



Received: 02-02-2024
Accepted: 11-03-2024

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Overview of Research Literature on Green Accounting

Nguyen Thi Linh

University of Labour and Social Affairs, Hanoi, Vietnam

Corresponding Author: Nguyen Thi Linh

Abstract

This article aims to evaluate research trends on green accounting in businesses based on documents in the Openalex database in the period from 2011–2023. Research results show that there have been a total of 569 articles on green accounting in businesses indexed in Openalex from 2011 to 2023. Regarding the number of publications, 2011 was the year with the lowest number of publications with 7 articles, but by 2023, the number of articles has increased dramatically to 163 articles on green accounting. Regarding frequently mentioned content, the keyword "business" is the

keyword that appears the most with 510 appearances, the keyword "accounting" appears the second most with 447 appearances. There are 1,060 authors participating in writing on the topic of green accounting. Author Muhammad Hasyim Ashari is the author with the most articles with 9 articles and corresponding citations of 7. In all, 34 countries published articles related to green accounting. Indonesia is the country with the most articles with a total of 225 articles, with a total of 2,107 citations.

Keywords: Green Accounting, Systematic Literature Review, VOSviewer

1. Introduction

With the global trend of green growth and green economy, green accounting is increasingly popular in many countries. Green accounting has also become a research topic for scholars around the world. The requirement for sustainable development, limiting and minimizing the impact of the environment has made green accounting become a concern of policy makers, business administrators, researchers and even people. According to research around the world, green accounting is considered an important tool related to aspects of the influence of the natural environment on the economy and is considered a transformation towards sustainable development, towards developing a green economy. There have been many studies in many different countries on green accounting in businesses. Therefore, in this study, it helps readers grasp the development and information quality of the current state of "green accounting" through the frequency of keyword use, number of citations, and number of times the author and co-authors are cited from time to 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 simultaneously related to green accounting in businesses from 2011 to 2023? Q2: What topics are the keywords used 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 569 articles published in the period 2011-2023. Research conducted through bibliometric analysis makes a great contribution to the research community because through bibliometrics, a valuable amount of information can be collected about a topic. By reflecting on what has been done and what needs future research, the article aims to add to the literature on different methods and contexts to support researchers in green accounting. The research is divided into parts: Defining the conceptual foundation, applied methods, research results and concluding remarks.

2. Theoretical basis

In 2014, the United Nations launched an application program called "Economic and Environmental Accounting System", also known as Green Accounting. The United Nations has also required countries and organizations around the world to implement an environmental accounting system to record data related to business activities of enterprises, including: Impact on the environment. Vandna (2018) believes that green accounting includes estimating environmental costs, identifying liabilities and payable costs related to handling environmental issues. Green accounting is the use of life cycle assessment to measure the

environmental impact of a business's activities, promote the adoption of clean production, apply total cost assessment and combine traditional accounting to publish environmental financial information of enterprises. The aim is to urge businesses to carry out effective and efficient environmental activities to achieve sustainable development. Asheim (1997) [2] 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 by recording environmental costs to have resources for implementing treatment measures. This accounting system also needs to consider economic measures that impact electricity production and consumption in terms of impact on the environment.

Betianu (2010) [3] argues that the performance of tasks can be measured by means of documenting environmental costs and identify relevant environmental costs from an accounting and financial perspective, their link with financial disclosure. Therefore, in the modern business world, implementing green accounting is considered an important factor. Limiting environmental impact and economic development is a challenging feature for developing countries. Organizations identified as being in the sector or related to energy-dependent manufacturers and utilities generating measured power experience more pressure towards implementing green accounting. At the same time, businesses from all business sectors are assumed to be implementing green accounting tools to a certain extent in the coming years. According to Varsha Agarwal & Kalpaja L (2018) [1], it is necessary to have standards and quantification to control business activities that pollute the environment before allowing an organization to operate production or business activities or forcing the organization to handle pollution problems caused by that organization. When a business considers the environmental aspects of its economic activities such as the cost of services and products in relation to environmental costs, the business may consider reducing the amount of natural resources. used in production and business 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 perspectives, including 5 main contents: Environmental financial accounting; environmental management accounting; environmental finance; environmental law; ethics and relations with the social community.

3. Method

This study uses the systematic literature review method SLR (Systematic Literature Review) of Tranfield *et al.* (2003) [7]. Sample selection for the study was based on PRISMA (priority items for systematic reviews and meta-analyses) originally proposed by Liberati *et al.* (2009) [5] and updated in 2021 by Page *et al.* (2021) [6]. The PRISMA flow diagram is based on three steps: Identification, screening, and study

inclusion.

As a first step, the authors began 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 database of scientific research systems. Data was collected on February 15, 2024, with the use of the following keywords "green accounting". Keywords were searched by filter in the title. Search period, author selected from 2011-2023.

In the second step, the author group screened to remove inappropriate documents through technical screening and content screening. For technical screening, documents of the following types: Paratest, book-chapter, book, and thesis will be eliminated by unchecking. 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 569 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. The results of bibliometric analysis will be presented in visual form. From the analysis results, the study finds popular research directions, names the research directions, and suggests future research directions.

4. Result

Statistics on year of publication

From 2011 - 2023 there were a total of 569 green accounting articles indexed in Openalex with an average of 41 articles published per year. The number of articles gradually increases over time. 2011 was the year with the lowest number of publications with 7 articles, but by 2023, the number of articles had increased dramatically to 163 articles on green accounting. From the statistical results of publication frequency each year, it shows that authors are having a strong interest in the topic of green accounting for businesses.

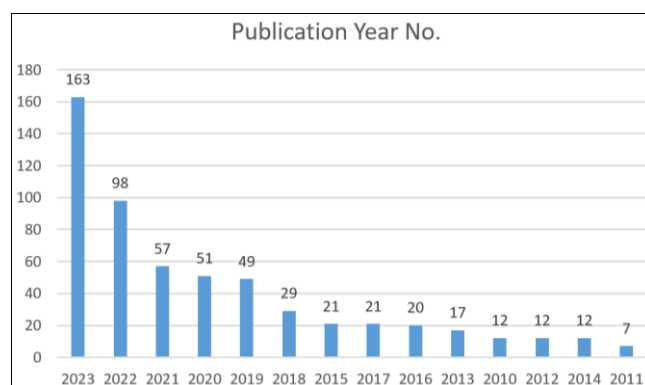


Fig 1: Chart of the number of studies over the years

Fig 2 presents the results of green accounting topics that receive the most attention. The topic "Drivers and Impacts of Green Consumer Behavior" has the most articles on green accounting with 133 articles. Next is the topic "Impact of Corporate Governance on Business Performance" with 103 articles related to the title of green accounting.

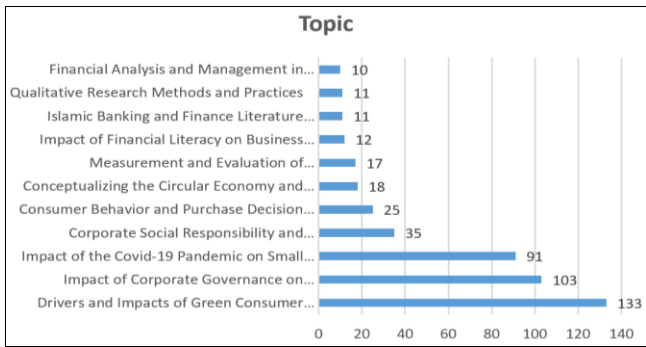


Fig 2: Topics of most interest

Regarding universities, the most published articles on green accounting are shown in Fig 3. Specifically, Universitas Trisakti has 21 articles, Universitas Patria Artha has 10 articles, University of Pembangunan Nasional Veteran and Universitas Krisnadwipayana has 8 articles together.

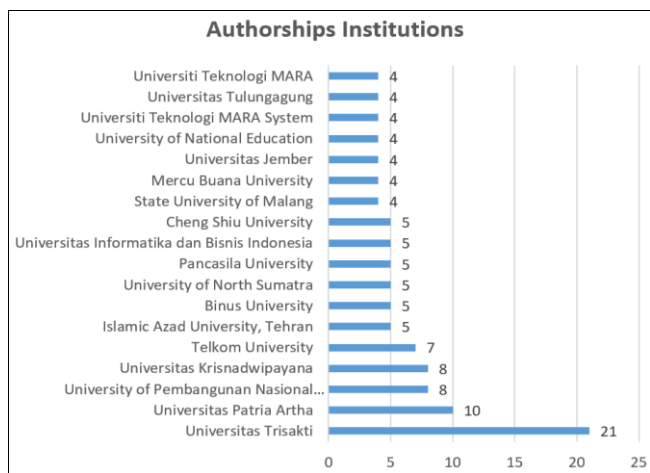


Fig 3: Organizations publishing the most publications

Keyword analysis results

To answer the question, on the topic of green accounting, what content is of interest to researchers, the author

researched the keywords that appear frequently in published publications. Among the 620 keywords that appeared, the study selected keywords that appeared 70 times or more, and there were 26 keywords that met this condition. Keywords are evaluated by the software based on the number of occurrences and total link strength. Keyword analysis results can be exported into files as images. The keyword analysis results are as follows:

Verify selected keywords

Selected	Keyword	Occurrences	Total link strength
<input checked="" type="checkbox"/>	business	510	2972
<input checked="" type="checkbox"/>	accounting	447	2873
<input checked="" type="checkbox"/>	economics	200	1469
<input checked="" type="checkbox"/>	environmental accounting	180	1414
<input checked="" type="checkbox"/>	biology	153	1311
<input checked="" type="checkbox"/>	finance	153	1276
<input checked="" type="checkbox"/>	political science	163	1249
<input checked="" type="checkbox"/>	ecology	136	1215
<input checked="" type="checkbox"/>	accounting information system	134	1110
<input checked="" type="checkbox"/>	sociology	107	993
<input checked="" type="checkbox"/>	mathematics	121	948
<input checked="" type="checkbox"/>	sustainability	90	826
<input checked="" type="checkbox"/>	population	81	810
<input checked="" type="checkbox"/>	stock exchange	86	803
<input checked="" type="checkbox"/>	law	100	798
<input checked="" type="checkbox"/>	computer science	122	771
<input checked="" type="checkbox"/>	demography	73	754
<input checked="" type="checkbox"/>	chemistry	76	741
<input checked="" type="checkbox"/>	statistics	81	730
<input checked="" type="checkbox"/>	sample (material)	70	718
<input checked="" type="checkbox"/>	corporate social responsibility	73	694
<input checked="" type="checkbox"/>	financial accounting	78	688

Fig 4: Keywords appearing multiple times

The group of keywords that appear 70 times or more includes, accounting, accounting information, biology, business, computer science, ecology, economics, environmental accounting, financial accounting, management accounting, sustainability, business administration, chemistry, demography, finance, mathematics, population, sociology, materials, statistics, stock exchange, corporate social responsibility, law, philosophy, political science, and public relations. The keyword "business" is the keyword that appears the most with 510 appearances, the keyword accounting appears the second most with 447 appearances.

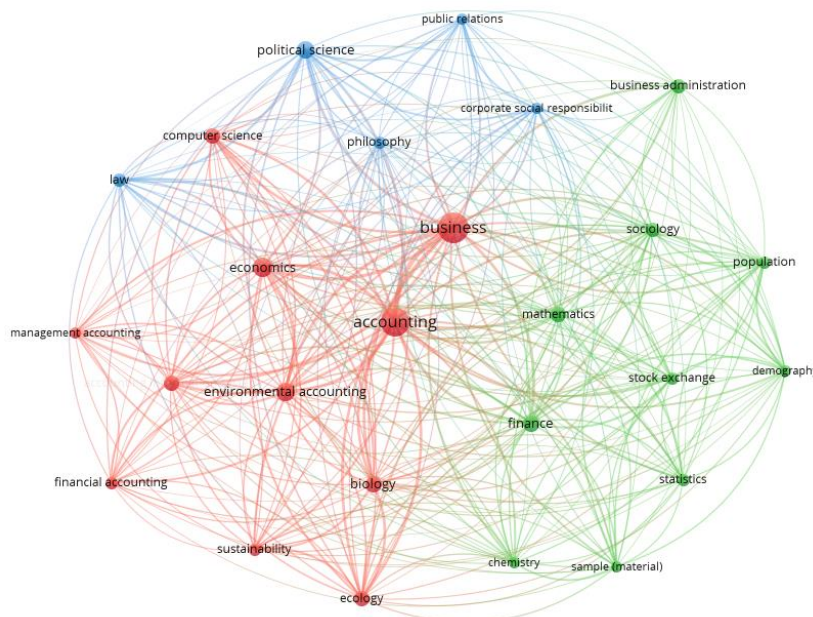


Fig 5: Co-occurrence networks

Fig 4 shows the keyword network. Note that the larger the circle, the more times it appears; the thicker the line connecting the two keywords, the greater the frequency of occurrences. Related keywords are grouped into groups, each group is a separate color. Looking at the image, it can be seen that the keywords are divided into 3 groups, with 325 links and total link strength of 13697. Group 1 is represented by red links with the keywords accounting, accounting information, biology, business, computer science, ecology, economics, environmental accounting, financial accounting, management accounting, and sustainability. Group 2 is represented by green links with keywords business administration, chemistry, demography, finance, mathematics, population, sociology, material, statistics, and stock exchange. Group 3 is represented by blue links with the keywords corporate social responsibility, law, philosophy, political science, and public relations. With 3 research directions and 26 popular keywords, the results show that research content on green accounting is receiving a lot of attention.

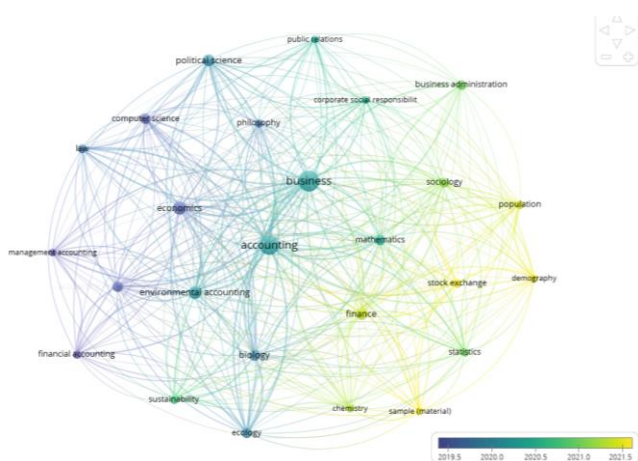


Fig 6: Keyword network over time

In addition, the results from the VOSviewer tool have shown the time of keywords appearing. Dark colors represent keywords researched from the first years (2019), in recent studies, keywords have appeared in brighter colors. The keyword appearance time chart shows that population, finance, chemistry, sociology are the keywords that have received the most attention recently.

Co-authorship analysis

To explore the trend of collaboration in green accounting research, this study analyzed co-authorship relationships between individual authors and between organizations. According to Benoit *et al.* (2018) [4], the analysis results help improve understanding of research collaboration and help discover influential researchers. In the period from 2011 to 2023, there are 1060 authors participating in writing on the topic of green accounting. Among them, 16 authors appeared 3 times, the results are shown in Fig 7. Author Muhammad Hasyim Ashari is the author with the most articles with 9 articles and 7 corresponding citations. Next is the author Maria Yovita R Pandin has the second most articles with 7 articles in the period from 2011 to 2023.

Verify selected authors

Selected	Author	Documents	Citations	Total link strength
<input checked="" type="checkbox"/>	muhammad hasyim ashari	9	7	9
<input checked="" type="checkbox"/>	hsiu-yu lee	4	4	6
<input checked="" type="checkbox"/>	oyong lisa	3	0	6
<input checked="" type="checkbox"/>	umi muawanah	3	0	6
<input checked="" type="checkbox"/>	yu-sheng yain	3	3	5
<input checked="" type="checkbox"/>	yu-ting lin	3	1	5
<input checked="" type="checkbox"/>	astrini aning widoretno	4	2	4
<input checked="" type="checkbox"/>	dwi suhartini	4	2	4
<input checked="" type="checkbox"/>	yudhi anggoro	3	7	3
<input checked="" type="checkbox"/>	ari yanuar ridwan	3	1	0
<input checked="" type="checkbox"/>	ayu dwi yulianthi	3	0	0
<input checked="" type="checkbox"/>	deasy ervina	3	0	0
<input checked="" type="checkbox"/>	hari budi yanti	3	0	0
<input checked="" type="checkbox"/>	maria yovita r pandin	7	0	0
<input checked="" type="checkbox"/>	radiah othman	4	0	0
<input checked="" type="checkbox"/>	siti choiriah	5	0	0

Fig 7: Co-authors appear multiple times

The author also conducted research on the countries with the most articles on this topic. This result is shown in Fig 8. In all, 34 countries published articles related to green accounting. Indonesia is the country with the most articles with a total of 225 articles, with a total of 2,107 citations. Next is China, which is the second country with a lot of interest in green accounting with 17 publications and 70 citations. Although Malaysia only has 7 articles published in the period from 2011 to 2023, the link strength is the highest.

Verify selected countries

Selected	Country	Documents	Citations	Total link strength
<input checked="" type="checkbox"/>	malaysia	7	57	7
<input checked="" type="checkbox"/>	indonesia	225	107	4
<input checked="" type="checkbox"/>	china	17	70	3
<input checked="" type="checkbox"/>	new zealand	3	0	3
<input checked="" type="checkbox"/>	taiwan	9	44	3
<input checked="" type="checkbox"/>	bangladesh	6	72	2
<input checked="" type="checkbox"/>	france	3	71	0
<input checked="" type="checkbox"/>	india	8	5	0
<input checked="" type="checkbox"/>	iran	6	40	0
<input checked="" type="checkbox"/>	nigeria	3	0	0
<input checked="" type="checkbox"/>	united kingdom	5	23	0
<input checked="" type="checkbox"/>	vietnam	3	1	0

Fig 8: Co-authorship analysis by country

Fig 9 shows the authors whose articles achieved the largest number of citations. Author Bablu Kumar Dhar has an article published in 2021 with the highest number of citations of 56 times.

Verify selected documents

Selected	Document	Citations	Links
<input checked="" type="checkbox"/>	haruna maama (2019)	26	3
<input checked="" type="checkbox"/>	bablu kumar dhar (2021)	56	3
<input checked="" type="checkbox"/>	crawford spence (2013)	12	3
<input checked="" type="checkbox"/>	mohammed mizanur rahman (2023)	12	3
<input checked="" type="checkbox"/>	ishmael wiredu (2023)	10	3
<input checked="" type="checkbox"/>	charles h. cho (2013)	71	2
<input checked="" type="checkbox"/>	craig deegan (2013)	74	2
<input checked="" type="checkbox"/>	jui-che tu (2015)	37	2
<input checked="" type="checkbox"/>	krishna moorthy (2013)	26	1
<input checked="" type="checkbox"/>	daniel b. thorton (2013)	27	1
<input checked="" type="checkbox"/>	mohammad mahdi rounaghi (2019)	40	1
<input checked="" type="checkbox"/>	sherine farouk (2012)	21	0
<input checked="" type="checkbox"/>	jeong tai kim (2013)	26	0
<input checked="" type="checkbox"/>	hanifa zulhaimi (2015)	10	0
<input checked="" type="checkbox"/>	i dewa made endiana (2020)	10	0

Fig 9: Articles with the most citations

5. Conclusion

In this study, we evaluated global publications on green accounting in business indexed in the Openalex database published between 2011 and 2023 to provide insights into the number of publications, publishing journals, keyword

networks and co-authorship networks. This study used bibliometric methods with the help of several statistical and data visualization applications to explore research trends in the content of green accounting in businesses.

Research results show that there have been a total of 569 articles on green accounting in businesses indexed in Openalex from 2011 to 2023. Regarding the number of publications, 2011 was the year with the lowest number of publications with 7 articles, but by 2023, the number of articles has increased dramatically to 163 articles on green accounting. Regarding frequently mentioned content, the keyword "business" is the keyword that appears the most with 510 appearances, the keyword accounting appears the second most with 447 appearances. In the period from 2011 to 2023, there are 1060 authors participating in writing on the topic of green accounting. Among them, 16 authors appeared 3 times, the results are shown in Fig 7. Author Muhammad Hasyim Ashari is the author with the most articles with 9 articles and corresponding citations of 7. In all, 34 countries published articles related to green accounting. Indonesia is the country with the most articles with a total of 225 articles, with a total of 2,107 citations.

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. Additionally, future research could systematically evaluate the literature on green accounting in more specific areas.

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