed literature. The keywords entered in the database search, including those related to the inclusion and exclusion of keywords in the literature's title, abstract, and keywords, as well as the affiliation country being Indonesia, were used to identify publications where at least one author was affiliated with an Indonesian institution. The complete inputted keywords were as follows: TITLE-ABS-KEY ("green accounting" OR "environmental accounting" OR "sustainability accounting" OR "carbon accounting" OR "environmental cost accounting") AND NOT TITLE-ABS-KEY ("triple bottom line" OR "natural capital accounting" OR "social accounting"). No further restriction was added to the database search to ensure no related publications were left out, except retracted publications found within the database.

Both dataset groups covered all publication years from 1970 to 2025 for the global dataset and from 2003 to 2025 for the Indonesia-affiliated dataset. Two dataset groups were exported from the database: global dataset – all retrieved publications related to green accounting; and Indonesia-affiliated dataset – a subset of publications related to green accounting written by at least one Indonesia-affiliated author. The exported datasets were reviewed to ensure no duplicate entries or misclassified publications were included, and then were exported in .csv format for bibliometric analysis. The retrieved datasets included metadata such as citation information – including but not limited to titles, authors' information, publication year, abstracts, keywords, and authors' affiliation(s). The completeness of the cleaned datasets was assessed using Biblioshiny to determine if the datasets were sufficiently well-populated for analysis, as presented in Tables 1 and 2. The cleaned datasets were analyzed using VosViewer v1.6.20 and Bibliometrix (R package) to examine the publication trends, keyword co-occurrence analysis, citation impact, and collaboration network comparison between global and Indonesia-affiliated studies.

**Table 1.** Completeness of metadata of publication datasets on the global green accounting studies

Description	Missing Counts	Missing (%)	Status	Description
Abstract	0	0.00	Excellent	No missing abstract, analysis relying on content by keyword analysis is ensured to be highly reliable
Document Type	0	0.00	Excellent	All retrieved publications have a defined type
Language	0	0.00	Excellent	No missing language data
Publication year	0	0.00	Excellent	No missing publication year, accurate time-based analysis ensured
Title	0	0.00	Excellent	No missing titles
Total Citation	0	0.00	Excellent	All retrieved publications have citation count data
Journal	1	0.02	Good	Only one publication is missing, impact on source-based analysis is deemed to be negligible
Author	43	0.97	Good	Author data are almost fully complete, author-based metrics (e.g., collaboration networks) are possible
Affiliation	137	3.08	Good	Small friction of affiliation data is missing, with a minor effect on institutional-level analysis
Cited Reference	241	5.43	Good	Majority of the publication data have cited references, co-citation, and reference-based metric analysis deemed possible
DOI	433	9.75	Good	Small portion of the dataset does not contain DOI, does not significantly impact the overall data quality
Keywords	987	22.22	Poor	Missing percentage is considered high due to the tendency of keywords being manually assigned and, at times, not a mandatory part of the publication's core metadata
Corresponding Author	1200	27.02	Poor	High number of missing corresponding authors is considered common due to not all publications consistently tagging or assigning any corresponding author

**Table 2.** Completeness of metadata of publication datasets on the Indonesia-affiliated green accounting studies

Description	Missing Counts	Missing (%)	Status	Description
Abstract	0	0.00	Excellent	No missing abstract, analysis relying on content by keyword analysis is ensured to be highly reliable
Document Type	0	0.00	Excellent	All retrieved publications have a defined type
Language	0	0.00	Excellent	No missing language data
Publication year	0	0.00	Excellent	No missing publication year, accurate time-based analysis ensured
Title	0	0.00	Excellent	No missing titles
Total Citation	0	0.00	Excellent	All retrieved publications have citation count data
Journal	0	0.00	Excellent	No missing journal information
Author	0	0.00	Excellent	Complete author data, author-based metrics (e.g., collaboration network), are deemed highly dependable
Affiliation	0	0.00	Excellent	No missing affiliation data
Cited Reference	2	1.32	Good	Very small number of publications are missing cited references, does not significantly impact co-citation analysis
DOI	13	8.61	Good	Small portion of the dataset does not contain DOI
Keywords	24	15.89	Acceptable	Noticeable percentage of keywords missing, possibly due to manually assigned keywords and/or not being a mandatory part of the publication's core metadata
Corresponding Author	50	33.11	Poor	High percentage of missing corresponding author information since not all publications require assignment of a corresponding author

### 3. RESULTS AND DISCUSSION

A total of 4,441 publications on green accounting were retrieved from the Scopus database, published between 1970 and 2025. Among these, 151 publications (published between 2003 and 2025) were affiliated with at least one author from an Indonesian

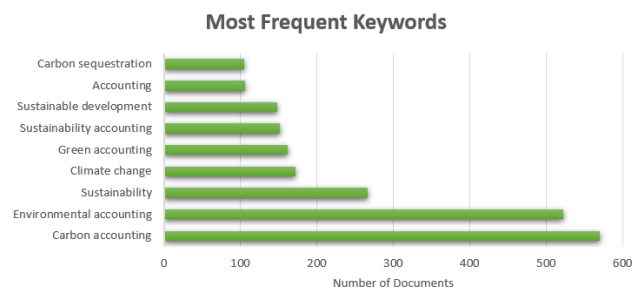
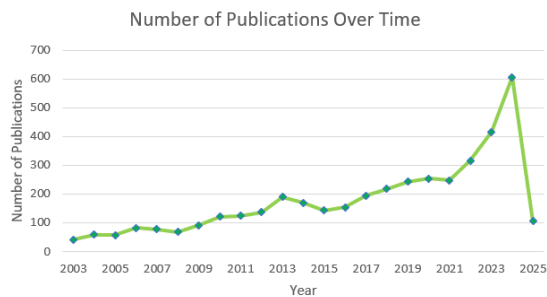
institution, representing 3.4% of the total dataset. The variety of document types, such as original research, review, conference paper, and book chapter, that are contained in each dataset is summarized in Table 3. The annual publication trends, top publishing journals, and most frequently used keywords are presented in Figures 1 and 2.

The annual growth rate of global publications on green accounting was 8.85%, while Indonesia-affiliated studies showed a slightly slower growth rate at 5.86%, indicating a relatively slower expansion of green accounting studies in Indonesia. In terms of publication growth, the global dataset showed a steady increase in green accounting studies, particularly in recent years, with a peak of 606 publications output in 2024, a 45% increase from the previous year. Meanwhile, Indonesia-affiliated publications emerged later, with the earliest record being in 2003, with a slower pace when compared to the global trend, yet also reached its peak in 2024, with an increase in publication volume from 21 to 45 papers.

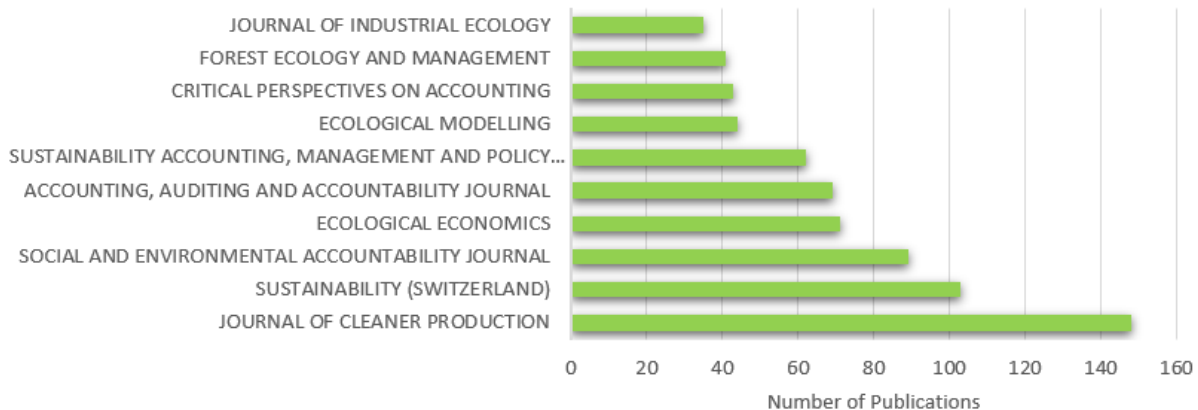
The global dataset contains publications from 1588 different sources, whereas the Indonesia-affiliated dataset includes 103 sources referring to the number of source title (i.e. journal names). Figure 1b and Figure 2b presented the top publishing journals from each dataset, showing the most prolific journals on green accounting studies on a global and Indonesia-affiliated landscape, respectively. The most prolific journals publishing global research on green accounting include Journal of Cleaner Production ( $n = 140$ , 3.1%), Sustainability (Switzerland) ( $n = 103$ , 2.3%), and Social and Environmental Accountability Journal ( $n = 89$ , 2%). Other notable sources included Ecological Economics, Sustainability Accounting Management, and Forest Ecology and Management. This suggests that global green accounting research is highly interdisciplinary and diverse, involving different perspectives such as business, environmental science, and sustainability policy. Indonesia-affiliated publications were found at most in the International Journal of Energy Economics and Policy ( $n = 13$ , 8.6% out of 151 papers) and IOP Conference Series ( $n = 8$ , 5.2%) journals, with no other journals publishing more than five documents. Compared to

**Table 3.** Document type of green accounting research (1975–2023)

Document Type	Number of papers (%)	
	Global (n = 4,441)	Indonesian (n = 151)
Original research	3190 (71.8%)	118 (78.1%)
Review	252 (5.7%)	3 (2%)
Conference paper	466 (10.5%)	23 (15.2%)
Book chapter	338 (7.6%)	6 (4.1%)
Other	195 (4.4%)	1 (0.6%)



### Top Publishing Journals



**Figure 1.** Publication trend of green accounting studies from the global dataset



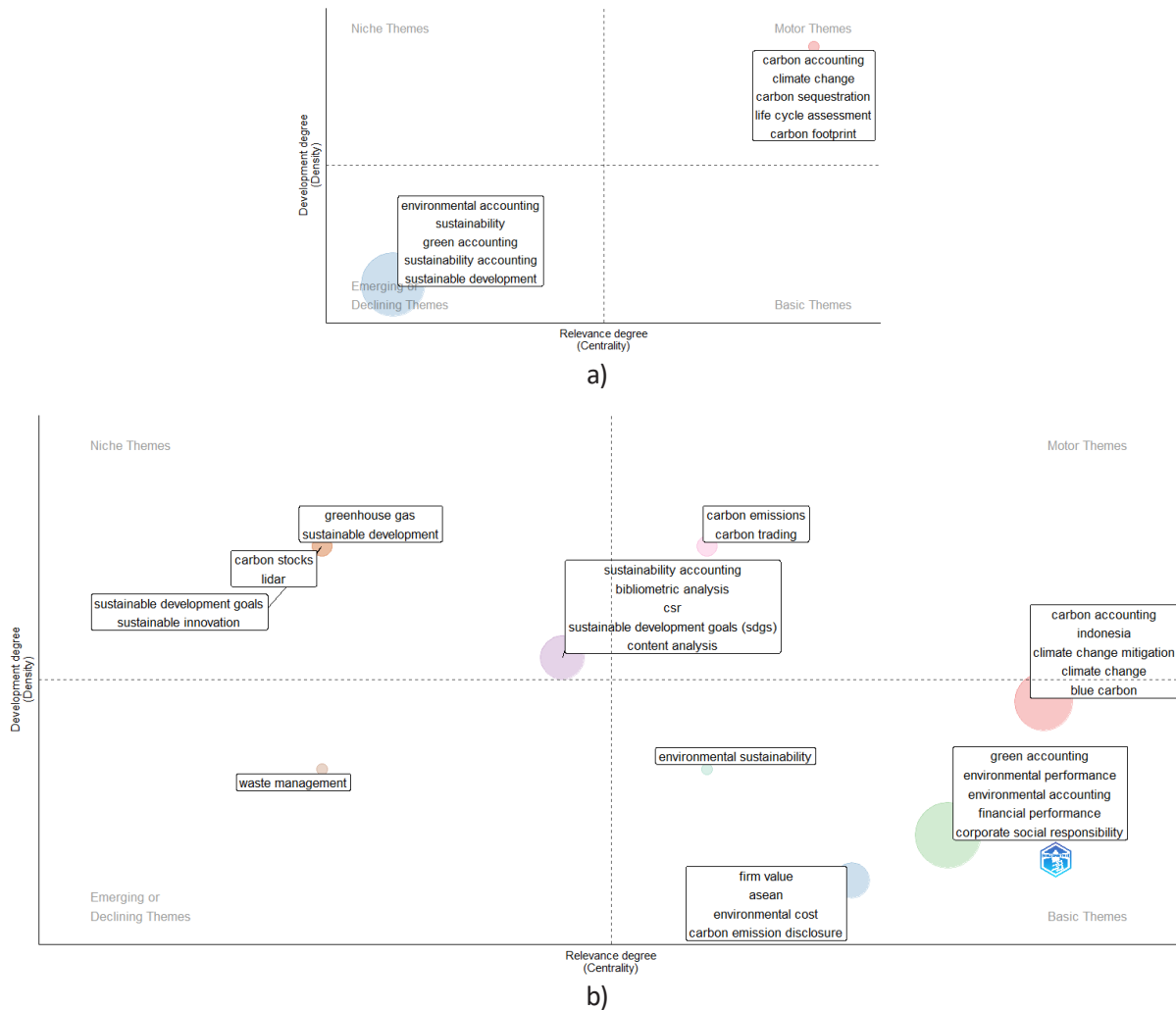
**Figure 2.** Publication trend of green accounting studies from the Indonesia-affiliated dataset

the global green accounting studies, Indonesia-affiliated publications appeared in a smaller range of journals, particularly focusing on energy-related sustainability issues (Gheewala, 2023; Latifah & Soewarno, 2023).

Emergence of prominent keywords such as ‘carbon accounting’, ‘environmental accounting’, ‘sustainability’, ‘climate change’, and ‘sustainability reporting & carbon sequestration’ in the global dataset suggests that the global research is more specialized, with a strong emphasis on sustainability reporting, corporate accountability, and carbon-related issues. Meanwhile, Indonesia-affiliated studies presented a different thematic focus, mostly utilizing different keywords, including ‘environmental & financial performance’ and ‘corporate social responsibility’. These indicate that Indonesia focuses more on green accounting and financial performance rather than on developing effective reporting methods. The keyword ‘Indonesia’ was also among the highly used key-

words, indicating Indonesia-affiliated study’s interest in regional focus on local challenges.

Development and relevance degree were also identified utilizing Bibliometrix, to observe the number of themes involved in both global and Indonesia-affiliated green accounting studies. These thematic figures illustrate how the centrality and development of various green accounting themes differ across the two contexts. In the global datasets, topics such as carbon accounting, climate change, and life cycle assessment occupy the most developed and central positions (Figure 3a). These themes are prominent in the global discourse on sustainability and environmental impact, highlighting a strong focus on carbon-related issues and sustainability reporting. On the other hand, themes like green accounting and sustainable development are more niche or emerging globally, indicating that they are still developing but not yet as central to the global research agenda (Figure 3a).

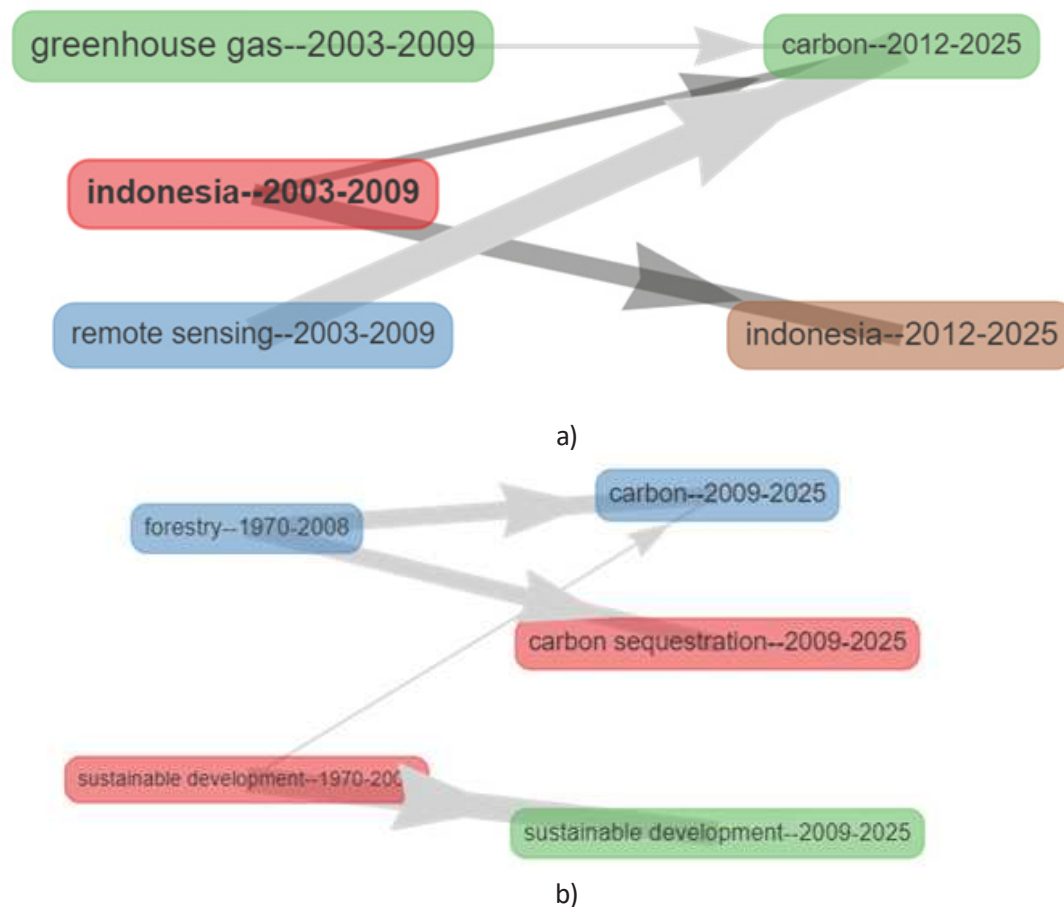


**Figure 3.** Thematic map of green accounting studies from global (a) and Indonesia-affiliated datasets (b)

As for the Indonesia-affiliated dataset, themes like carbon accounting and carbon emissions are found to remain central (Figure 3b). However, the dataset has a clear emphasis on environmental performance, corporate social responsibility, and financial performance. This suggests a unique focus on how environmental and financial outcomes intersect, with regional-specific issues such as waste management emerging as niche concerns. Additionally, themes like sustainable development goals (SDGs) and greenhouse gases reflect the broader sustainability concerns shaping Indonesian research (Figure 3b). However, comparing the thematic map with that of the global dataset requires an even distribution of publication counts. The dispersion in the Indonesian dataset could be derived from its small sample size ( $n = 151$ ), which limits keyword co-occurrence and weakens connections between themes. In biblio-

metric analysis, larger datasets ( $n = 4,441$  globally) increase network density and clustering, as repeated keyword associations strengthen thematic cohesion. With fewer publications, the likelihood of shared keywords decreases, resulting in a fragmented research structure.

The thematic evolution of both publications reporting green accounting from global and Indonesia-affiliated datasets is presented in Figure 4. The selected cutting year is set at around 2008–2009, considering the year range of the retrieved datasets from 1970 to 2025, as well as the relatively increasing number of publications over the aforementioned research theme over these years. The thematic evolutions demonstrate similar overall trends but with slight differences in terms of the research focus and timing. Global studies reporting on green accounting began earlier, with our



**Figure 4.** Thematic evolution of green accounting studies from global (a) and Indonesia-affiliated datasets (b)

dataset including publications from as early as the 1970s, emphasizing forestry. For instance, there are reports on the review of short ratios in terrestrial biomes (Mokany et al., 2006) and sustainable development (Wiedmann, 2009). The focus then shifted to carbon sequestration – for example, a report on the assessment of the role of trees on agricultural lands and their significance for carbon sequestration at the global level (Zomer et al., 2016), and sustainable development still remains the main research focus from 2009 to the present time.

Meanwhile Indonesia-affiliated studies picked up 33 years after green accounting research was first introduced. The studies focus on greenhouse gas and remote sensing – one of the studies was reporting on the use of remote sensing to present a canopy height quantile-based approach for quantifying above-ground carbon content (Patenaude et al., 2004), then followed the global trend on carbon research from 2012 to the present time. The

thematic evolutions obtained from both datasets indicate an increasing integration of carbon-related studies with broader sustainability and policy discussions.

The lists of top-cited publications reporting green accounting are presented in Tables 4 and 5. The most influential publication on a global landscape is “What are ecosystem services? The need for standardized environmental accounting units” authored by Boyd and Banzhaf (2007), cited in 1579 papers. This study highlighted the necessity to define standardized units in ecosystem services and their importance in integrating these units into environmental accounting. Other highly cited global publications also emphasized themes, including but not limited to environmental disclosures and corporate legitimacy (Cho & Patten, 2007), consumption-based environmental accounting, and corporate greenwashing and accountability (Laufer, 2023). The most influential work authored by at least one Indonesia-affiliated

researcher, Zomer et al. (2016), was cited 396 times since its publication in 2016, emphasizing the role of agroforestry and tree cover on agricultural land in carbon sequestration, part of climate change mitigation. Other top-cited Indonesia-affiliated publications also focused on a similar theme, indicating the importance of discussion on deforestation, carbon sequestration, and land-use policies (DeFries et al., 2007; Masera et al., 2003; Smith et al., 2012). Unlike global research, which is more

diverse in corporate accountability and sustainability reporting, Indonesia-affiliated publications are strongly tied to forestry, land-use, and carbon sequestration policy, aligning with the country's resource challenges.

The visualized co-occurrence networks of author keywords are presented in Figures 5 and 6. The visualizations were generated using VOSviewer, highlighting the most frequently associated key-

**Table 4.** Top 10 most cited globally published articles on green accounting

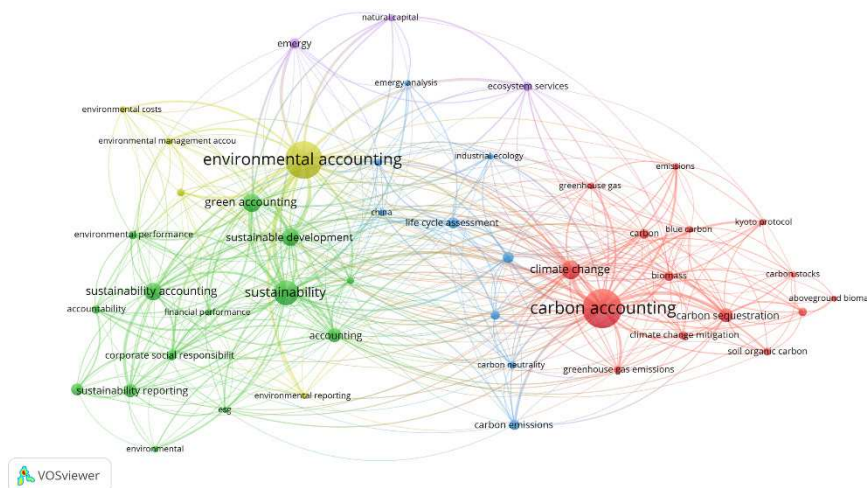
Rank	Title	Source	Year of Publication	Times of Citations
1	What are ecosystem services? The need for standardized environmental accounting units	Boyd and Banzhaf (2007)	2007	1,579
2	The role of environmental disclosures as tools of legitimacy: A research note	Cho and Patten (2007)	2007	1,304
3	Critical analysis of root: Shoot ratios in terrestrial biomes	Mokany et al. (2006)	2006	1,218
4	A review of recent multi-region input-output models used for consumption-based emission and resource accounting	Wiedmann (2009)	2009	932
5	Social accountability and corporate greenwashing	Laufer (2003)	2003	870
6	Is accounting for sustainability actually accounting for sustainability...and how would we know? An exploration of narratives of organizations and the planet	Gray (2010)	2010	847
7	Using content analysis as a research method to inquire into intellectual capital reporting	Guthrie et al. (2004)	2004	777
8	Sustainable tourism: Research and reality	Buckley (2012)	2012	768
9	New technologies reduce greenhouse gas emissions from nitrogenous fertilizer in China	Zhang et al. (2013)	2013	740
10	Achieving the United Nations Sustainable Development Goals: An enabling role for accounting research	Bebbington and Unerman (2018)	2018	676

**Table 5.** Top 10 most cited published Indonesia-affiliated articles on green accounting

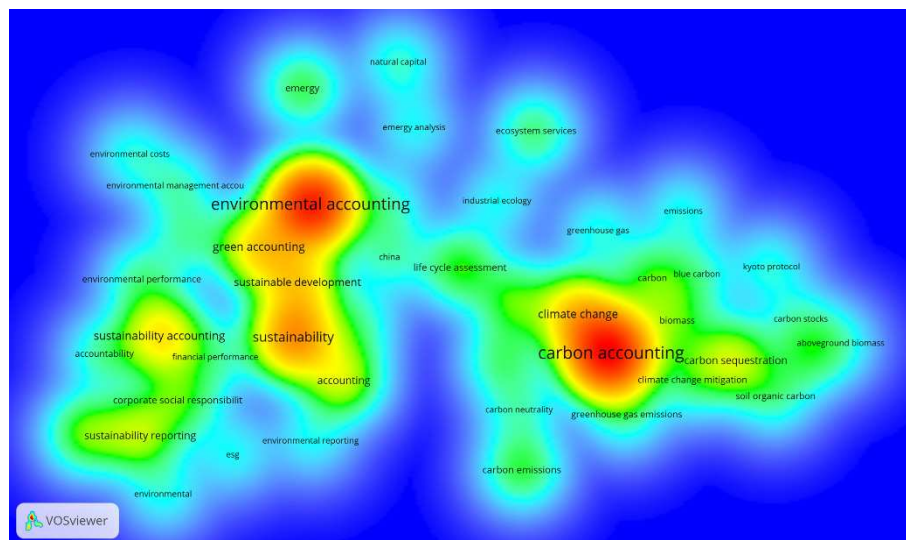
Rank	Title	Source	Year of Publication	Times of Citations
1	Global tree cover and biomass carbon on agricultural land: The contribution of agroforestry to global and national carbon budgets	Zomer et al. (2016)	2016	396
2	Earth observations for estimating greenhouse gas emissions from deforestation in developing countries	DeFries et al. (2007)	2007	290
3	Modeling carbon sequestration in afforestation, agroforestry and forest management projects: The CO2FIX V.2 approach	Masera et al. (2003)	2003	261
4	Quantifying forest above-ground carbon content using LIDAR remote sensing	Patenaude et al. (2004)	2004	219
5	Derivation of burn scar depths and estimation of carbon emissions with LIDAR in Indonesian peatlands	Ballhorn et al. (2009)	2009	177
6	Quantifying changes in the rates of forest clearing in Indonesia from 1990 to 2005 using remotely sensed data sets	Hansen et al. (2009)	2009	166
7	Linking environmental strategy to environmental performance: Mediation role of environmental management accounting	Solovida and Latan (2017)	2017	154
8	Towards an integrated global framework to assess the impacts of land use and management change on soil carbon: Current capability and future vision	Smith et al. (2012)	2012	152
9	Temporal and spatial variability of the beginning and end of daily spring freeze/thaw cycles derived from scatterometer data	Bartsch et al. (2007)	2007	100
10	Life cycle assessment for the sustainability assessment of biofuels and bioproducts	Gheewala (2023)	2023	76

words in green accounting studies and identifying dominant themes and key research areas in both global and Indonesia-affiliated publications. To enhance the analysis of keyword co-occurrences, a minimum occurrence threshold was applied: 27 for the global dataset and 3 for the Indonesia-affiliated dataset, both retrieved from the Scopus database. The decision to apply the restriction was based on the suggestion from previous literature (Ginting et al., 2023; Pratama et al., 2024; Iqhrammullah et al., 2024). Network visualization and density visualization were produced from keywords' co-occurrences, with the latter specifically utilized to identify the main keywords of focus and how they revolve around other keywords.

Out of 8910 keywords retrieved from the global green accounting dataset, 46 met the threshold, with the most used keywords being 'carbon accounting' (occurrences = 570), followed by 'environmental accounting' (occurrences = 522), 'sustainability' (occurrences = 266), 'climate change' (occurrences = 172), 'green accounting' (occurrences = 162), and 'sustainability accounting' (occurrences = 152). Among the keywords analyzed, only the first two mentioned appeared more than 500 times. In the network visualization, the color of each node reflects the proximity of a keyword to a specific research theme. Six major research clusters emerged, focusing on 'carbon management', 'sustainable finance', 'sustainability disclosure', 'environmental accounting', 'sustainable development', and 'climate change'.

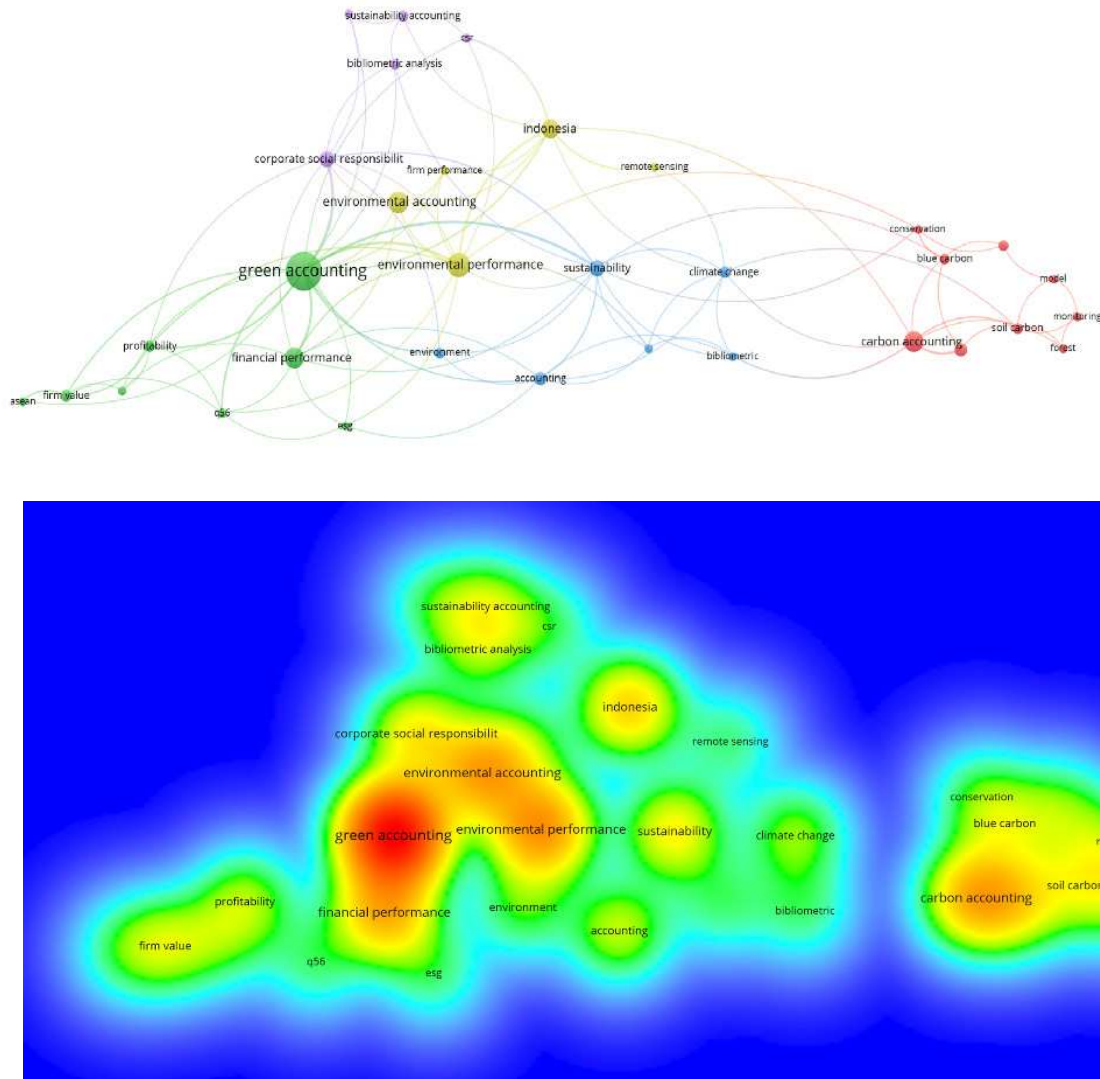


a)



b)

**Figure 5.** (a) Network visualization of global green accounting keywords (weights: occurrences) and (b) Density visualization of global green accounting keywords (weights: occurrences)



**Figure 6.** (a) Network visualization of Indonesia-affiliated green accounting keywords (weights: occurrences) and (b) Density visualization of Indonesia-affiliated green accounting keywords (weights: occurrences)

sure’, ‘circular economy’, ‘natural capital’, and ‘climate mitigation’. The density visualization further highlights keyword prominence, with yellow indicating the highest publication density, followed by shades of green. Mapping of the global dataset revealed that ‘environmental accounting’ and ‘carbon accounting’ had the highest density, while a smaller group of keywords was also concentrated around ‘sustainability’ and ‘climate change’.

Out of 417 keywords retrieved from the Indonesia-affiliated green accounting dataset, 33 met the threshold, with the most used keywords being ‘green accounting’ (occurrences = 33), followed by ‘environmental performance’ (occurrences = 15),

‘environmental accounting’ (occurrences = 13), ‘financial performance’ (occurrences = 12), ‘carbon accounting’ (occurrences = 12) and ‘sustainability’ (occurrences = 8). Only the first keyword had more than 30 occurrences. The five research clusters, distinct by color, formed in the visualization mainly discussed topics related to ‘carbon management’, ‘sustainable finance’, ‘sustainability disclosure’, ‘climate change adaptation’, and ‘corporate social responsibility’. The Indonesian density visualization suggested ‘green accounting’ and ‘environmental performance’ were the keywords with the highest density, while keywords like ‘carbon accounting’ and ‘corporate social responsibility’ also appeared in lower density.

The analysis of affiliations' publication trend over time was conducted using Bibliometrix, with the results presented in Figure 7. The publication trends indicate a marked contrast between global and Indonesia-affiliated research outputs in the field of green accounting. The global data demonstrate a consistent and substantial rise in publications starting around 2012, with an even steeper growth after 2017. The most notable contributors in this domain include Beijing Normal University, Tsinghua University, and the University of Maryland, all of which have seen a significant increase in their research output, particularly in the past five years. These institutions, particularly those in China and the United States, have established themselves as leaders in green accounting research.

In contrast, the trend for Indonesia-affiliated universities reveals a more gradual rise in publication outputs (Figure 7b). While the number of articles remained low through the early 2010s, a notable increase in research activity began to emerge around 2014. The Universitas Gadjah Mada and Universitas Indonesia show significant growth in the number of publications from 2020 onward, indicating a growing focus on green accounting within Indonesian academia. However, the overall volume of publications from Indonesian institutions still lags behind their global counterparts, with universities like Bina Nusantara University contributing fewer articles in comparison to the leading global institutions.

The clusters, along with suggested research trends derived from the keyword co-occurrence network visualizations, are presented in Tables 6 and 7. Five clusters were identified in each visualization, representing key dimensions of green accounting research at the global level and within Indonesia-affiliated studies. The clusters from global visualization suggested a focus on dominant areas related to green accounting, such as carbon management. The focus is on carbon accounting and climate change mitigation (Liu et al., 2025), with the others focusing on sustainability (Basu et al., 2025), environmental accounting (Muller et al., 2011), circular economy and ecosystem services (Scarpellini et al., 2020), and natural capital (Brandon et al., 2021), reflecting the diversity of global green accounting studies. Indonesia-affiliated visualization revealed its focus on carbon management and climate change mitigation (Andrian et al., 2023; Agus et al., 2021), with carbon accounting playing a central role similar to global research. Another important focus in Indonesia-affiliated research was found in financial performance (Pamungkas et al., 2024) and sustainability disclosure (Ihsani et al., 2021). It emerged as the second most studied topic, followed by research on environmental management practices, environmental performance, CSR practices, and their relation to the Sustainable Development Goals within the Indonesian context.

Countries' co-authorship analysis was conducted to identify collaborations between countries, fo-

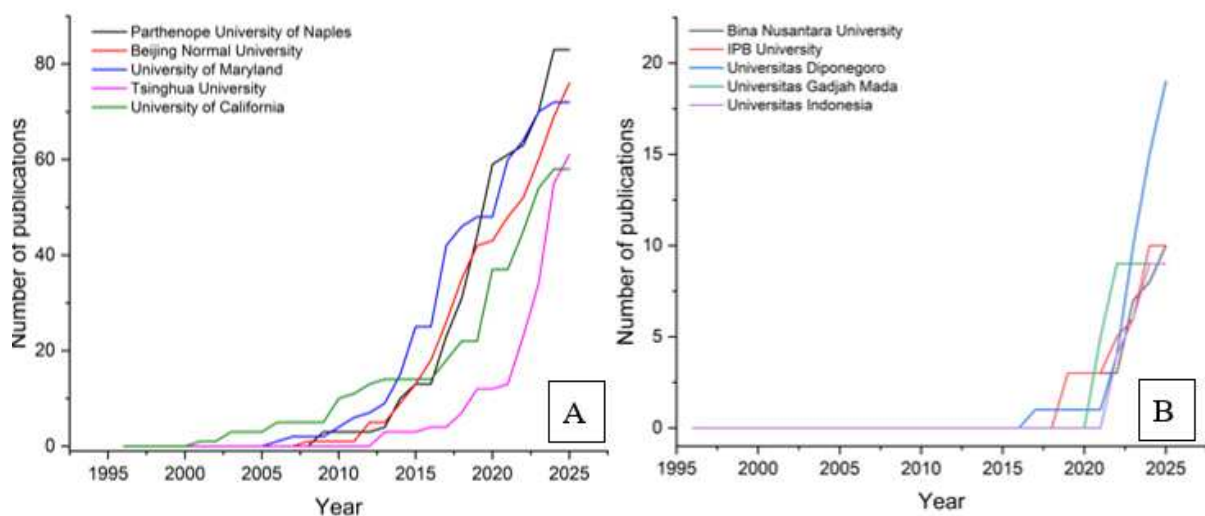


Figure 7. Green accounting trends among institutions in global (A) and Indonesia-affiliated datasets (B)

**Table 6.** Clusters of trending green accounting studies

Cluster (color)	Keywords of interest	Research trend
Red (I)	Carbon accounting, climate change mitigation, greenhouse gas emission, carbon sequestration, biomass	Increasing focus on carbon pricing mechanisms, advancements in carbon capture and storage (CCS), policy-driven carbon neutrality goals, and renewable biomass technologies
Green (II)	Green accounting, sustainability, environmental performance, corporate social responsibility	Integration of ESG (Environmental, Social, and Governance) criteria in corporate reporting, development of sustainability disclosure standards, and impact assessment of green finance on corporate sustainability
Mustard (III)	Environmental accounting, environmental management, and environmental reporting	Evolution of mandatory environmental disclosure regulations, digital transformation in sustainability reporting, and corporate adaptation to global sustainability frameworks (e.g., GRI, TCFD, IFRS Sustainability Standards)
Orange (IV)	Life cycle assessment, carbon emission, industrial neutrality, circular economy	Expansion of circular economy practices in manufacturing, advancements in industrial decarbonization strategies, and integration of life cycle analysis in sustainable product design
Blue (V)	Ecosystem services, natural capital, energy	Monetization of ecosystem services, nature-based solutions for climate adaptation

**Table 7.** Clusters of trending Indonesia-affiliated green accounting studies

Cluster (color)	Keywords of interest	Research trend
Red (I)	Carbon accounting, carbon sequestration, climate change mitigation	Growing interest in carbon sequestration in tropical forests and peatlands, policy-driven carbon offset markets, and the role of conservation initiatives in Indonesia's net-zero commitments
Green (II)	Green accounting, financial performance, ESG	Expansion of sustainability reporting in Indonesian corporations, the impact of green accounting on firm profitability, and alignment with ASEAN ESG disclosure frameworks
Mustard (III)	Climate change, sustainability, environmental management	Focus on the adaptation of climate policies in Indonesia, implementation of green management practices, and the growing role of sustainable environmental policies in corporate governance
Orange (IV)	Environmental accounting, environmental performance, and firm performance	Adoption of environmental management accounting in industries, corporate responses to Indonesia's climate policies, and the role of remote sensing in monitoring environmental performance
Blue (V)	CSR, sustainability accounting, sustainable development	The evolution of CSR practices in Indonesia, the integration of sustainability accounting in corporate governance, and the importance of sustainable development goals for Indonesia's economic growth

cusing on both global and Indonesia-affiliated datasets. The obtained network visualizations are presented in Figure 8. A restriction was added to the network visualizations where the minimum number of documents of a country was set at 20 and 3, respectively. The network visualization of countries' co-authorship mapped green accounting research at the global level and in Indonesia-affiliated studies. It shows patterns of collaboration and co-authorship among different groups of countries.

In the global dataset, 47 countries met the inclusion threshold, while 17 countries were identified in the Indonesia-affiliated dataset. The global collaboration network revealed that the United States (841 documents, 38,213 citations, TLS = 599), China (712 documents, 10,429 citations, TLS = 295), the United Kingdom (575 documents, 27,032 citations, TLS = 559), and Australia (546 docu-

ments, 22,320 citations, TLS = 390) were the most prominent contributors. Among them, the United States, the United Kingdom, and Australia formed the central nodes in the collaboration network.

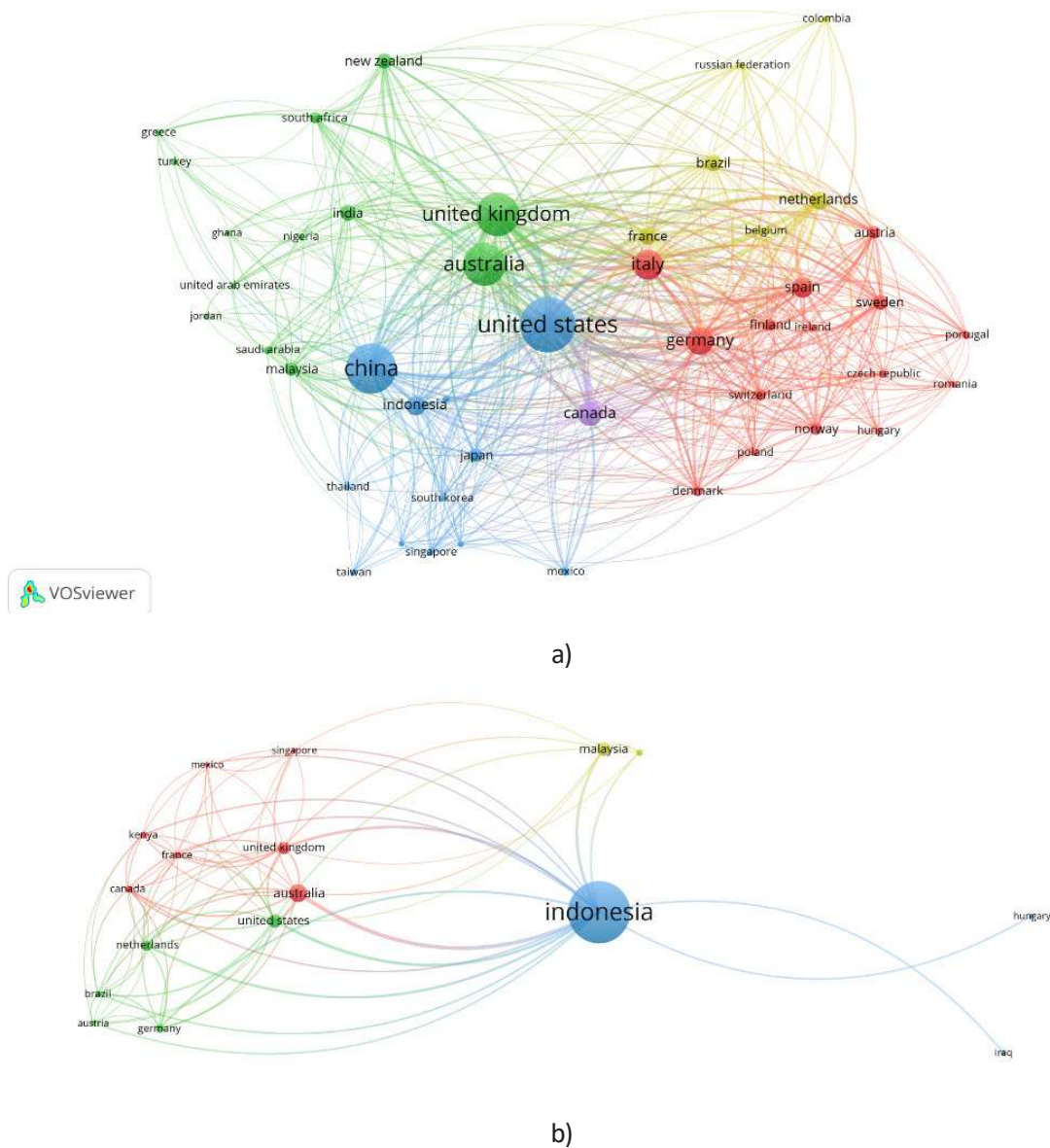
The link strength (LS) between nodes represents the frequency of co-authorship between countries. The strongest collaboration was between the United States and the United Kingdom (LS = 70), followed by the United States and China (LS = 60), the United Kingdom and Australia (LS = 56), and the United States and Australia (LS = 54). The strongest link involving a country outside the top four was between the United States and Canada (LS = 48).

Indonesia-affiliated authors' co-authorship revealed Indonesia (documents = 151, citations = 2952, TLS = 103), maintaining key collaborations with nearby countries such as Australia

(documents = 20, citations = 437, TLS = 52) and Malaysia (documents = 12, citations = 113, TLS = 21). Indonesia conducted the most collaborations with Australia (LS = 20), followed by Malaysia (LS = 12). The United States and the United Kingdom also maintained a similar level of collaboration with Indonesia, collaborating 12 and 10 times, respectively. However, Indonesia's collaboration network is relatively less dense when compared to other leading nations, suggesting that while Indonesia does contribute to the global stage in green accounting studies, there is room for improvement with regard to international collabora-

tions. Strengthening collaborations between countries may not only enhance Indonesia-affiliated research visibility but also increase the impact of their research, as reflected by the number of citations from other leading countries in the study.

Comparative analysis between global and Indonesia-affiliated research showed that Indonesia has made a significant contribution to green accounting, particularly in issues related to forestry and financial performance (Langi, 2023; Al-Naser et al., 2021). However, there are still gaps in both research focus and volume. The data in-



**Figure 8.** Network visualizations of co-authorship countries for the green accounting research based on global (a) and Indonesia-affiliated datasets (b)

indicated that global research in green accounting is considered increasingly diverse, covering various critical themes less discussed in Indonesia-affiliated research, including but not limited to sustainability reporting, climate change mitigation, capital reporting, ecosystem services, and environmental performance (Bernardes et al., 2024; Ratmono et al., 2024). Indonesia-affiliated research appears to be vigorously focused on a narrower set of topics, emphasizing financial and environmental performance, with some of its top-cited publications revolving heavily around forestry issues (Kiswanto et al., 2023; Indrajaya et al., 2024).

Another underexplored area in Indonesia-affiliated green accounting studies is the integration of environmental, social, and governance (ESG) criteria and CSR into corporate governance. While corporate sustainability has been gaining attention recently in Indonesia (Tjahjadi et al., 2021), the implementation of sustainability reporting standards such as GRI, Task Force on Climate-related Financial Disclosures (TCFD), and International Financial Reporting Standards (IFRS) remains underrepresented in Indonesia-affiliated publications (Pesci et al., 2024; De Villiers et al., 2022). Such is a rising and extensively studied theme in global research, with the most recent studies reporting on sustainable business practices and corporate responsibility and the analysis of corporate ESG reporting preparedness in Central and Eastern European companies (Rüdele & Wolf, 2024; Suta et al., 2025).

Moreover, the discussion on environmental management accounting (EMA) is still emerging in Indonesia, with a recent study discussing conceptual environmentally sustainable development and emphasizing the role of EMA in promoting company sustainability (Zatini et al., 2025). In comparison to global research, where EMA is widely discussed in corporate governance (Nkundabanyanga et al., 2021) and regulatory compliance (Zatini et al., 2025), Indonesia-affiliated research has yet to fully explore how EMA can contribute to long-term environmental sustainability issues in the critical industries such as agriculture and mining – both of which are crucial to the Indonesian economy.

Lastly, while remote sensing is an increasingly popular discussion in Indonesia-affiliated research,

its use in environmental accounting remains limited. The global trend showed how remote sensing is widely utilized to track environmental performance and manage a cost-efficient carbon accounting system (Malerba et al., 2023; Simpson et al., 2022). Other potential points of discussion may also be found in recent findings on the integration of multi-source remote sensing data in building carbon-efficiency (Zheng et al., 2025) and the utilization of machine learning and remote sensing for informed decision-making in forest management, carbon assessment, and ecological monitoring initiatives (Anees et al., 2024). Thematic evolutions visualized in Figure 4 also showed Indonesia-affiliated studies' tendency before migrating their research focus to carbon-related studies. Themes pursued currently in global studies, such as sustainable development goals (SDGs) and greenhouse gases, also offer potential despite their significant rise in the number of publications. Several top-cited publications reporting on both themes also presented potential unexplored issues in their respective topics. They include the pressing concern for more clarity on the role of offsetting emissions and the urgency to harmonize the city's carbon accounting methods, ensuring they are flexible enough to accommodate adjustments to local conditions and broader system transitions (Huovila et al., 2022). In addition, it is worth mentioning future research opportunities to refine how carbon accounting directly support helping business to achieve the climate goals of the Paris Agreement (He et al., 2022) and emergences of technologies for emissions monitoring and eliminating sources in supporting the decision-making process for the carbon neutrality plan for the globe (Raza et al., 2023).

The research gaps identified here suggest that Indonesia-affiliated green accounting research would benefit from a broader and more diversified focus on well-established topics related to green accounting globally. Example topics include strengthening research in carbon policy adaptation, global sustainability reporting standards, and environmental management accounting, which could contribute significantly to both Indonesia's environmental sustainability and, on a global landscape, its visibility in green accounting studies.

The evidence presented in this bibliometric analysis solely relies on the published research, specifi-

cally on certain literature databases, while there are findings of green accounting that either have not been published or are not indexed on the searched database, in this case, the Scopus database. Future studies should consider validating these findings with a more direct approach, such

as interviews or case studies. However, despite its limitations, bibliometric analysis remains a robust tool in achieving effective research landscape mapping. This study is one of the first to use a bibliometric approach to compare global and Indonesia-affiliated research on green accounting.

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## CONCLUSION

This study has provided a bibliometric approach to green accounting studies on a global landscape and its comparison to Indonesia-affiliated research, with a particular focus on the trends, impact, and collaboration patterns in this evolving field. This study aimed to conduct a comparative bibliometric analysis of global and Indonesia-affiliated studies on green accounting, particularly through network visualizations, collaboration networks and research clusters within the green accounting landscape. Key clusters of research were identified for both global and Indonesia-affiliated research, including topics on carbon accounting, sustainability, environmental performance, and the growing integration of ESG factors into corporate policies. The network visualization of countries' co-authorship revealed global collaboration trends, highlighting Indonesia's unique position in collaborating with leading countries in this field, such as the United States and Australia. This study also emphasizes the importance of exploring a broader and diverse approach to green accounting, which is still underrepresented among Indonesia-affiliated researchers. Moving forward, future research could potentially contribute more robustly to already emerging topics in global green accounting research, such as sustainable practices, carbon management, and the global sustainability reporting standards, to further increase the visibility of Indonesia-affiliated research and contribute to a global landscape.

## AUTHOR CONTRIBUTIONS

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Validation: Surna Lastri.

Visualization: Surna Lastri, Syamsidar, Emmi Suryani Nasution.

Writing – original draft: Surna Lastri, Williams Chiari, Linda.

Writing – review & editing: Surna Lastri, Syamsidar, Intan Rizkia Qudri, Linda.

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