

STUDYING THE RELATIONSHIP BETWEEN GREEN ACCOUNTING AND SUSTAINABLE DEVELOPMENT USING BIBLIOGRAPHY METHOD

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Abstract: This article aims to evaluate research trends on the relationship of green accounting and sustainable development in businesses based on articles in the Openalex database in the period from 1995 - 2024. Research results show that there have been a total of 121 articles on this topic indexed in Openalex from 1995 - 2024. Regarding frequently mentioned content, there are 339 keywords appearing in the articles, and 20 keywords appear 20 times or more. Regarding authors participating in the research, there are 253 authors participating in writing on the topic of green accounting towards sustainable development, in which author Giles Atkinson is the author with the most articles with 3 articles and corresponding citations of 546. In all, 24 countries published articles related to green accounting towards sustainable development. United Kingdom is the country with the most total citations at 512 times. University College London is the workplace of the authors with the most cited articles, with 2 articles corresponding to 228 citations. Finally, through systematic literature research, many contents have been identified that will be important research points for future studies on green accounting towards sustainable development.

Keywords: Green accounting, sustainable development, systematic literature review, VOSviewer.

1. INTRODUCTION

Promoting sustainable development is a current global goal, especially when environmental issues are being seriously affected. Many measures are taken at both the international and national levels to minimize and prevent environmental impacts on the economy, politics, and society. At that time, corporate social responsibility is closely linked to business activities. Sustainable development is becoming a common trend of countries around the world, the government is moving towards "greening" activities such as: green growth, green bonds, green accounting. At that time, balancing economic growth with social progress and environmental protection became a common trend and goal of most countries in the world. Careful analysis of environmental costs and benefits is necessary for businesses. Green accounting is considered an important tool related to aspects of the influence of the natural environment on the economy and is considered a direction for transformation towards sustainable development. The United Nations requires countries and organizations worldwide to implement an environmental accounting system, to record data related to business activities that impact the environment. Green accounting will help businesses determine the use of natural resources and costs incurred on the production and business activities ecosystem. Green accounting uses life cycle assessment to measure the environmental impact of a business's activities, promoting the adoption of clean production, comprehensive cost assessment, and a combination of traditional accounting to disclose corporate environmental financial information. Many countries worldwide require businesses to implement green accounting and disclose environmental information to stakeholders. Implementing green

accounting and providing environmental information allows businesses to effectively carry out environmental-related activities, improve business performance, and achieve sustainable development. There have been many studies in many countries on green accounting associated with sustainable business development. Therefore, this study helps readers grasp the development and information quality of publications "Green accounting towards sustainable development" through the frequency of using keywords, number of citations, and number of authors and co-authors cited over time. At the same time, it helps future researchers know the trends of this topic over time.

The article clarifies the following research questions, including Q1: What is the number of articles related to green accounting towards sustainable development in businesses from 1995 to April 2024? Q2: What topics are the keywords grouped into? And have these keywords changed and emphasized over time? Q3: Which authors and countries are influential and have published many publications on this content?

To answer the above questions, the study reviewed 121 articles published in the period 1995 - 2024. The research was conducted through bibliometric analysis with great contributions to the research community because through bibliometrics, a valuable amount of information can be gathered about a topic. By reflecting on what has been done and what needs to be researched in the future, the article aims to add to the literature on different methods and contexts to support green accounting researchers toward development. The research is divided into defining the conceptual foundation, applied methods, research results, and concluding remarks.

2. THEORETICAL BASIS

2.1. Green accounting

In 2014, the United Nations launched an application program called "Economic and Environmental Accounting System", also known as Green Accounting. The United Nations also requires countries and organizations around the world to implement environmental accounting systems, to serve the recording of data related to the business activities of the enterprise, which have an impact on the environment. Vandna Shiva (2018) believes that green accounting includes estimating environmental costs, identifying debts and payable costs related to handling environmental issues. Green accounting is using life cycle assessment to measure the environmental impact of a business's activities, promoting the adoption of clean production, applying total cost assessment and combining traditional accounting to publish environmental financial information of enterprises. The aim is to urge businesses to carry out effective environmental practices and to achieve sustainable development. Asheim (1997) believes that it is necessary to establish a green accounting or environmental accounting system to help prevent environmental pollution or limit damage caused by environmental pollution through recording environmental costs and estimating resources for implementing treatment measures.

Gray and Bebbington (2001), argue that green accounting includes the assessment of potential environmental liabilities, the evaluation of assets and the forecasting of environmentally related capital resources, developing an accounting information system covering various aspects of environmental activities, evaluating investment activities related to the environment, analyzing

environmental protection costs, developing accounting techniques to calculate assets and liabilities related to the environment in both financial and non-financial aspects.

The data and presentation of green accounting must reflect the socio-environmental aspects of a business (Fowler, 2008). Green accounting addresses actions, liabilities, and all aspects of business that impact the environment. This information must be clearly shown on financial statements and is an indispensable part of the overall accounting of a business. The purpose of green accounting is as a tool for environmental management and communication with the community and stakeholders. The role of green accounting is to improve environmental performance, thereby bringing operational efficiency to businesses and protecting the environment, towards sustainable development of the whole economy.

2.2. The role of green accounting in the sustainable development trend

The whole world is facing environmental degradation and crisis, causing many ecological and social disasters, strongly affecting sustainable development. Climate change and environmental pollution have created many natural disasters, social disasters and economic disasters. These disasters cause energy crises, resource scarcity, poverty, and social inequality. Since then, natural resources have been exhausted and led to environmental destruction (Gore, 2013). According to Thornton (2013), traditional accounting ignores recognition, measurement of value, recording and reporting of environmental accounting related to the business. Specifically, the basic principles and standards of traditional accounting ignore the recording of social and environmental information in financial reports. Therefore, content related to social and environmental responsibility as well as activities with non-economic benefits of environmental activities tend to be overlooked in corporate financial reports. With the global trend of green growth and green economy, green accounting is increasingly popular in many countries. Originating from the requirement for sustainable development and minimizing the impact of the environment on life, green accounting is becoming a concern of policy makers, business administrators, researchers and the whole people. The United Nations Committee on Sustainable Development (2001) believes that green accounting provides immediate and foresighted information. This is an information system that allows companies to manage economic and environmental information to implement environmental protection strategies. According to research by Lafontaine (2002), when considering environmental aspects in economic activities, businesses must reduce consumption of natural resources to save to the greatest extent. Betianu (2010) argues that the performance of production and business activities can be measured using environmental cost techniques and thereby, identify environmental costs related to accounting and finance, linking environmental information with financial disclosure. Limiting environmental impact and economic development is a challenging feature for developing countries. Businesses in the sector or related to energy-dependent manufacturers face more pressure when implementing green accounting. However, in the future, businesses from all business sectors need to implement green accounting as a tool towards sustainable development.

According to Lako (2015), green accounting strives to minimize expenses, improve revenue, earnings, and corporate assets; increase the value of the enterprise's shares; and encourage

enterprises to operate in a sustainable manner. Green accounting assesses the environmental impact of corporate activities, promotes clean production, uses total cost assessment, and combines traditional accounting to expose the company's environmental financial information. The purpose is to promote businesses to carry out effective environmental activities and to achieve sustainable development. According to Varsha Agarwal & Kalpaja L (2018), it is necessary to have standards and quantification to control business activities that pollute the environment before allowing an organization to operate production and business activities or forcing the organization to handle pollution problems caused by that organization. When a company evaluates the environmental aspects of its economic activities, such as the cost of services and products in comparison to environmental expenses, it can consider minimizing the amount of natural resources used in production and commercial activities. Many studies have shown that green accounting includes three main goals: Identify, collect, calculate and analyze materials and energy-related materials; Internal reporting and use of information on environmental costs; Provide other cost-related information in the decision-making process, with the aim of making effective decisions and contributing to environmental protection. Besides, many other researchers believe that green accounting is divided into many different angles, including five main contents: Environmental financial accounting; environmental management accounting; environmental finance; environmental law; ethics and relations with the social community.

3. METHOD

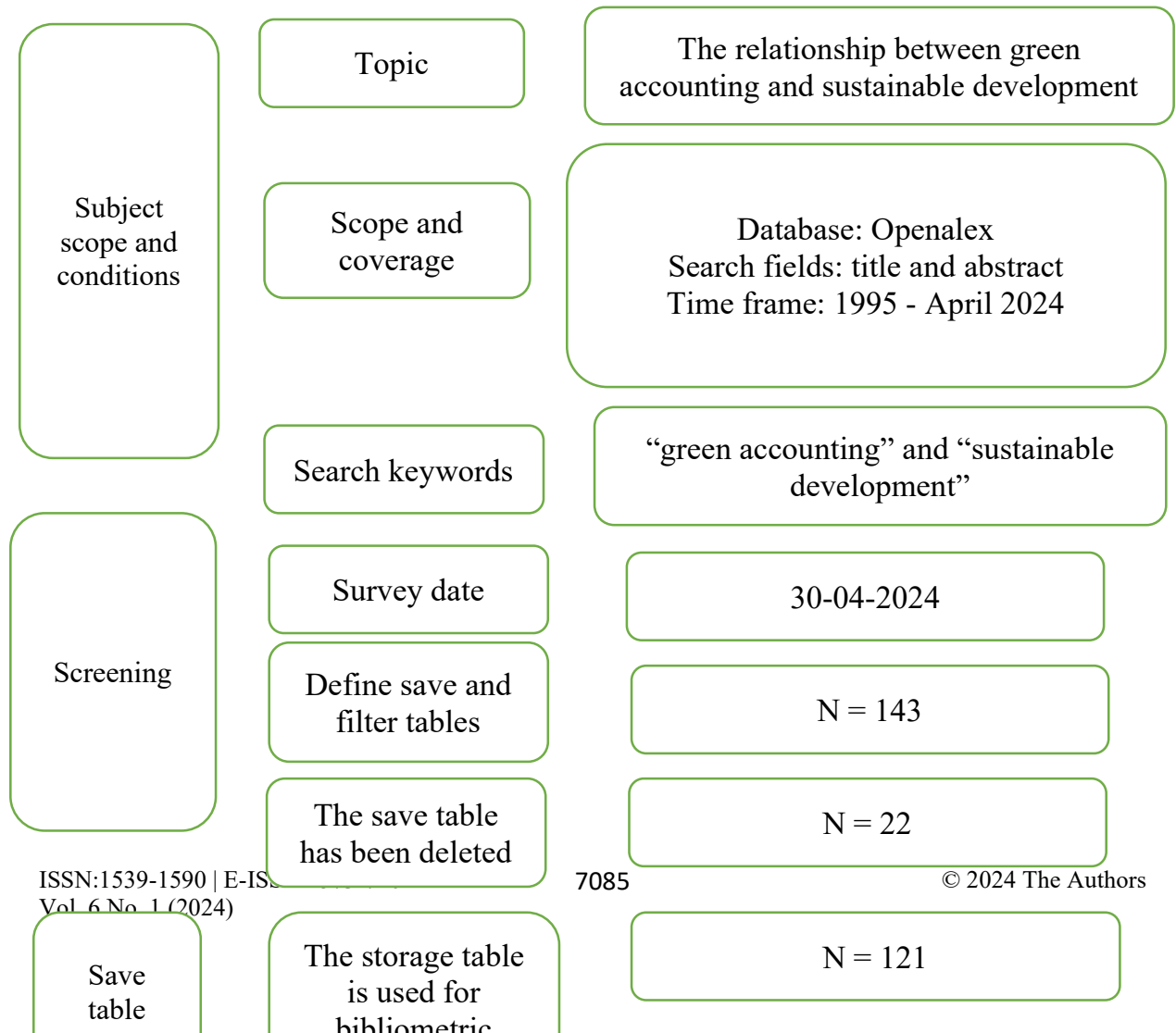


Figure 1. Search diagram

This study uses the Systematic Literature Review method of Tranfield et al. (2003). Sample selection for the study was based on PRISMA, originally proposed by Liberati et al. (2009) and updated in 2021 by Page et al. (2021). The PRISMA process is based on three steps: identification, screening and study inclusion.

As a first step, the author begins by selecting a database to collect articles to include in the study. The database chosen is OpenAlex, known as a free database, connecting data points to create a comprehensive, interconnected global scientific research system. Data was collected on April 30, 2024, with the use of the following keywords "Green Accounting" and "Sustainable Development", the author uses the "AND" operator between these two keywords to search for documents that appear both keywords simultaneously. In the data filtering field, the author chooses to filter keywords by "Title and abstract". The author selected the search period from 1995 to April 30, 2024. The results were 143 documents with the keywords "Green Accounting" and "Sustainable Development" in the title and abstract published in period from 1995 - 2024.

In the second step, the author screened to remove inappropriate documents through technical screening and content screening. For technical screening, the author selects documents in the article. As a result, 22 documents were eliminated, including documents in the form: 1 document in paratext, 11 documents in book-chapter, 3 documents belong to book, 4 documents belong to preprint, 2 documents belong to review and 1 document belongs to thesis. For content screening, documents are pre-read to eliminate documents with irrelevant content even though they contain search keywords. The results after filtering showed that all 121 results met the filtering conditions for inclusion in the study.

The remaining number of documents after the two steps are analyzed as a whole in the SLR document system and entered into VosViewer software to analyze keywords and co-citation analysis. The results of SLR analysis are presented in tables and graphs. From the analysis results, the study finds popular research directions, names the research directions, and suggests further research directions related to the topic of Green Accounting towards sustainable development.

4. RESULT

4.1. Statistics on the number of articles on green accounting towards sustainable development and the number of citations of the articles

From 1995 - 2024, a total of 121 articles on green accounting for sustainable development were indexed in Openalex with an average of 4 articles published per year. The number of articles has increased sharply in recent years. In particular, 2022 and 2023 increased dramatically with 13 and 24 articles. From the statistical results of publication frequency each year, it shows that authors are having a strong interest in the topic of green accounting towards sustainable development in businesses.

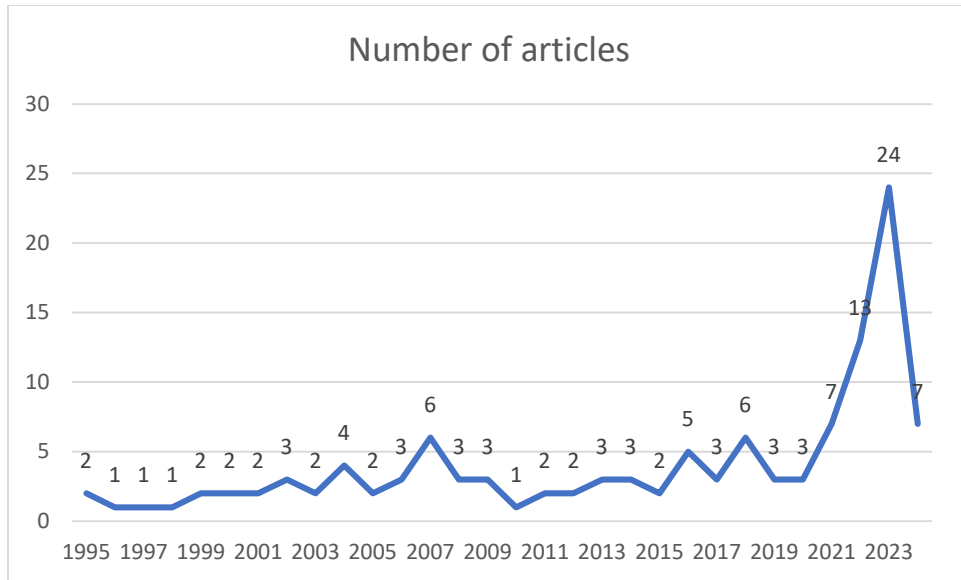


Figure 2. Chart of number of publications by year

Source: Author compiled research

Statistics of articles with the most citations are shown in Table 1. Up to now, there are 3 articles with the most citations. That is, “Measuring Corporate Sustainability” by author Giles Atkinson was published in 2000 with 312 citations, “PICABUE: a methodological framework for the development of indicators of sustainable development” by author G. Mitchell|A. May|A. McDonald was published in 1995 with 282 citations, “Measuring sustainable development: progress on indicators” by David Pearce|Kirk Hamilton|Giles Atkinson was published in 1996 with 228 citations.

Table 1. Statistics of articles with the most citations

No.	Title	Author	Publishing company	Year	Cited
1	Measuring Corporate Sustainability	Giles Atkinson	Taylor & Francis	2000	312
2	PICABUE: a methodological framework for the development of indicators of sustainable development	G. Mitchell A. May A. McDonald	Taylor & Francis	1995	282
3	Measuring sustainable development: progress on indicators	David Pearce Kirk Hamilton Giles Atkinson	Cambridge University Press	1996	228

4	On the evolution of Cleaner Production as a concept and a practice	L. Hens C. Block J.J. Cabello-Eras A. Sagastume-Gutierrez D. Garcia-Lorenzo C. Chamorro K. Herrera Mendoza D. Haeseldonckx C. Vandecasteele	Elsevier BV	2018	195
5	The concept of natural capital	Edward B Barbier	Oxford University Press	2019	81
6	Impact of social responsibility disclosure between implementation of green accounting and sustainable development: A study on heavily polluting companies in Bangladesh	Bablu Kumar Dhar Sabrina Maria Sarkar Foster K. Ayittey	Wiley-Blackwell	2021	74
7	Indicators, Green Accounting and Environment Statistics” Information Requirements for Sustainable Development	Walter Radermacher	Wiley-Blackwell	1999	19
8	Assessing The Impact Of Environmental Accounting Disclosure On Corporate Performance In China	Andrew Agyemang Kong Yusheng Maxwell Kongkuah Alhassan Musah Mohammed Musah	Polytechnic Institute of Iasi	2023	15
9	Accounting for Sustainability: A Dissenting Opinion	Robert D. Cairns	Multidisciplinary Digital Publishing Institute	2011	11
10	Greece's institutional response to sustainable development	Panos Fousekis Joseph N. Lekakis	Taylor & Francis	1997	11

Source: Author compiled research

4.2. Analyze main topics in green accounting content towards sustainable development

To answer the question, on the topic of green accounting towards sustainable development, what content is of interest to researchers, the author researched the keywords that appear frequently in published publications. Among the 339 keywords that appeared, the study selected keywords that appeared 20 times or more, and there were 20 keywords that met this condition. The group of

keywords that appear 20 times or more is shown in Table 2. The keyword “Business” is the keyword that appears the most with 107 appearances and a link strength of 803, the keyword “Accounting” appears the second most with 95 appearances and a link strength of 732.

Table 2. Keyword analysis results

No.	Keyword	Occurrences	Total link strength
1	Accounting	95	732
2	Accounting information system	37	347
3	Biology	60	528
4	Business	107	803
5	Computer science	35	285
6	Ecology	59	522
7	Economics	78	659
8	Environmental accounting	44	411
9	Environmental economics	32	292
10	Environmental full-cost accounting	22	234
11	Environmental resource management	30	290
12	Finance	32	251
13	Financial accounting	24	245
14	Geography	27	211
15	Law	74	594
16	Management accounting	20	190
17	Natural resource economics	22	172
18	Political science	78	616
19	Sustainability	35	324
20	Sustainable development	83	688

Source: Author compiled research

Keywords are evaluated by Vosviewer software based on the number of occurrences and total link strength. Keywords are linked together in three main groups, shown as red, green and blue links (Figure 3).

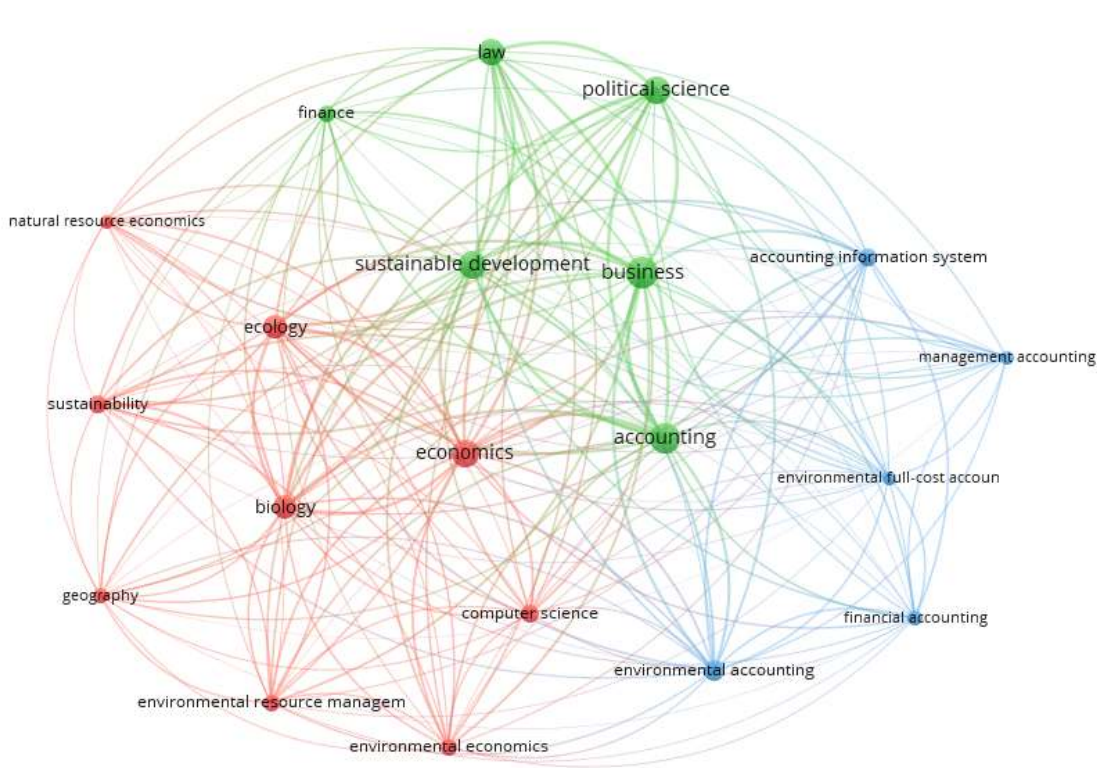


Figure 3. Keyword network map visualization

Table 3 shows the main topics of publications, 121 articles were published under 29 main topics. There are 32 publications published with the topic “Drivers and Impacts of Green Consumer Behavior”, 19 publications published with the topic “Measurement and Evaluation of Sustainable Development”, and 14 publications published with the topic “Corporate Social Responsibility and Financial Performance”.

Table 3. Statistical results by topic

No.	Topic	Count
1	Drivers and Impacts of Green Consumer Behavior	32
2	Measurement and Evaluation of Sustainable Development	19
3	Corporate Social Responsibility and Financial Performance	14
4	Impact of the Covid-19 Pandemic on Small and Medium Enterprises in Indonesia	10
5	Ecological Assessment and Urban Development	5
6	Impact of Corporate Governance on Business Performance	5
7	Conceptualizing the Circular Economy and Sustainable Supply Chains	4
8	Industrial Symbiosis and Eco-Industrial Parks	3
9	Sustainable Development and Innovation Management	3
10	Economic Implications of Climate Change Policies	2
11	Role of Agriculture in Regional Economy Development	2

12	Qualitative Research Methods and Practices	2
13	Data-Driven Decision-Making in Smart Manufacturing Systems	2
14	Comprehensive Assessment of Safety in Energy and Infrastructure	2
15	Economic Impact of Environmental Policies and Resources	1
16	Discrete Choice Models in Economics and Health Care	1
17	Optimal Operation of Water Resources Systems	1
18	Islamic Banking and Finance Literature Review	1
19	The Political Economy of Resource Curse Hypothesis	1
20	Sustainable Construction and Green Building	1
21	Impact of Workspace Environment on Work Performance	1
22	Skills and Attributes in Accounting Education	1
23	Global Energy Transition and Fossil Fuel Depletion	1
24	Physics Education in Indonesian Schools	1
25	Community-based Tourism Development and Sustainability	1
26	Sustainable Development and Economic Management	1
27	Imperialism and Global Capitalism Critique	1
28	Applications of Remote Sensing in Geoscience and Agriculture	1
29	Spatial Shift-Share Analysis in Economic Development	1

Source: Author compiled research

4.3. Analyze trends in cooperation between authors, organizations and countries

To explore the trend of collaboration in research on green accounting towards sustainable development, this study analyzed co-authorship relationships between individual authors and between organizations. According to Benoit et al. (2018), the analysis results help improve understanding of research collaboration and help discover influential researchers. In the period from 1995 to 2024, there were 253 authors participating in writing on the topic of green accounting towards sustainable development. Among them, 8 authors appeared twice, the results are shown in Table 4. Author Giles Atkinson is the author with the most articles with 3 articles and 546 citations respectively.

Table 4. Results of author analysis

No.	Author	Documents	Citations	Total link strength
1	Andrew Osei Agyemang	2	17	0
2	Bablu Kumar Dhar	2	74	0
3	Giles Atkinson	3	546	0
4	Meilda Wiguna	2	1	0
5	Mishelei Loen	2	3	0
6	Seema Gupta	2	4	2
7	Shaizy Khan	2	4	2

8	Walter Radermacher	2	22	0
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Source: Author compiled research

The author also conducted research on the countries with the most articles on this topic. This result is shown in Table 5. In all, 24 countries have authors publishing articles related to green accounting and sustainable development. Indonesia is the country with the most authors with a total of 25 articles, with a total of 10 citations. United Kingdom is the country with the most total citations at 512 times.

Table 5. Results of country analysis

No.	Country	Documents	Citations	Total link strength
1	China	19	101	3
2	India	5	12	1
3	Indonesia	25	10	0
4	Romania	3	2	0
5	United Kingdom	4	512	1
6	United States	5	82	1
7	Vietnam	3	4	0

Source: Author compiled research

Visualizing the network map of linked countries is shown in Figure 4. This connection is shown through red, green and blue links. China is the country with the highest level of connectivity, followed by the United Kingdom.



Figure 4. Visualization of network map of interconnected countries

There are 99 organizations with authors participating in writing about green accounting towards sustainable development. Table 6 shows organizations (universities) with many publications on green accounting towards sustainable development in the period 1995-2024. University College London is the workplace of the authors with the most publications and citations, with 2 articles corresponding to 228 citations.

Table 6. Results of organizational analysis

No.	Organization	Documents	Citations	Total link strength
1	Amity University	2	4	0

2	Hohai University	2	0	0
3	Iain Palangka Raya	2	1	0
4	Jiangsu University	2	17	0
5	Rau University	2	1	0
6	Universitas Krisnadwipayana	2	3	0
7	Universitas Trisakti	2	0	0
8	University College London	2	228	0
9	University Of Pembangunan Nasional Veteran	2	0	0

Source: Author compiled research

The results of analysis and visualization of the network map of interconnected organizations are shown in Figure 5.

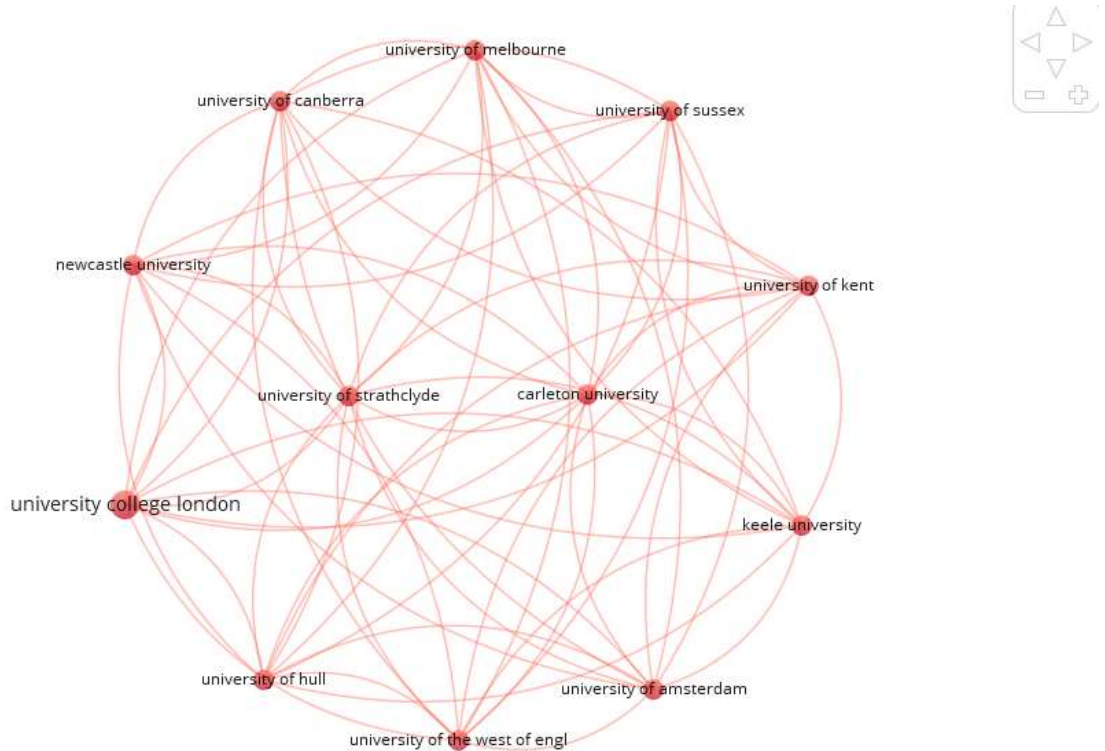


Figure 5. Network map visualization of interconnected organizations

5. CONCLUDE

Faced with environmental changes due to negative impacts from human activities such as depletion of natural resources, environmental pollution, and abnormal climate. At the same time, promoting corporate social responsibility in production and business activities towards sustainable development, many countries around the world require businesses to implement green accounting and disclose environmental information for Interested parties refer. For Japan, accounting must quantitatively assess costs and benefits of environmental activities and must regulate a systematic reporting system of positive relationships between businesses and the ecosystem. In European

countries, green accountants are required by law to disclose environmental information to national governments. Thus, green accounting has become a mainstream trend in the world and the promulgation of laws and regulations related to green accounting is necessary.

In this study, we evaluated global publications on green accounting for corporate sustainability indexed in the Openalex database published between 1995 and April 2024 to provide detailed information about the number of publications, publishing journals, keyword networks and co-author networks. This study used the bibliometric method with the help of several statistical and data visualization applications to explore research trends in the content of green accounting towards sustainable development.

Research results show that there have been a total of 121 articles on green accounting in businesses indexed in Openalex from 1995 to 2024. Regarding the number of publications, 2023 is the year with the highest number of publications. The largest with 24 articles on green accounting towards sustainable development. Regarding frequently mentioned content, the keyword "Business" is the keyword that appears the most with 107 appearances and the link strength is 803, the keyword "Accounting" appears the second most with 95 appearances. In the period from 1995 to 2024, there were 253 authors participating in writing on the topic of green accounting towards sustainable development. Author Giles Atkinson is the author with the most articles with 3 articles and 546 corresponding citations. In all, 24 countries published articles related to green accounting. Towards sustainable development. Indonesia is the country with the most authors with a total of 25 articles, with a total of 10 citations. The United Kingdom is the country with the most total citations at 512 times. The research results have contributed to the general theoretical basis, serving as a basis for reference studies on green accounting in businesses. Data collected from richer sources such as Scopus or Web of Science are suggestions for further research on green accounting towards sustainable development, in addition, future studies can systematically evaluate the literature on green accounting towards sustainable development in more specific areas of production and business activities.

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