

Beyond Numbers: Unravelling the Dimensions of Environmental Accounting through Bibliometric Exploration

Edy Susanto¹, Khoiruddin²

¹ Indonesian Muslim University

² Darul Ulum University

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ABSTRACT

Environmental accounting has received significant attention in recent years due to the increasing awareness of the impact of business activities on the environment. Traditional accounting practices often need to capture the true costs of environmental externalities, necessitating a more comprehensive approach. This study aims to explore the dimensions of environmental accounting beyond numbers by using an exploratory bibliometric methodology. By conducting a systematic review of the relevant literature and analyzing bibliometric data, this research seeks to identify emerging trends, key contributors, and research gaps in the field of environmental accounting.

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Corresponding Author:

Name: Edy Susanto

Institution: Indonesian Muslim University

Email: edysusanto@umi.ac.id

1. INTRODUCTION

Over the course of its history, accounting research has undergone a number of notable transformations, including the development of empirical methods and the expansion of quasi-experiments [1]. Research in accounting is a vast field that may be broken down into a number of specialised subfields, one of which is environmental accounting research. Accounting for the environment examines how the effects of economic activities on natural resources and the environment may be measured and accounted for [2]. Environmental accounting research is important because it helps organizations understand the environmental impact of their operations and make informed decisions about resource use and waste reduction. It also helps organizations to

comply with environmental regulations and improve their environmental performance [3].

According to the findings of one study, environmental accounting academics have a reasonably significant amount of influence among the authors of the most cited accounting works, despite the fact that the majority of their research is focused on environmental issues published in non-tier-tier accounting journals [1], [2]. This suggests that environmental accounting research may need the attention it deserves in the academic community. Other studies have found that adopting environmental management accounting practices can positively impact a company's environmental and financial performance [3]. This highlights the importance of environmental accounting research in helping organizations improve their environmental and financial

performance. Research in the discipline of accounting has expanded to encompass a wide variety of subfields, one of which is environmental accounting research. Research in environmental accounting is extremely important because it enables businesses to understand the impact their activities have on the surrounding environment and to make educated choices about the utilisation of resources and the reduction of waste. This research not only helps organisations enhance their environmental performance but also helps them comply with environmental legislation.

The accounting environment plays a vital role in business success. Accounting information systems (AIS) are essential for processing financial transactions and providing relevant decision-making information [4]. Advanced technologies, such as cloud computing and web reporting, have brought significant changes to the accounting and financial environment worldwide [5]. Forensic accounting is another crucial aspect of the accounting environment. This involves applying accounting knowledge and skills to legal matters and is used to detect fraudulent financial reporting [6]. Forensic accounting can help companies detect fraudulent financial statements and prevent financial losses. In today's complex commercial environment, the meaning and use of forensic accounting has become much broader. Forensic accounting is now used to investigate and solve various financial problems, including tax evasion, money laundering, and embezzlement [6]. Management accounting is another critical aspect of the accounting environment. This involves using accounting information to support an organization's decision-making, planning, and control activities [7]. Management accounting systems, such as activity-based costing and the balanced scorecard, can help organizations achieve strategic objectives and improve their financial and non-financial performance [8].

In conclusion, understanding the accounting environment is essential for a business's success. AIS, forensic accounting,

and management accounting are critical components of the accounting environment that businesses need to understand and leverage to achieve their goals.

Based on published or perish results, I found several articles related to bibliometric analysis of accounting research. Analyses of fraud-related research in the accounting and auditing disciplines from 1926 to 2019 [9]. The findings of this research show that there have been some shifts in the theories, frameworks, and issues that have formed the research field. The authors conclude that developments in the regulatory environment are intimately connected to the progression of fraud research within the accounting and auditing professions. They also demonstrate that the splintered body of literature may be divided up into several groupings, which is characteristic of various other lines of investigation.

Examines the nature and current trends of enterprise risk management (ERM) research using bibliometric analysis [10]. This study found that ERM has been explored in various disciplines, especially business, management, and accounting. The research results also reveal an increasing trend in ERM research associated with crises such as financial outbreaks and pandemics. The authors identify five main themes that best capture the heterogeneous nature of ERM research.

Presented an empirical analysis on the distribution of research in the field of accounting as a subject of various business studies across countries using bibliometric approaches [11]. This data provides more evidence that, between the years 1996 and 2015, there has been a continuing trend towards research specialisation in accounting. The authors also found that the link between accounting and other subfields of business study is undergoing a gradual but discernible transformation.

Overall, these articles provide insight into trends and developments in accounting research using bibliometric analysis. These articles offer helpful information for

researchers focused on research in accounting.

Table 1. Some bibliometric analyses that have been done by previous researchers on the topic of Environmental Accounting

Author & Years	Number of Document Analyzed	Sources	Finding
[12]	814	Emerald	The bibliometric analysis discovered trends in EMA research publications that indicated that EMA has progressed as a new discipline, but that the field still confronts hurdles to become more entrenched in mainstream accounting and management research. Even while the number of publications keeps rising, the vast majority of them have been published in journals, books, and reports that are not related to accounting. This is despite the fact that the number of publications continues to increase. In recent years, there has been a trend towards the establishment of specialised publications on environmental accounting (and sustainability), and this trend is still prevalent today. EMA may still be considered a mainstream research area despite the low amount of highly referenced publications produced by certain authors in this field.
[13]	503		Our findings imply that there has been a large increase in the number of publications published in this topic during the period that was analysed, indicating interest among academics and the relevance of this issue. Designed and built bibliometric maps, tables, and graphs. Built-in bibliometric maps, tables, and graphs make it possible to visually identify the leading countries (England, the United Kingdom, the United States of America, Australia, Germany, Italy, and Spain), scientists working on this issue, the most prolific journals (Journal of Net Production, Sustainability (Switzerland), Management and Sustainability Accounting Journal Journal), as well as key research areas in the near future (sustainability reporting, corporate social responsibility, and sustainability reporting).
[14]	38		According to the findings, research on social and environmental reporting in the public sector is likely still in its preliminary phases. The number of current investigations, while progressively increasing, is still quite low and tends to be regional in scope. The majority of the studies examine the reasons why public organisations report, as well as what and how they report; nonetheless, there are a great number of facets that require additional research. Relationships and differences between various types of non-financial reporting, including ICR and IR, are one of the many factors that need to be researched more extensively or require additional validation in order to uncover new paths for future research. This is one of the many aspects that needs to be validated.

The importance of environmental accounting has been underlined by global

sustainability challenges and increasing stakeholder expectations. Governments,

investors and consumers are demanding greater transparency and accountability in environmental performance. Effective environmental accounting practices enable organizations to understand their ecological footprint, identify areas for improvement, and communicate their sustainability efforts to stakeholders. Therefore, there is a need to dig deeper into the dimensions of environmental accounting beyond the numerical aspects to uncover its broader implications and complexities.

This research seeks to explore dimensions of environmental accounting beyond numbers through bibliometric exploration. The main objectives of this research are as follows:

- a. Conduct an in-depth analysis of the current literature on environmental accounting in order to determine the most important themes, theoretical frameworks, and research approaches.
- b. Use bibliometric analysis to analyze research trends, key contributors, and emerging areas of environmental accounting.
- c. Uncover the multidimensional aspects of environmental accounting, including social, economic, and regulatory dimensions, beyond the numerical aspects.
- d. Identify research gaps and propose future directions for environmental accounting research, focusing on areas requiring further investigation and development.

Environmental accounting is a set of accounting practices that help companies determine the costs of protecting the environment in the normal course of business, determine the benefits to be derived from those activities, offer the best measurement measure (either in terms of monetary worth or actual physical units), and report your findings [15]. Environmental protection is defined as prevention of environmental impacts, mitigation and/or avoidance, as well as disaster mitigation, and other activities. Environmental impacts are the activities of companies or the burdens placed on the environment by other human activities, as

well as potential barriers to protecting the environment [15]. 2012 Economic-Environmental Accounting System.

In general, environmental accounting is an important instrument that may be used to measure the contribution that the natural world makes to human well-being and can also be used to manage natural resources in a sustainable manner [16]. Environmental accounting can help governments, conservation organizations and environmental markets to measure ocean economic activities and increase evidence of ocean sustainability [17]. Additionally, it can be used to measure the eco-efficiency performance of solid waste, as well as to evaluate the efficiency of industrial processes in relation to the best current techniques, or to confirm those procedures [18], [19].

2. METHOD

The overall research design and reasons for using the exploratory bibliometric methodology. Describe the use of bibliometric analysis as an effective approach to uncovering trends, key contributors, and research gaps in environmental accounting.

Define data sources for bibliometric analysis, such as scientific databases, (Web of Science, Scopus) and relevant journals.

An outline of the various methods of bibliometric analysis that will be implemented, such as the co-citation analysis, the co-authorship analysis, and the keyword analysis. The ways in which these methods will assist in revealing aspects of environmental accounting that go beyond the statistics. VOSviewer and Publish or Perish both make use of many software and technologies.

Table 2. Selected journal metric information

Metrics Data	Information
Publication year	1976-2023
Citation years	47
Papers	980
Citations	125349
Cites/year	2667.00
Cites/papers	127.91
Authors/papers	2.12

h-index	157
g-index	321
hi, norm	123
hi, annual	2.62
ha, index	40

3. RESULTS

Using the VosViewer software, by constructing maps based on text data using title and abstract columns, and using the binary counting approach, a total of 3795 terms were obtained in order to address the first goal of this study regarding how articles on the facets of the accounting environment are categorised. This was accomplished by utilising the counting method. With a minimum number of occurrences of a term of 10 times, 133 thresholds were found.

On the other hand, a relevance score will be determined for each of these 133 terms individually. The terms that are the most pertinent to your search will be chosen for you automatically based on this score.

On the basis of this score, the most pertinent phrases will be chosen automatically by default at a percentage of 60%, which will result in the 80 words that are most pertinent. However, the verification procedure must still be carried out by hand, and this involves deleting words that are in no way connected to the topic at hand. These words include editorial, sample, and abstract, amongst others. As a result, there is a maximum of eighty words that can be used into the development of the map.

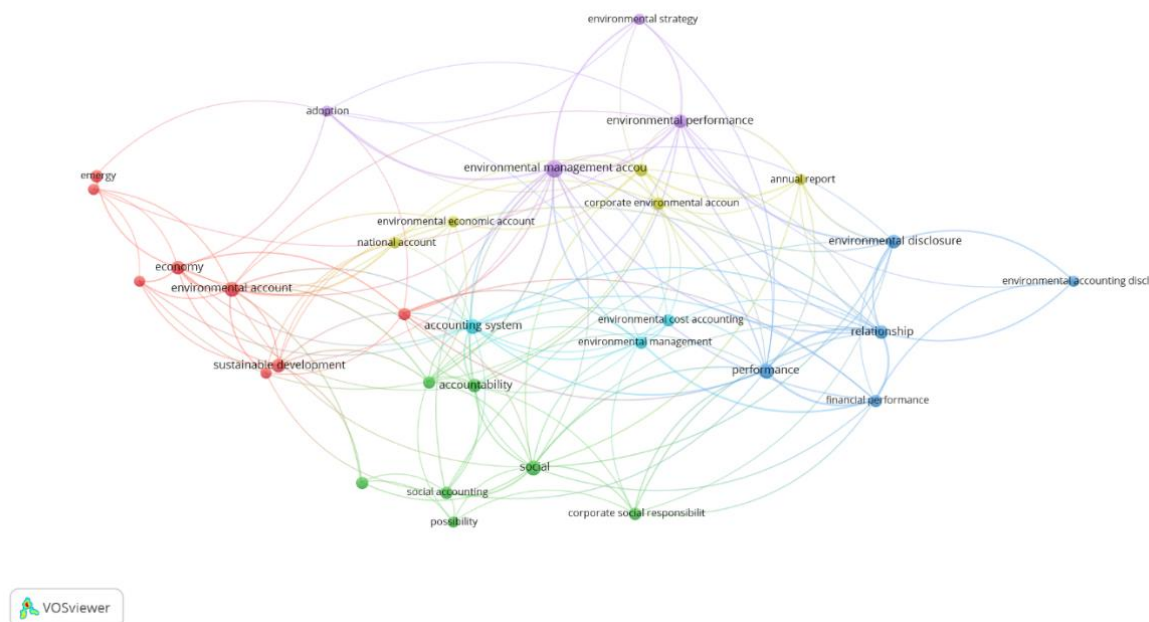


Figure 1. Network visualization map of keywords

According to Figure 1, there are a number of clusters represented by the colours blue, purple, yellow, red, and green. When looking at all of the articles, certain words in

this cluster come up more frequently than others. According to these clusters, there have been a total of five different article categories published up to this point. Table 3 provides more information that may be seen here.

Table 3. Clusters and keywords therein

Clusters	Total Items	Most frequent keywords (occurrence)	Keyword
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1	9	Ecosystem service (12), Environmental accounting (10)	Economic accounting, economy, ecosystem service, energy, environmental accounting disclosure, environmental accounting, natural resources
2	6	Accountability (10), Corporate social responsibility (15)	Accountability, accounting education, challenge, corporate social responsibility, possibility, social accounting
3	5	Environmental Accounting (20), Financial Performance (14)	Environmental accounting, disclosure, financial performance, relationships, national accounts
4	4	Annual Reports (10)	Annual report, corporate environmental, environmental economic, environmental information,
5	4	Environmental Strategy (15)	Adoption, environmental management, environmental performance, environmental strategy
6	3	Accounting Systems (12)	Accounting system, environmental cost accounting, environmental management

Then, to answer how research trends in the accounting environment dimension, we can see the answer from the cluster itself. Figure 2 shows a visualization of the density

of articles published by JSE and SEJ. Cluster 1, with the words resources and services being the words that appear most frequently.

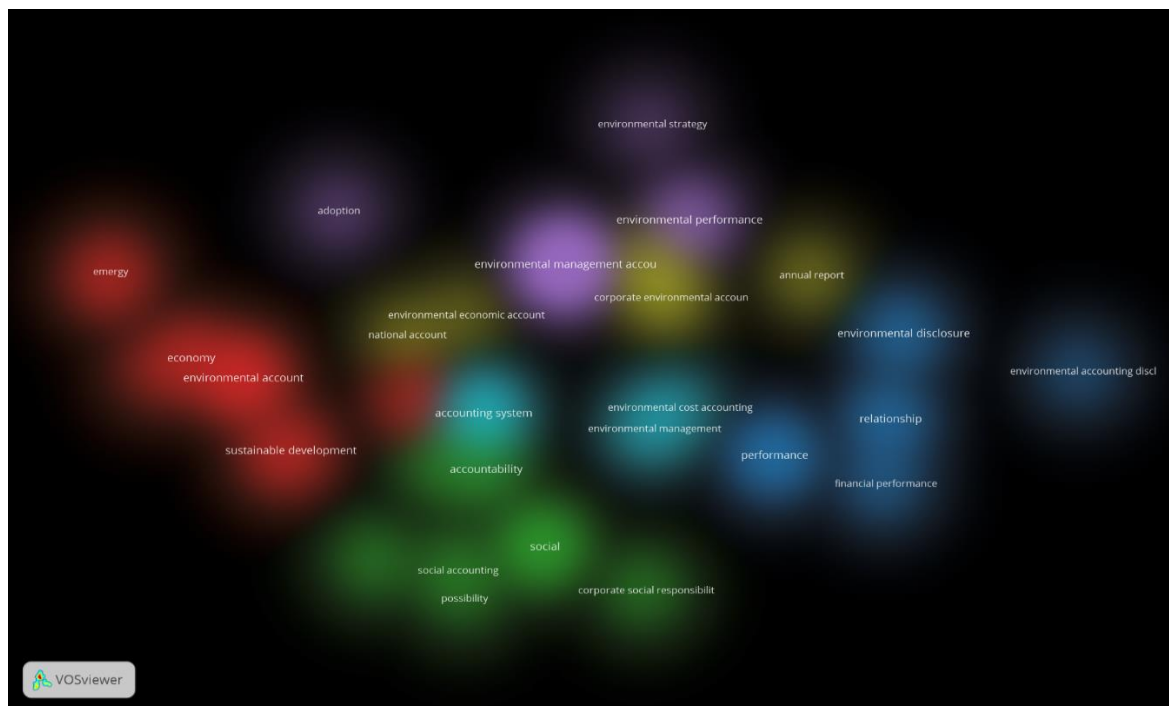


Figure 2. Density visualization map of keywords

There is one cluster from the results of this mapping that appears at least in keywords, namely cluster 6. This cluster

covers the topic of the dimensions of the accounting environment. From the

researcher's point of view, there are also five clusters, as shown in Figure 3.

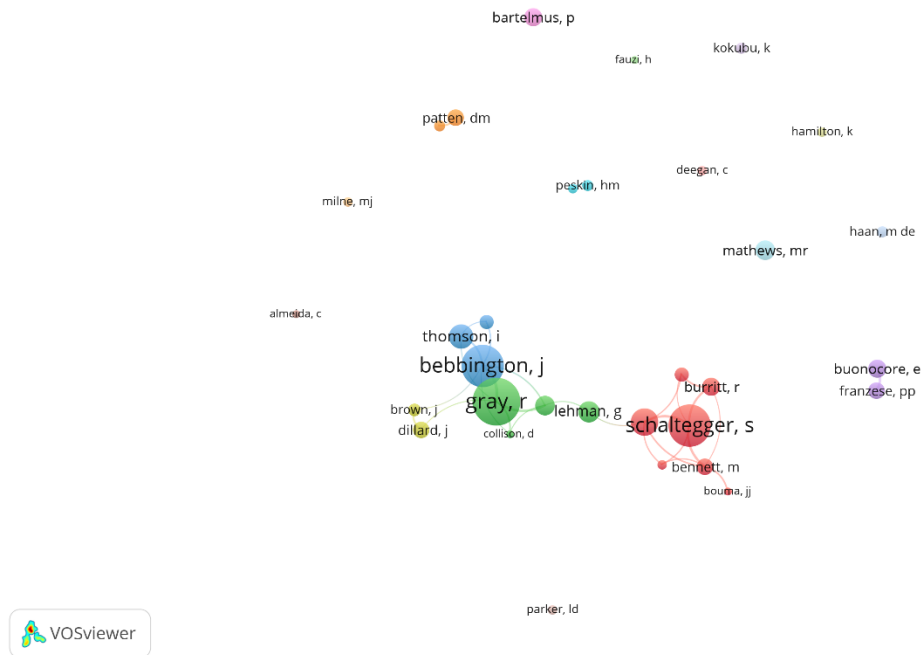


Figure 3. Network Visualization Map of Authors

Based on Figure 3, it can be seen that the big names from each cluster are marked with big dots in each cluster. In the image,

only authors who have links in publications are shown. However, if authorship is deleted, Table. 4.

Table 4. The Top Ten Cited Documents

Citations	Author and Year	Title
5329	C Deegan, 2002	Introduction: The legitimising effect of social and environmental disclosures—a theoretical foundation [20]
4981	HT Odum, 1996	Environmental accounting: energy and environmental decision making [21]
3914	R Gray, D Owen, C Adams, 1996	Accounting & accountability: changes and challenges in corporate social and environmental reporting [22]
3461	J Boyd, S Banzhaf, 2007	What are ecosystem services? The need for standardized environmental accounting units [23]
2751	J Brown, J Dillard, 2013	Agonizing over engagement: SEA and the “death of environmentalism” debates [24]
2232	CH Cho, DM Patten, 2007	The role of environmental disclosures as tools of legitimacy: A research note [25]
1936	R Gray, J Bebbington, 2001	Accounting for the Environment [26]
1750	WS Laufer, 2003	Social accountability and corporate greenwashing [27]
1577	R Gray, 2010	Is accounting for sustainability actually accounting for sustainability... and how would we know? An exploration of narratives of organisations and the planet [28]

1387	S Schaltegger, R Burritt, 2017	Contemporary environmental accounting: issues, concepts and practice [29]
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It is clear that the years 1976 through 2023 are the ones in which the documents relating to the accounting environment are expressly quoted the most. This can be seen by looking at the graph. New information is less likely to be acknowledged, with the exception

of works written by authors who have already conducted study in the topic and are quite well-known. Then, in order to determine which areas of research have been covered in a greater number of publications, we can look at Table 5.

Table 5. The 5 Most and Least Common Terms

Most occurrences		Fewer occurrences	
Occurrences	Term	Occurrences	Term
119	Environmental Management Accounting	14	Extensions
93	Company	14	Adoption
77	System	14	Natural Resources
75	Accounts	13	Environment Accounting Model
73	Social	13	Ecosystem Services
61	Environmental Account	13	Accounting Education
56	Performance	13	Accounting Information
53	Disclosure	12	Environmental Strategy
52	Accounting System	12	Economic Accounting
42	Environmental Performance	12	Possibility
41	Relationships	11	Progress
38	Environmental Disclosure	11	Education
32	Economy	10	Insights
32	Application	10	Challenge

Table 6 not only describes which themes appear most frequently in publications, but it also reveals the final purpose of this study, which is to explain the future aspects of the accounting environment that create prospects for further research. This is in addition to explaining which topics appear most frequently in publications. Issues that are more particular and lead to implications or measurements from the realm of business and entrepreneurship are opportunities that could be studied more fully.

4. CONCLUSION

In this study, 990 articles that have topics that are linked to the various aspects of the accounting environment are analysed. Based on the findings of our research, we have determined that there are six distinct

categories into which accounting publications can be grouped. The study that is being done on the many aspects of the accounting environment is increasingly focusing on the accounting side of things. There are several topics that frequently appear in publications, such as marketing perspectives from one variable to another. The current study has at least two limitations. Using formal tools (PoP, VOSviewer, and Mendeley software), the subjective judgment of the author is maintained and can still lead to an admission of error. Future studies should use a larger sample size which includes other journals, even if they are not indexed by Scopus. Besides that,

This study conducts a bibliometric exploration to uncover dimensions of environmental accounting beyond numbers. By systematically reviewing the literature and

analyzing bibliometric data, this research has contributed to our understanding of the multidimensional nature of environmental accounting and identified emerging trends, key contributors, and research gaps in the field. The analysis revealed several important findings. First, it is evident that environmental accounting has evolved significantly over the years, with a shift from traditional accounting practices to more comprehensive approaches that consider the environmental impact of business activities. The literature review highlights the development of frameworks, standards and methodologies for integrating environmental factors into accounting practice.

Through bibliometric analysis, influential articles and authors in this field were identified through co-citation and co-authorship analysis. These key contributors have played an important role in shaping the environmental accounting discourse and have made substantial contributions to the field.

Their insights and research have paved the way for the integration of environmental considerations into accounting practice. In addition, analysis of keyword frequency and co-occurrence reveals emerging trends and research groups in environmental accounting. These trends cover topics such as carbon accounting, life cycle assessment, environmental performance measurement and sustainability reporting.

Despite advances in this area, this study also identified several research gaps that require further exploration. These gaps include the need for more interdisciplinary research, the integration of social and economic dimensions into environmental accounting, and the development of standard measurement and reporting frameworks. Addressing this gap will contribute to a more holistic understanding of environmental accounting and facilitate its practical implementation within organizations.

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