



Environmental Accounting: A Systematic Review (2014–2023)

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ABSTRACT:

Environmental accounting is a new and developing field that seeks to identify, collect, and provide relevant and necessary information on environmental costs and revenues to guide businesses in making economic decisions, encouraging them to strive for efficient resource use, minimize environmental degradation, and change their behaviors toward the environment. The purpose of this study is to systematize previous studies on environmental accounting in enterprises, use statistics, and evaluate, according to the authors, the most influential research articles in the study of environmental accounting in enterprises. The research data were collected and analyzed from Google Scholar data on VOSviewer software 1.6.19 with 500 articles for the keyword "environmental accounting" filtered in abstract. The results show that research on environmental accounting in the past 10 years has always been a topic of interest and study by researchers. The study also identifies the most influential authors in terms of the number of articles and citations. The research results have contributed to synthesizing a system of research documents on environmental accounting.

Keywords: environmental accounting, vosviewer

1. Introduction

Russell, S., Milne, M. J., & Dey, C. (2017) had research about Accounts of nature and the nature of accounts: Critical reflections on environmental accounting and propositions for ecologically informed accounting. The purpose of this paper is to review and synthesise academic research in environmental accounting and demonstrate its shortcomings. It provokes scholars to rethink their conceptions of "accounts" and "nature", and alongside others in this *AAAJ* special issue, provides the basis for an agenda for theoretical and empirical research that begins to "ecologise" accounting. Environmental accounting research overwhelmingly focuses on economic entities and their inputs and outputs. Conceptually, an "information throughput" model dominates. There is little or no environment in environmental accounting, and certainly no ecology. The papers in this *AAAJ* special issue contribute to these themes, and alongside social science literature, indicate significant opportunities for research to begin to overcome them.

Rounaghi, M. M. (2019) had researched about economic analysis of using green accounting and environmental accounting to identify environmental costs and sustainability indicators. Research shows that green accounting is a type of accounting that attempts to factor environmental costs into the financial results of operations. Apart from answering the question whether the economy has performed sustainably during one or more accounting periods, green accounting indicators [green gross domestic product (GDP)] can be used in policy formulation and evaluation. Green GDP calculations can contribute to raise awareness for sustainability concerns among national governments/policy-makers, who tend to concentrate on their countries' fast economic development. Environmental accounting can be applied to large and small companies in various industries, as well as in manufacturing or service sectors. Environmental accounting can be applied on a large or a smaller scale in a systematic manner for the required bases. Environmental accounting requires the collection of information from all the groups. People of various groups need to talk to each other to achieve a common vision and understanding of environmental accounting and to realize this vision. Undoubtedly, to establish an ideal system of environmental accounting in the country, accountants can become a powerful forearm of the government regarding economical and financial controls. To achieve this goal, environmental accounting objectives and tasks should be identified and defined in detail, and the standards, rules and criteria should be grounded and codified based on reasonable and practical principles.

Taqi, M., Rusydiana, A. S., Kustiningsih, N., & Firmansyah, I. (2021) had research about Environmental accounting: A scientometric using biblioshiny. This study aims to determine the development of research trends on environmental accounting published by national and international journals. The data analyzed consists of 500 indexed research publications during the period 1981-2020. The data is then processed and analyzed using the R Bibliometric application to determine the bibliometric map of environmental accounting developments. The results showed that the number of publications on the development of the role of research related to environmental accounting has increased significantly. Then, the most common type of document that analyzes environmental accounting is journal articles. The most popular writer was Wood R, who during the research period he consistently conducted research on this theme, and the most popular keywords were energy, environmental and assessment.

Thus, this study helps readers grasp the development and information quality of environmental accounting through the frequency of keyword use, the number of citations, and the number of times authors are cited over time. At the same time, it helps future researchers to know the trend of this topic over time.

2. Environmental accounting

The United States Environmental Protection Agency (USEPA, 1995) describes environmental accounting (EA) as a crucial element of an organization's (O's) overall environmental management, quality management, and cost management. USEPA (1995) defined EA in three different senses: (1) EA in a national context is income accounting, referring to the accounting of natural resources, which can affect the statistics of a country or region, affecting the quality and value of natural resources; (2) EA in the context of financial accounting (FA) usually refers to the preparation of financial statements (FS) for external parties using generally accepted accounting principles; (3) EA as an aspect of management accounting (MA) serves managers in making investment decisions, design decisions, performance evaluations, and a range of future business decisions.

According to the United Nations Commission on Sustainable Development (UNSD, 2002), EA is the identification, collection, analysis, and use of two types of information for internal decision-making, including: physical information (non-monetary) on the use, circulation, and disposal of energy, water, and materials (including waste); and monetary information on costs, revenues, and potential savings related to the environment.

According to the International Federation of Accountants (IFAC, 2005), Environmental Accounting (EA) is a broad term used in a number of different contexts; EA is the management of economic and environmental activities through the implementation of accounting systems and appropriate practical activities related to environmental issues.

At the national level: EA is defined as an activity related to: (1) assessment and disclosure (DI) of environmental financial information in the context of FA and FS; (2) assessment and use of physical and monetary information related to the environment in the context of environmental MA; (3) estimating external environmental impacts and costs, known as full cost accounting; (4) accounting for inventories and flows of natural resources (NR) in both physical and monetary terms (NR Source Accounting); (5) consolidation and reporting of organizational-level accounting information, NR source accounting information, and other information for national accounting purposes. At the enterprise level:

EA is an activity that takes place in the enterprise, including: environmental MA (e.g., assessing the organization's costs for pollution control equipment; revenue from recycled materials; annual cash savings from new energy-efficient equipment); and environmental FA (e.g., assessing and reporting the organization's current environmental liabilities).

According to the EA guidance document of the Ministry of the Environment of Japan (February 2005), EA is defined as an integrated system of financial and environmental activities. EA is considered completely independent of any corporate FA.

In summary, the term EA can be understood as follows: EA is a part of accounting in an enterprise related to information on environmental activities within the scope of the enterprise in order to collect, process, analyze, and provide information on the environment for internal and external entities to use for decision-making.

3. Research methodology

The authors synthesize previously published review documents related to environmental accounting from data sources on Google Scholar. Review studies will aim to explain the urgency of the study and point out gaps in the research.

The authors use VOSviewer software 1.6.19 to filter data with the keyword "environmental accounting" filtered in the abstract of the Google Scholar database, accessed on 12/20/2023. The results show 337 related articles in the selected category out of 500 articles. The collected data is used to analyze and answer the following research questions:

Q1: Research on environmental accounting from 2014 to December 2023

Q2: The most influential authors in terms of the number of articles and the number of citations in publications on environmental accounting in enterprises

Q3: Which keywords are grouped into which topics?

4. Results

Statistics on environmental accounting publications

From 2014 to 2023, the group of authors searched for a maximum of 500 articles; there were 337 articles on environmental accounting indexed in Google Scholar. The group of authors excluded articles, books, and citations. An average of 33.7 articles were published each year. This shows that the issue of environmental accounting is still a concern for researchers today.

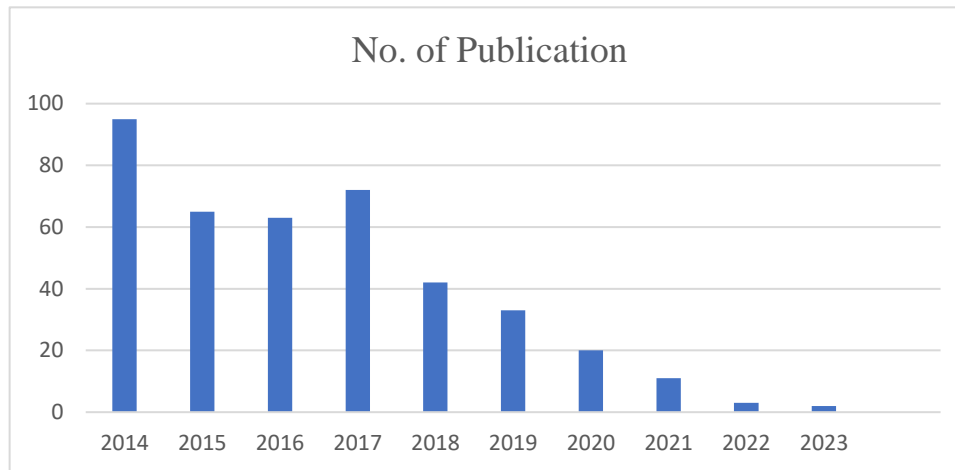


Figure 1. Graph of the number of studies over the years

Statistics on the most influential authors in environmental accounting research

To assess the most influential authors in environmental accounting research, we consider the number of citations in the article (Table 1), the number of articles by the authors (Table 2, Figure 2), and the number of citations by the author (Table 3).

Highest citation by documents

Table 1 shows the number of citations in the article by the group of authors: R. Costanza, R. De Groot, P. Sutton... (2014) "Changes in the global value of ecosystem services" has the most citations (63588 times), followed by WJ Ong, LL Tan, YH Ng, ST Yong, and SP Chai (2016), "Graphitic Carbon Nitride (gC₃N₄)-Based Photocatalysts for Artificial Photosynthesis and Environmental Remediation: Are We a Step Closer to Achieving..." with 5693 citations. J. Poore, T. Nemecek (2018), "Reducing food's environmental impacts through producers and consumers," has 4225 citations. The remaining articles have all been cited more than 2,000 times.

Table 1. Frequency of the highest citation by documents

Documents	Cites
R Costanza, R De Groot, P Sutton... (2014)	6358
WJ Ong, LL Tan, YH Ng, ST Yong, SP Chai (2016)	5693
J Poore, T Nemecek (2018)	4225
Y Luo, W Guo, HH Ngo, LD Nghiem, FI Hai... (2014)	3854
CD Stone (2017)	3343
A Murray, K Skene, K Haynes (2017)	3246
W Leontief (2018)	3188
MP Timmer, E Dietzenbacher, B Los... (2015)	3092
J Lehmann, S Joseph (2015)	3077
WA Collins, EE Maccoby, L Steinberg... (2022)	2857
HE Daly (2017)	2734
J Chave, M Rôjou-Môchain, A Býrquez... (2014)	2586
A Abadie, S Athey, GW Imbens... (2023)	2573
M Springmann, M Clark, D Mason-D'Croz, K Wiebe... (2018)	2445
N Bloom, J Liang, J Roberts... (2015)	2394
R Costanza, R De Groot, L Braat, I Kubiszewski... (2017)	2393
E Saez, G Zucman (2016)	2388
BC O'Neill, E Kriegler, KL Ebi, E Kemp-Benedict... (2017)	2338
EB Barrier (2017)	2285

(Source: Authors compiled from VOSviewer software)

The highest documents by authors

Table 2. Frequency of the highest documents by authors

Selected	Author	Documents
<input checked="" type="checkbox"/>	li, j	4
<input checked="" type="checkbox"/>	yang, d	4
<input checked="" type="checkbox"/>	li, x	4
<input checked="" type="checkbox"/>	schaltegger, s	4
<input checked="" type="checkbox"/>	springmann, m	4

(Source: Authors compiled from VOSviewer software)

Statistics show that the authors with the most articles on environmental accounting are Li, J.; Yang, D.; Li, X.; Schaltegger, S.; and Springmann, M., with 4 articles.

Co-author analysis

To investigate the trend of cooperation in environmental accounting research, this study conducted an analysis of the co-authorship relationship between individual authors. According to Benoit et al. (2018), the results of the analysis help improve understanding of research collaboration while also helping to identify influential researchers. Figure 1 presents a map of the co-author network. The link between two nodes represents the collaborative relationship between two authors, and the thickness of the link represents the intensity of the collaboration. The group of authors who collaborate most closely are the authors shown in the figure below. This is a group of co-authors who have published many articles over the years.



(Source: Authors compiled from VOSviewer software)

The highest citation by authors

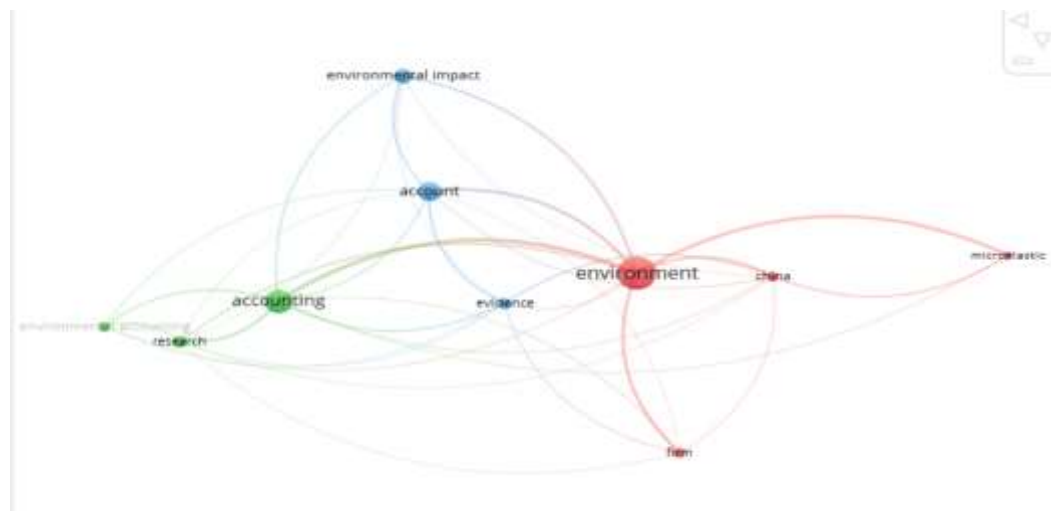
We have selected the 10 authors with the most citations (Table 3). A Abadie, S Athey, GW Imben... is the group of authors with the most citations in the year with 2573, followed by WA Collins, EE Maccoby, L Steinber... with 1428.5 citations, and WJ Ong, LL Tan, YH Ng, ST Yong, and SP Chai with 711.63 citations. The remaining authors have more than 350 citations.

Table 3. Frequency of the highest citations by authors

Authors	CitesPerYear
A Abadie, S Athey, GW Imbens...	2573
WA Collins, EE Maccoby, L Steinberg...	1428.5
WJ Ong, LL Tan, YH Ng, ST Yong, SP Chai	711.63
J Poore, T Nemecek	704.17
R Costanza, R De Groot, P Sutton...	635.8
W Leontief	531.33
RW Butler	521.25
CD Stone	477.57
A Murray, K Skene, K Haynes	463.71
P Miller, T O'leary	424.4
M Springmann, M Clark, D Mason-D'Croz, K Wiebe...	407.5
HE Daly	390.57
C Flammer	387
Y Luo, W Guo, HH Ngo, LD Nghiem, FI Hai...	385.4
BF Chorpita, DH Barlow	375.33
D Rothschild, O Weissbrod, E Barkan, A Kurilshikov...	374.33
A Vives	352

Results of keyword analysis

In the keyword analysis section, the study selects keywords that appear 15 times or more. Based on the quantity of occurrences and the overall strength of the link, the software evaluates the keywords. The results of the keyword analysis can be exported as an image file. The result of the keyword analysis is as follows:

**Figure 4. Co-occurrence networks and keyword networks**

Related keywords are grouped into groups; each group has a separate color. Looking at the image, it can be seen that the keywords are divided into three groups. Group 1 is represented by red links, combined by 4 keywords including environment, firm, china, and microplastic, with the central keyword being "environment" with 9 links, and the total link strength is 176. This keyword appears 254 times. Group 2 is represented by green links combined by 3 keywords: accounting, environmental accounting, and research, in which the central keyword is "accounting" with 9 links and the total link strength is 102 and it appears 128 times. Group 3 is represented by blue links consisting of 3 keywords: "account, environmental impact, evidence," with the central keyword being "account" with 8 links, and the total link strength is 59, appearing 86 times. With 3 research directions and 9 common keywords, the results provide an overview of environmental accounting issues. Future studies can use this as a basis for choosing a research direction to fill the gap or for further analysis.

4. Conclusion

In this study, we conducted a systematic review of environmental accounting studies indexed in the Google Scholar database. These studies were published in the past 10 years, from 2014 to 2023, to provide detailed information on the number of publications, frequency of author citations, citations of studies, keyword networks, etc. The research results have contributed to the general theoretical basis, serving as the basis for reference studies on environmental accounting. Data collected from richer sources such as Scopus and OpenAlex are also suggestions for further research in the future.

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