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BIBLIOMETRIC ANALYSIS IN ENVIRONMENTAL ACCOUNTING

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Abstract

This study aims to determine the trend of environmental accounting publications in Scopus-indexed scientific articles in 2011-2020 based on keyword mapping. Mapping is done using VOSviewer. The results showed that there were 494 different keywords. They formed 1580 connecting lines and 45 clusters out of 200 articles related to the accounting environment, which were published in book form as much as 2.5%, journals 90% and other documents 7.5%. Keywords obtained based on VOSviewer with the most vital links include environmental accounting (38), environmental management accounting (30), sustainability (16), energy (12), life cycle assessment (9), social and environmental accounting (9), environmental performance (8), management accounting (8) and accounting (8).

Keywords: Bibliometric, Vosviewer, Accounting, Management, Environment

INTRODUCTION

Big data is a common buzzword in the business and research community, referring to the great mass of digital data collected from various sources (Liao et al, 2018). Big data is one of the advancements in the field of technology that is developing and needed today, big data will be able to store large data and integrated between data from each other. With big data we can use the correct and fast data from anywhere safely and conveniently (Supriyanto et al., 2021). In 2015, there were over 3 billion Internet users around the world. Accordingly, data have become more complex due to the increasing volume of structured and unstructured data with a growing number of various applications produced by the social media, Internet of Things (IoT), and multimedia, and etc (Kalantari et al., 2017). Accounting is the art of recording, classifying, and summarizing in a certain way and is expressed in money, transactions, and events that are and are part of finance (Aminah & Noviani, 2014). According to Fernando, (2022) accounting is the process of recording financial transactions pertaining to a business. The accounting process includes summarizing, analyzing, and reporting these transactions to oversight agencies, regulators, and tax collection entities. The financial statements used in accounting are a concise summary of financial transactions over an accounting period, summarizing a company's operations, financial position, and cash flows. In modern industry, many companies apply the concept of maximizing profit, but violating the principles of profit maximization itself. Modern philosophy defines the principle as the starting point of a theory or worldview. These provisions determine the system of knowledge, values and behavior of a person, social group and society (Latyshev et al., 2020). The principles that were violated included the principles of economic costs, accounting costs and opportunity costs. The implications for violating these principles include neglecting environmental management (Taqi

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et al., 2021). Reporting to env.go.jp on April 22, 2022, environmental accounting is a tool to complement environmental management, such as determining steps to deal with environmental problems and preservation. Environmental accounting consists of three main aspects, namely: environmental conservation costs (monetary value), environmental conservation benefits (physical units), and economic benefits associated with environmental conservation activities (monetary value). Environmental accounting is structured to identify, measure and communicate company activities based on environmental conservation costs or economic benefits associated with environmental conservation activities, company financial performance expressed in monetary value, and environmental conservation benefits, organizational environmental performance, which are designated in physical units. There are various approaches to environmental accounting at the micro or company level, including environmental management accounting, energy, raw material accounting, financial reporting, and social responsibility reports. The internal use of environmental accounting produces environmental information to help make management decisions regarding price levels, factory overhead control, and capital budgeting. External interests environmental accounting discloses environmental information for the benefit of the public and other financial communities (Pratiwi, 2013).

Environmental accounting, also called green accounting, refers to modification of the System of National Accounts to incorporate the use or depletion of natural resources. Environmental accounting is a vital tool to assist in the management of environmental and operational costs of natural resources. Valuation of natural resources is an essential input into both social cost-benefit analysis and some approaches to environmental accounting (Muralikrishna & Manickam, 2017). Environmental accounting is called green accouting too. Environmental or "green" accounting is an expanding field focused on factors like resource management and environmental impact, in addition to a company's revenue and expenses.

United States Environmental Protection Agency defines environmental accounting as follows:

> "Environmental accounting in the context of national income accounting refers to natural resource accounting, which can entail statistics about a nation's or regions' consumption, extent, quality, and value of natural resources, both renewable and non-renewable. Environmental accounting in the context of financial accounting usually refers to preparation of financial reports for external audience using Generally Accepted Accounting Principles. Environmental accounting as an aspect of management accounting serves business managers in making capital investment decisions, costing determinations, process/product design decisions, performance evaluations, and a host of other forward-looking business decisions".

As a tool of environmental management, environmental accounting is used to assess the effectiveness of conservation activities based on the summary and classification of environmental conservation costs. Accounting data is also used to determine the cost of the environmental management facility, the overall cost of conservation and investment necessary for environmental management activities. Besides, environmental accounting is also used to

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assess the level of output and performance every year to ensure the improvement of environmental performance should take place continuously (Nur & Sukoharsono, 2016).

Disclosure, dissemination of information for the public interest, and generating new ideas for science and technology can be done through the publication of scientific journals. A scientific journal is the channel, by excellence, for the dissemination and popularization of scientific knowledge, in the form of results, advances and research findings. Therefore, they are the reference space in which the novelties and updates of any discipline can be found, contributing to the development of the scientific discourse or narrative, as well as to the conformation of the state of the art of the field. Thus, people who investigate or research in the different niches of knowledge have in them the ideal resource to define and delimit their research path.

A publication that claims to be scientific requires an operational structure, an adequate format, prestige and reputation for the soundness of its publications, and transparent and clear regulations, based on a commitment to the rigor and ethics of the intellectual exercise. Nowadays, most scientific publications have opted for an electronic format, in which it is quite easy to recognize the quality of the publication and its rigorousness in terms of content, human resources, processes, deadlines, impact and visibility of the papers that are accepted (Pérez-Rodríguez, 2021).

A scientific journal is a publication that is published regularly by a professional organization or academic institution that contains articles that are the product of empirical scientific thinking (articles of thought) in a particular field of science. Scientific journals as a communication forum for members of the scientific community of certain disciplines. The contents of scientific journals are scientific articles, namely writings that contain systematic reports on the results of studies or research results (Suryoputro et al, 2012). An electronic journal or e-journal itself is a journal in which all aspects are carried out electronically and the journal must be listed in one of the indexing institutions. Indexation is the registration of journals at reputable indexing institutions with the hope of increasing citations and even reputations for the journal so that the journal is easier to find, thus making the journal more useful for researchers and the public, when researchers have been indexed, the research journal will look quality because it registers journals. Indexing institutions is not easy and directly shows that indexed journals are journals that comply with International Standards (Yani et al, 2020). One of the journal's assessment criteria is journal indexation which is divided into three, namely high, medium and low reputation. The top indexing institutions are Scopus and the web of science. The moderately reputable indexers are DOAJ, Gale, and Pubmed. Low-reputable indexers are Google Scholar, Garuda Portal, Moraref, and so on (Muriyatmoko, 2018).

Journals should be evaluated from a research perspective. This can be done by applying the bibliometric method. Bibliometric analysis is a popular and rigorous method for exploring and analyzing large volumes of scientific data. It enables us to unpack the evolutionary nuances of a specific field, while shedding light on the emerging areas in that field (Donthua et al., 2021). Bibliometrics comes from the word Biblio or bibliography and metrics, Biblio means book and metrics are measuring (Fatmawati, 2012). Bibliometrics is defined as measuring or analyzing books/literature using a mathematical and statistical approach to explain the written

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communication process and the nature and direction of development in a descriptive manner, counting and analyzing various communication facets. Bibliometric is the attempt to quantitatively assess the academic quality of journals or authors by statistical methods such as citation rates. Care must be taken to first suitably define quality criteria and then suitably implement them by selecting a suitable empirical basis; else misunderstanding on the meaning of quality can occur. Bibliometric includes all the main bibliometric methods of analysis, but it especially for science mapping and not for measuring science, scientists, or scientific productivity. Synthesizing past research findings is one of the most important tasks in advancing a line of research. Various methods exist to summarize the amount of scientific activity in a domain, but bibliometrics has the potential to introduce a systematic, transparent and reproducible review process (Sangadi, 2022).

Bibliometrics can provide an explanation of the written communication process and its development in a discipline. Three theorems in bibliometrics are Lotka's theorem, Zift's theorem, and Bradford's law. Lotka's theorem is used to determine the author's productivity, and Zift's theorem is to calculate word rank and frequency in literature. Bradford's law is used to find out the core journal (Royani & Idhani, 2018). Bibliometrics are tools that can be used in the preaward phase for a number of things. It can be used to document and justify the role of the researcher and the research team for being partners or coordinators of the project. Often CVs of the involved partners have to be provided with publication lists and other types of bibliometric information (H-index, Journal impact factor, and so on). Bibliometrics can also be used to identify key partners, through surveys of who are the most appropriate contributors in the field. As a research administrator, basic knowledge of the terminology and tools of bibliometrics is important, and good links with your organization’s library or analytic groups are equally important (Andersen, 2018).

This study aims to determine the trend of publications related to environmental accounting in Scopus indexed scientific articles in 2011-2020 based on keyword mapping. Mapping is an important procedure of bibliometrics. Up to now, the bibliometrics has been widely used in hotspot research (Yeung et al, 2017), co-authorship analysis (Saleh et al 20116), Co-citation analysis (Merigo et al, 2017), and the development of the whole subject fields (Merigo et al, 2017). Mapping can represent the situation and status of the development of science. There are many software for bibliometric analysis, one of which is VOSviewer (Liao et al, 2018). VOSviewer is a software tool for creating maps based on network data and for visualizing mappings. VOSviewer is used to analyze bibliometric networks and create, visualize, and explore maps based on network data types (Eck & Waltman, 2018). The advantage of VOSviewer compared to other analytical applications is that this program uses a text-mining function to identify combinations of noun phrases that are relevant to mapping and an integrated clustering approach to examine cocitation data networks and co-occurrence (Tupan et al, 2018).

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METHODOLOGY

The method used in this study is a bibliometric analysis which can assist researchers in studying the bibliographic content of each article published in the Scopus journal for the period 2011-2020. Bibliometric analysis is a quantitative method for analyzing bibliographic data in articles/journals. Quantitative method used to emphasize the analysis on numerical data(numbers) are processed with statistical methods (Syafitri et al., 2017). There are 4 (four) benefits that can be obtained by using bibliometric analysis methods, namely analyzing trends in individual research or fields of study, providing evidence for the impact of individual research or fields of study, discovering new and emerging areas of research, identifying potential research collaborators, and identifying sources suitable for publication (Maudisha, 2022). This analysis is usually used to cover scientific article references cited in a journal, the relevance of the scientific field of a journal, and to classify scientific articles according to a research field (Rostiany & Tjandra, 2022). The steps taken include the process of collecting data, checking and filling in bibliographic attributes, then the bibliometric analysis is carried out using VOSviewer software. Data was collected by searching for Scopus indexed journal articles through Publish or Perish (PoP). Data from Publish or Perish (PoP) is filled in and completed in the author keywords section manually using the Mendeley desktop software and then integrated into the VOSviewer software for mapping. Figure 1 below is a bibliometric analysis of the keyword mapping flowchart.

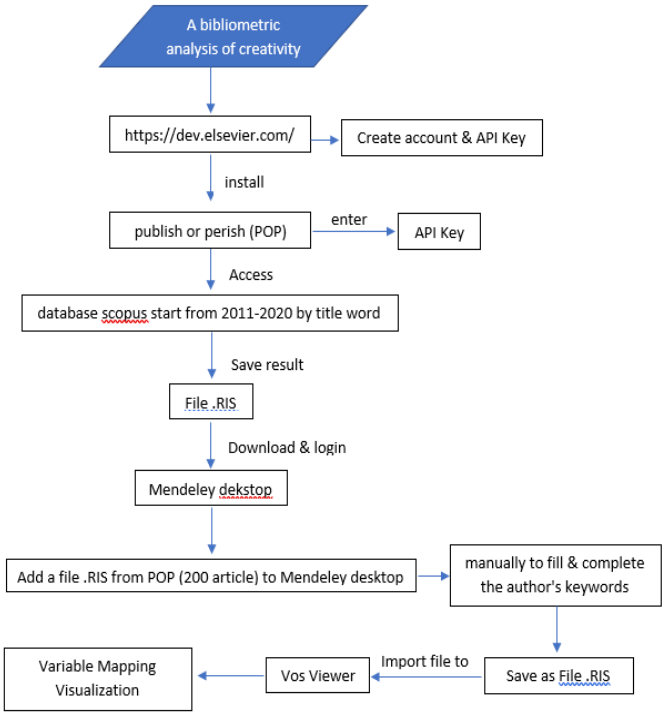

Figure 1: Bibliometric Analysis Flowchart

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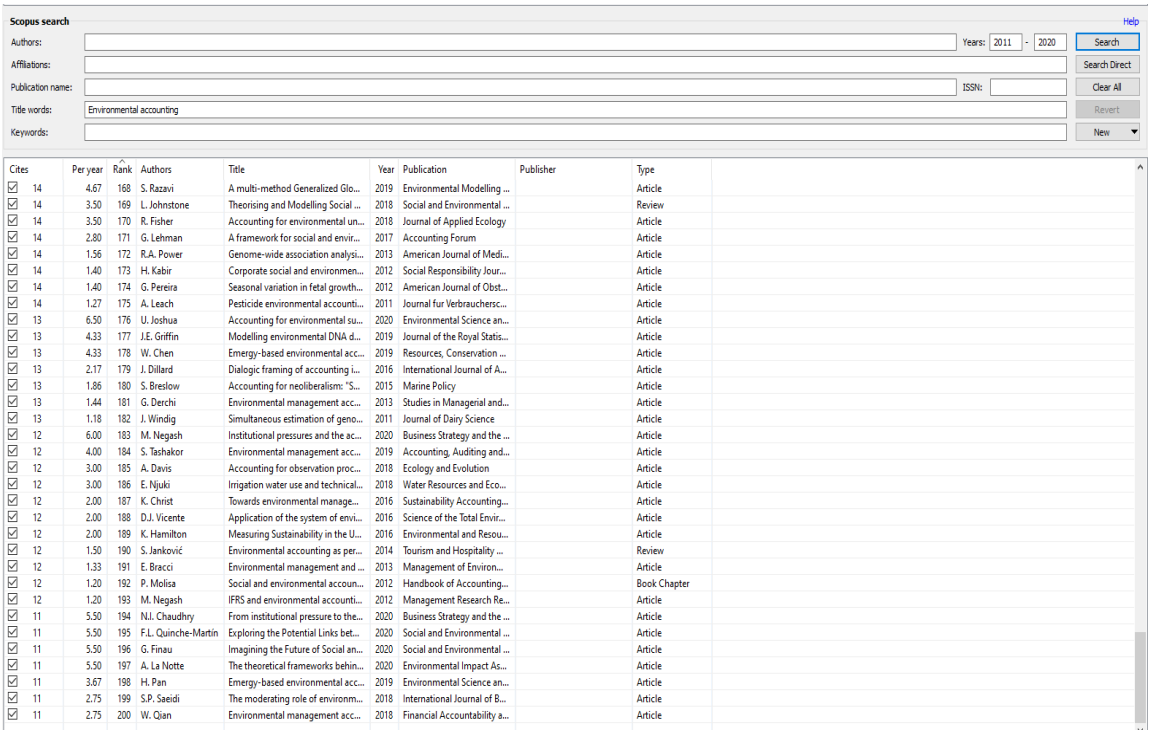
RESULTS

Big data has received wide attention from the academia, the economic community and even the government (Wamba et al, 2015). The search for bibliographic data is limited in three aspects, namely: (1) selected scientific works only articles from 2011-2020; (2) in the Publish or Perish (PoP) software to search for the title of the word entered, namely "environmental accounting"; (3) scientific articles taken are articles sourced from Scopus. A search on the PoP application was conducted on Saturday, April 18, 2022, and obtained data in the form of 200 scientific articles related to environmental accounting. Figure 2 below is the process of presenting data retrieval through PoP software.



Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher	Type
14	4.67	168	S. Razavi	A multi-method Generalized Glo...	2019	Environmental Modelling ...		Article
14	3.50	169	L. Johnstone	Theorising and Modelling Social ...	2018	Social and Environmental ...		Review
14	3.50	170	R. Fisher	Accounting for environmental un...	2018	Journal of Applied Ecology		Article
14	2.80	171	G. Lehman	A framework for social and envir...	2017	Accounting Forum		Article
14	1.56	172	R.A. Power	Genome-wide association analysi...	2013	American Journal of Medi...		Article
14	1.40	173	H. Kabir	Corporate social and environmen...	2012	Social Responsibility Jour...		Article
14	1.40	174	G. Pereira	Seasonal variation in fetal growth...	2012	American Journal of Obst...		Article
14	1.27	175	A. Leach	Pesticide environmental accounti...	2011	Journal fur Verbrauchersc...		Article
13	6.50	176	U. Joshua	Accounting for environmental su...	2020	Environmental Science an...		Article
13	4.33	177	J.E. Griffin	Modelling environmental DNA d...	2019	Journal of the Royal Statis...		Article
13	4.33	178	W. Chen	Emergy-based environmental acc...	2019	Resources, Conservation ...		Article
13	2.17	179	J. Dillard	Dialogic framing of accounting i...	2016	International Journal of A...		Article
13	1.86	180	S. Breslow	Accounting for neoliberalism: "S...	2015	Marine Policy		Article
13	1.44	181	G. Derchi	Environmental management acc...	2013	Studies in Managerial and...		Article
13	1.18	182	J. Windig	Simultaneous estimation of geno...	2011	Journal of Dairy Science		Article
12	6.00	183	M. Negash	Institutional pressures and the ac...	2020	Business Strategy and the ...		Article
12	4.00	184	S. Tashakor	Environmental management acc...	2019	Accounting, Auditing and...		Article
12	3.00	185	A. Davis	Accounting for observation proc...	2018	Ecology and Evolution		Article
12	3.00	186	E. Njuki	Irrigation water use and technical...	2018	Water Resources and Eco...		Article
12	2.00	187	K. Christ	Towards environmental manage...	2016	Sustainability Accounting...		Article
12	2.00	188	D.J. Vicente	Application of the system of envi...	2016	Science of the Total Envir...		Article
12	2.00	189	K. Hamilton	Measuring Sustainability in the U...	2016	Environmental and Resou...		Article
12	1.50	190	S. Janković	Environmental accounting as per...	2014	Tourism and Hospitality ...		Review
12	1.33	191	E. Bracci	Environmental management and ...	2013	Management of Environ...		Article
12	1.20	192	P. Molisa	Social and environmental accoun...	2012	Handbook of Accounting...		Book Chapter
12	1.20	193	M. Negash	IFRS and environmental accounti...	2012	Management Research Re...		Article
11	5.50	194	N.J. Chaudhry	From institutional pressure to the...	2020	Business Strategy and the ...		Article
11	5.50	195	F.L. Quinche-Martín	Exploring the Potential Links bet...	2020	Social and Environmental ...		Article
11	5.50	196	G. Finau	Imagining the Future of Social an...	2020	Social and Environmental ...		Article
11	5.50	197	A. La Notte	The theoretical frameworks behin...	2020	Environmental Impact As...		Article
11	3.67	198	H. Pan	Emergy-based environmental acc...	2019	Environmental Science an...		Article
11	2.75	199	S.P. Saeidi	The moderating role of environm...	2018	International Journal of B...		Article
11	2.75	200	W. Qian	Environmental management acc...	2018	Financial Accountability a...		Article

Figure 2: Data search process through Publish or Perish (PoP) software

The next stage after the data is obtained is to check or recheck and manually fill in incomplete data on bibliographic attributes with the help of the Mendeley desktop. Checking the completeness of attributes includes the author's name, article title, keywords, abstract, and year, volume, DOI or issue number, and page, number of journal citations, article links, and journal publishers. The bibliographic keyword section or author keywords are filled in and completed manually so that keywords can be mapped and analyzed using VOSviewer. The stages after checking and filling in the bibliographic attributes are completed, then proceed with the bibliometric analysis. The bibliometric analysis carried out in this study is based on publication trends or publication developments on Scopus indexed scientific articles based on keywords.

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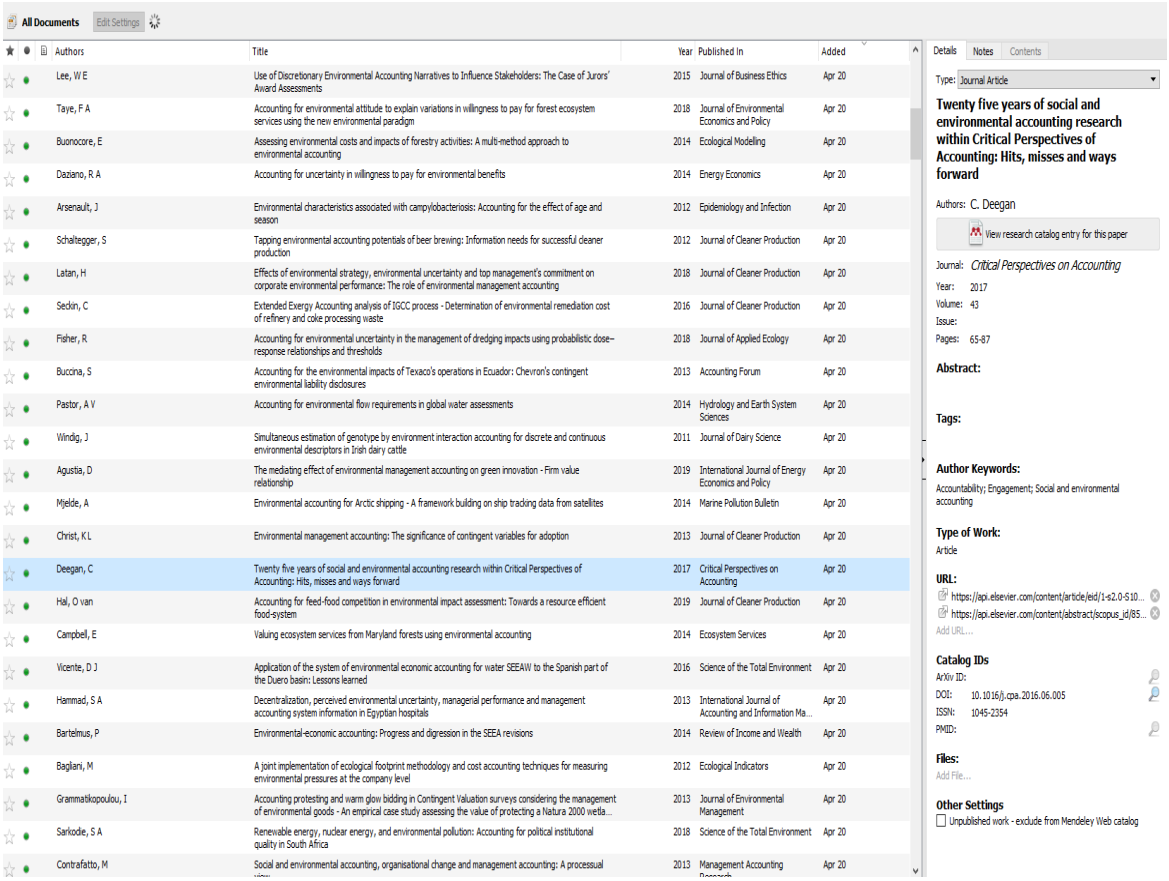

Figure 3: The Process of Checking Bibliographic Attributes Using the Mendeley Desktop Software

The results of the analysis of publication trends or the development of publications from 2011 to 2020 can be seen in Table 1. Percentage of Scopus indexed articles that discuss the accounting environment, and are published in journals 90%; Book 2.5% and 7.5% of other documents.

Table 1: Number of References Based on Document Type

Reference type	Number of Articles	Percentage (%)
Book	5	2,5
Journal	180	90
Other Documents	15	7,5

Table 2. Below is the percentage trend of publication of Scopus indexed environmental accounting scientific articles from 2011 to 2020. The highest number of article publications was in 2018 with 29 articles or 14.5% of the total. The lowest data were in 2011 and 2012 with 15 articles each or about 7.5% of the total.

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Table 2: Distribution of Articles by Year of Publication

Publication Year	Number of Article	Percentage (%)
2011	15	7,5
2012	15	7,5
2013	29	14,5
2014	20	10
2015	17	8,5
2016	16	8
2017	20	10
2018	26	13
2019	24	12
2020	18	9

The graph in Figure 4 below is a visualization of the development trend of the publication of environmental accounting scientific articles from 2011-2020.

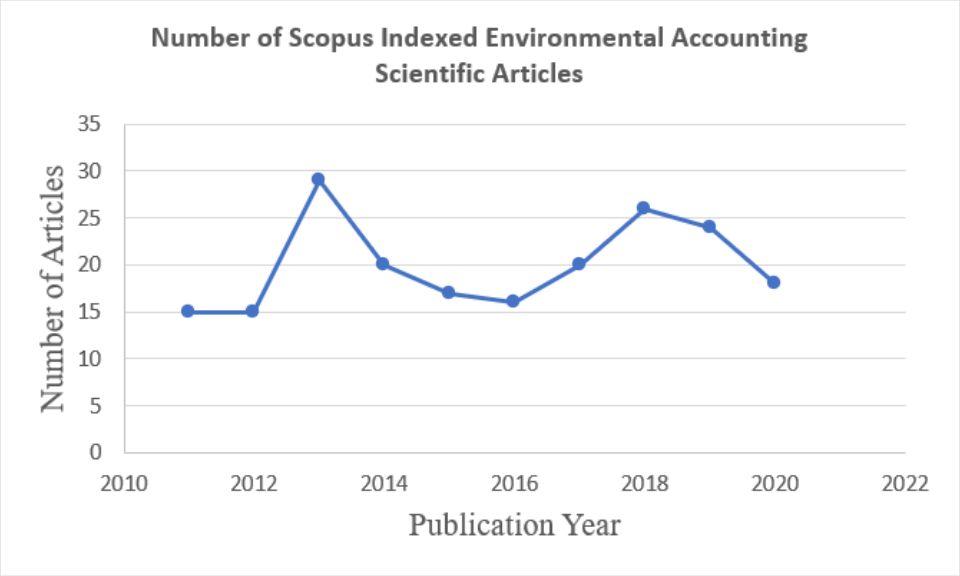

Figure 4: Graph of Publication Trends in Environmental Accounting Scientific Articles from 2011-2020

Keyword analysis in VOSviewer software was carried out using co-occurrence and then obtained a mapping of relationships between keywords.

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Keyword mapping forms a network as shown in Figure 5.

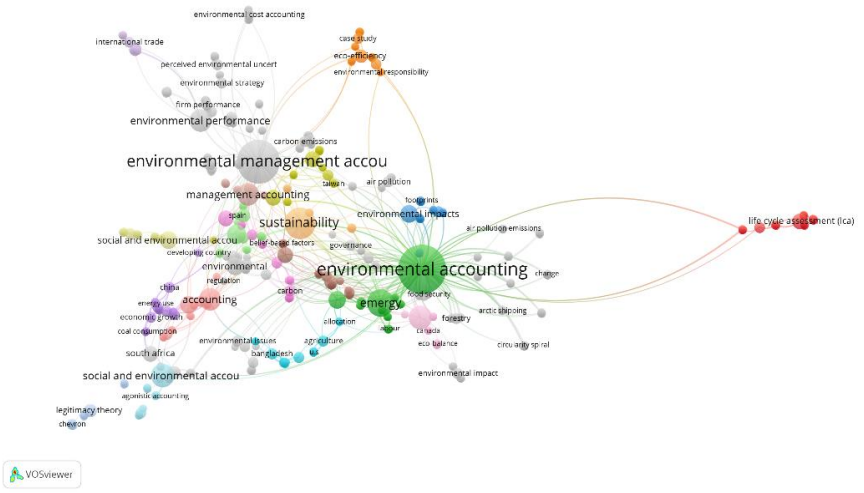

Figure 5: Network Visualization VOSviewer

Found 494 keywords that are interconnected with one another. These keywords form 1580 connecting lines. Environmental accounting as the keyword with the highest frequency of association is a natural thing considering the search keywords used to use the word environmental accounting. Keywords with the strongest links based on VOSviewer include environmental accounting (38), environment management accounting (30), sustainability (16), emergy (12), life cycle assessment (9), social and environmental accounting (9), and environmental performance (8), management accounting (8) and accounting (8). This shows that during the last ten years, the subject of environmental accounting, environmental management accounting, sustainability, emergency, life cycle assessment, social and environmental accounting, environmental performance, management accounting, and accounting are variables or topics that are often discussed in Scopus indexed scientific articles.

Table 3: The Top 9 Keywords of the Environmental Accounting-Related Publications

Rank	Keywords	Frequency	Total Link Strength
1	Environmental Accounting	38	161
2	Environment Management Accounting	30	118
3	Sustainability	16	64
4	Emergy	12	41
5	Life Cycle Assessment	9	38
6	Social And Environmental Accounting	9	30
7	Environmental Performance	8	42
8	Management Accounting	8	37
9	Accounting	8	31

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The visualization map in Figure 5 shows the existence of a relationship or relationship between keywords as a representation of research and activities that occur. Based on the keywords with the strongest links, it can be concluded that the relationship between the linked keywords is as follows: environmental accounting is used for disclosure and reporting of cost, quality activities (Setiawan, 2016) as well as emergency response plans included in environmental management accounting. The urgency of environmental accounting as a form of corporate responsibility in environmental management is as an accounting information system that provides information on environmental aspects. This is intended so that the management can improve environmental performance as well as financial performance which will indirectly have an impact on the sustainability of the company in the future (Idrawahyuni, 2016). Social and environmental accounting is important because companies need to convey information about social activities and environmental protection to company stakeholders (Suaryana, 2011). Environmental management also pays attention to the Life Cycle Assessment (LCA) to make improvements in the production life cycle which aims to reduce emissions from factory production residues to the environment (Parameswari, 2019). Environmental management is a process that industries, companies, and individuals undertake to regulate and protect the health of the natural world. In most cases, it does not actually involve managing the environment itself, but rather is the process of taking steps and promoting behaviors that will have a positive impact on how environmental resources are used and protected. Organizations engage in environmental management for a couple of different reasons, but caring for the natural world, following local laws and rules about conservation, and saving money are usually near the top of most lists. Management plans look different in different industries, but all aim for roughly the same goals (Burkot, 2022).

Table 4: Scopus Indexed Scientific Article Cluster Related to Environmental Accounting 2011-2020

Cluster	Number of Keywords	Selected Keywords
Cluster 1	23	anaerobic co-digestion, carbon footprint, crepe rubber, eco-design, emissions, emissions modeling, energy-related product, enterprise servers, greenhouse gases, incineration landfill, life cycle assessment, Maine catch crop rotation, manure fertilization, material flow analysis (MFA), material flow cost accounting (MFCA), municipal solid waste (MSW), natural rubber, production theory, recycling, resource efficiency, reuse, Sri Lanka, waste reduction
Cluster 2	21	Chinese economy, cloud computing, data center, ecological modeling, ecosystem services, embodied energy Ica, emergy, emergy sustainability index, engineering, environmental accounting, forests, green ICT information, labor, Maryland, sustainability assessment, system ecology, temperate forest, uev, united states national forest system, university
Cluster 3	20	accountability regimes, bory tucholskie national park, company's supply network, copper concentrate, diet formulation, environmental impacts, footprints, forest ecosystem services, hunting organizations, Ica, long-term emissions, management flow cost accounting, multi-objective synthesis, multicriteria, nonprofit sector, nutritional strategies, renewables, sustainable livestock diets, tailings disposal, total footprints

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Cluster 4	20	city, corn, cost accounting, depletion, ecological footprint, embodied energy analysis, emergy accounting, environmental activity-based costing, environmental carrying capacity, environmental cost, environmental load, exhaustible resources, firm metabolism, food, Hartwick rule, social and environmental audit, sugarcane, sustainable development, Taiwan, universities
Cluster 5	19	China, CO_2 emissions, coal consumption, democracy, developing country, economic growth, employment, energy consumption, energy use, engagement, environmental Kuznets curve, FDI, foreign direct investment, globalization index, offshore activities, politics, ranciere, sea, tourism arrivals
Cluster 6	18	agriculture, allocation, Bangladesh, c21, chartered accountants, corporate social and environmental accounting prac, energy productivity and efficiency, irrigation water use efficiency, jel classification, maize, o33, organic farming, q18, random parameters, season selection decision, stochastic production frontier, technical efficiency, u.s
Cluster 7	18	car manufacturing, carbon performance, case study, cleaner production, disclosure strategies, eco-efficiency, environment-related management accounting (ema), environmental accounting information, environmental reporting, environmental responsibility, Grenelle 2 law, hotel sustainability, material flow, normativity, organizational change, semi-structured interviews, sustainable value drivers, voluntary disclosure
Cluster 8	17	Australia, belief-based factors, benthic habitat, classification, cotton farming, ecological value, ecosystem service, environmental accounts, environmental information, farmers, landscape ecology, marine habitats, marine protected areas, natural capital, natural resources, system of national accounts, theory of planned behavior
Cluster 9	17	Author-supplied keywords, carbon, carbon models, circular economy, corporate finance, dynamic capabilities, environmental change, institutional logics, institutional theory, land use, land-cover change, reflexive isomorphism, review, stakeholders, topic burst, unfccc, water supply organizations
Cluster 10	17	accountability, accounting, accounting for nature cultures, beauty, case studies of south-east Asian companies, environmental and social assessment in finance, environmental education research, environmental liabilities, environmental risk, expressive, international accounting standards, international finance, language, legitimating the social accounting project, neo-institutional theory, reporting, sustainability accounting
Cluster 11	16	accounting methods, bibliometric analysis, contingency planning, contingency theory, development, discipline, environmental data, environmental management, environmentally sensitive industries, government-linked companies, local government, socio-economic data, Spain, sustainable development goals, waste and recycling management, waste management
Cluster 12	16	camouflaging, chevron, ChevronTexaco, Ecuador, environmental liability, environmental remediation, financial disclosure, functional stupidity, HIV/aids, legitimacy theory, organizational hypocrisy, stakeholder theory, substantive management, symbolic management, Texaco, theoretical frameworks
Cluster 13	16	accounting and accountability, accounting and development, carbon accounting, carbon disclosure and reporting, carbon financial accounting, carbon management accounting, carbon storage and sequestration, climate change mitigation, critical perspectives, development countries, environmental-economic accounting, forest management, management control, political ecology (pe), social and environmental accounting (sea), socio-environmental conflicts

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Cluster 14	15	business, consumption-based accounting, economics, embodied carbon emissions, environmental analysis, environmental assessment, environmental economics, environmental impact assessment, environmental pollution, environmental science, government integrity, input–output tables, international trade, quantiles via moments, trade
Cluster 15	15	agonistic accounting, agonistics, critical theory, dialogic accounting, engagement research, environmental decision-making, environmental externalities, evaluative framework, graphical practices, impression management, interpretation, lake Pedder, microfinance, pragmatism, social and environmental accounting
Cluster 16	14	orders of worth and pragmatic sociology, ecological accounts, environment statistics, environmental performance measurement, environmental performance measurement, flow cost accounting, fuzzy-ahp, life-cycle, nature, pluralism, product development, sustainability, the environmental management accounting network, valuation
Cluster 17	14	business organizations, ecological aspects of sustainability, environmental management accounting (ema), environmental management controls (emcs), global sustainability, institutions, management accounting, monetary environmental management accounting, organizational change, physical environmental management accounting, planetary boundaries, processes of change, profit-seeking, social and environmental accounting, and reporting
Cluster 18	13	Canada, commodity flow modeling, eco-balance, elite, food systems sustainability, institutional work, life cycle assessment, management accounting innovation, pig production, supply chains, uncertainty analysis, urban wetland park, écobilan
Cluster 19	13	and governance (ESG), corporate social responsibility (CSR), environmental, ethical investing, firm value, green innovation, literature review, public interest, regulation, social, social and governance (ESG) disclosures, socially responsible investing (SRI), stock market performance
Cluster 20	13	ema, EMASM, environmental accounting information system, environmental management systems, firm performance, Indonesia, Iran, iso 14001, management accounting and control, process innovation, product innovation, small-medium enterprises, SMEs
Cluster 21	12	annual report, Bangladesh bank, climate change, climate finance, disaggregate energy, disclosure, economies, nuclear energy, pacific small island developing states (PSIDS), project financing, renewable energy, South Africa
Cluster 22	11	carbon emissions, innovation accounting tests, migration index, monetary policy, renewable energy consumption, sustainable environment, trade policy, trade-offs, united states, water risk, win-wins
Cluster 23	10	corporate reports, corporate social reporting, corporate social responsibility, environmental issues, financial reporting, manufacturing industries, quantitative research, social accounting, Swaziland, transparency, and accountability
Cluster 24	9	corporate environmental performance, decentralization, Egypt, environmental strategy, hospital, management accounting system, managerial performance, perceived environmental uncertainty, top management's commitment
Cluster 25	8	CO_2 emission, ecological footprinting, emergy analysis, energy analysis, environmental input-output analysis, gold production, governance, lead and zinc
Cluster 26	8	accuracy, completeness, consistency, environmental footprint, environmental performance, life-cycle accounting, relevance, transparency

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Cluster 27	8	coal-fired power generation, environmental impact, external environmental cost, externalities, herbicides, pesticide environmental accounting, resource consumption cost, sugar beet
Cluster 28	8	diffusion of innovation, eco-control, eco-practices, environmental and economic performance, environmental costing, environmental management accounting, sustainable management, temporal paths of development
Cluster 29	7	corporate sustainability, district heating, environmental cost accounting, environmental cost accounting guideline, external cost, Korean manufacturing industries, social cost
Cluster 30	7	air pollution, deflation, fetal growth, index numbers, pregnancy, temperature, weather
Cluster 31	7	environmental proactivity, institutional pressures, moderating effects, Pakistan, perceived benefit, pls-sem, top management support
Cluster 32	7	bioenergy, forestry, province of Trento, Tarantino valley, timber, urban systems, wood chips
Cluster 33	6	agricultural systems, environmental footprints, food security, Lebanon, robustness, ternary diagram
Cluster 34	6	coercive isomorphism, institutional pressure, Malaysia, mimetic processes, new institutional sociology, normative pressure
Cluster 35	5	circularity spiral, environmental provisions, internalizing externalities, sustainable business model canvas, transition management
Cluster 36	5	change, collective identity, institutional logic, m41, performance measurement systems
Cluster 37	5	data quality, decision-making strategies, ecological accounting, investment decision making, sustainability balanced scorecard
Cluster 38	5	financial reporting, globalization, international financial reporting standards, international standards, sustainability reports
Cluster 39	4	ais (automatic identification system), arctic shipping, black carbon emissions, heavy fuel oil
Cluster 40	4	air pollution emissions, coal-fired electric generation, economy, industry
Cluster 41	4	ecosystem metabolism, fund-flow model, integrated assessment, musiasem
Cluster 42	4	forest, land-use change, land use survey, statistical sampling
Cluster 43	3	Environmental-economic accounting, natural capital accounting, system of environmental-economic accounting
Cluster 44	3	carbon disclosure, carbon management, sustainability management
Cluster 45	3	climate change policy, corporate GHG strategies, financial statements

The visualization of 45 clusters can be seen in Figure 5, the network visualization obtained from VOSviewer. The size of the circle can reflect the frequency of the keyword, is the larger the circle, the higher the frequency, or the more often the keyword is discussed in scientific articles. The smaller the circle size, the lower the frequency or the less frequently these keywords are discussed in scientific articles. The line thickness is proportional to the closeness of the connection between the two keywords. A thicker line between two words means there is a closer relationship (Farida & Firmansyah, 2020). Before that, when working with VOSviewer, it is important to understand the terminology used by the software. Maps created, visualized, and explored using VOSviewer include items. Items are the objects of interest. Items may for example be publications, researchers, or terms. A map normally includes only one type of item. It is for example uncommon to have a map that includes both publications

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and terms. Between any pair of items there can be a link. A link is a connection or a relation between two items. Examples of links are bibliographic coupling links between publications, coauthorship links between researchers, and co-occurrence links between terms. A map normally includes only one type of link. Also, between any pair of items, there can be no more than one link. Each link has a strength, represented by a positive numerical value. The higher this value, the stronger the link. The strength of a link may for example indicate the number of cited references two publications have in common (in the case of bibliographic coupling links), the number of publications two researchers have co-authored (in the case of co-authorship links), or the number of publications in which two terms occur together (in the case of cooccurrence links). Sometimes the links between items all have a strength of one. VOSviewer then does not show the strength of a link. Items and links together constitute a network. Hence, a network is a set of items together with the links between the items (Waltman, 2022).

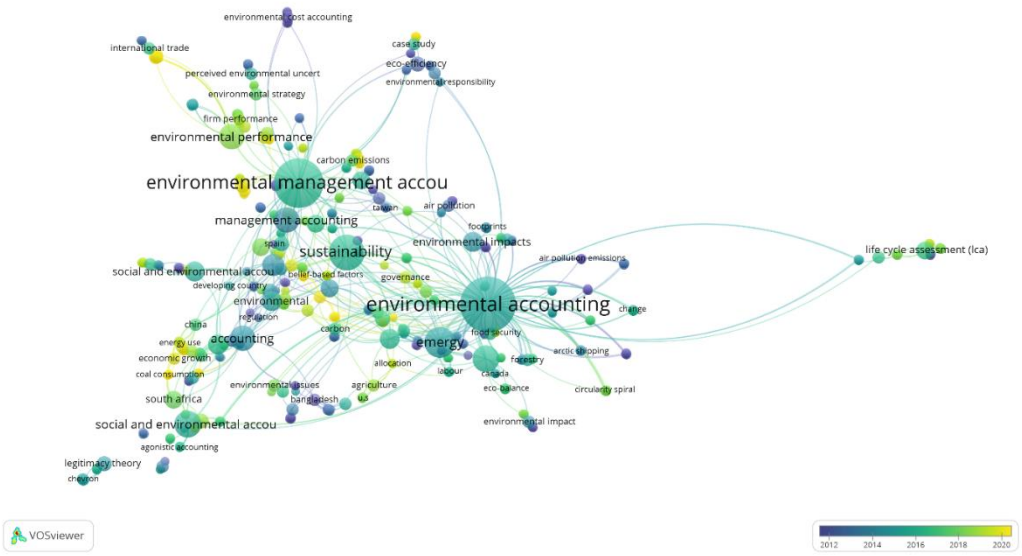

Figure 6: Overlay visualization VOSviewer

Figure 6 is an overlay visualization or keyword mapping from VOSviewer which is colored by year of publication. Colors range from purple (oldest year) to green to yellow (most recent publication year) (Eck & Waltman, 2018). If the color of the circle gets lighter, then the variable or keyword is relatively new or the keyword has been discussed recently. Researchers if they want to know variables or keywords that are still rarely discussed related to environmental accounting, can look at the map on the visualization overlay with small and light-colored circles. The latest keywords in environmental accounting that are still rarely discussed in scientific articles are stakeholders, corporate finance, circular economy, economic growth, CO2 emissions, allocation, agriculture, review, energy use, coal consumption, governance, environmental analysis, business, environmental proactivity, disclosure strategies, author-

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supplied keywords, review, topic burst, innovation accounting test, reporting, neo-institutional theory, foreign direct investment, diffusion of innovation.

CONCLUSION

From the results of the analysis of keyword mapping on scientific articles indexed by Scopus from 2011–2020, it is known that in the last 10 years, in Scopus indexed journals there are 494 different keywords and form 1580 connecting lines and 45 clusters. Keywords with the strongest links based on VOSviewer include environmental accounting (38), environment management accounting (30), sustainability (16), emergy (12), life cycle assessment (9), social and environmental accounting (9), and environmental performance (8), management accounting (8) and accounting (8). These keywords are variables or topics that are often discussed in Scopus indexed scientific articles. The latest keywords in environmental accounting that are still rarely discussed in scientific articles are stakeholders, corporate finance, circular economy, economic growth, CO2 emissions, allocation, agriculture, review, energy use, coal consumption, governance, environmental analysis, business, environmental proactivity, disclosure strategies, author-supplied keywords, review, topic burst, innovation accounting test, reporting, neo-institutional theory, foreign direct investment, diffusion of innovation.

Reference

1) Andersen, J. (2018). Preaward—Project Preparation. In Research Management Europe and Beyond (pp. 147–171).

2) Burkot, R. (2022). What is Environmental Management? Practical Adult Insights. https://www.practicaladultinsights.com/what-is-environmental-management.htm

3) Donthua, N., Kumar, S., Mukherjeec, D., Pandeyb, N., & MarcLim, W. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296.

4) Fernando, J. (2022). Accounting Explained With Brief History and Modern Job Requirement. Investopedia. https://www.investopedia.com/terms/a/accounting.asp

5) Kalantari, A., Kamsin, A., Kamaruddin, H. S., Ebrahim, N. A., Gani, A., Ebrahimi, A., & Shamshirband, S. (2017). A bibliometric approach to tracking big data research trends. Journal of Big Data, 30, 1–18.

6) Latyshev, O. Y., Skorobogatov, A. V., & Krasnov, A. V. (2020). Legal Principle Between Concept And Content. JILS (JOURNAL of INDONESIAN LEGAL STUDIES), 5(2), 479–500.

7) Maudisha. (2022). The Role of Bibliometric Analysis in the Research of Library Science and Universities. Universitas Indonesia.

8) Muralikrishna, I. V., & Manickam, V. (2017). Environmental Accounting. In Environmental Management Science and Engineering for Industry (pp. 113–134).

9) Nur, A. K. M., & Sukoharsono, E. G. (2016). Analysis of Environmental Accounting as a Form of Corporate Social Responsibility in Environmental Management Effort to Reduce Externalities Impact (Case Study In Rumah Sakit Islam Malang-UNISMA). Jurnal Ilmiah Mahasis FEB Universitas Brawijaya, 2(1), 1–19.

10) Pérez-Rodríguez, A. (2021). What does it mean to publish in a scientific journal? Revistacomunicar. https://doi.org/https://doi.org/10.3916/school-of-authors-167

ISSN 1533-9211

DOI 10.17605/OSF.IO/BZF2Y

11) Rostiany, Y., & Tjandra, E. (2022). Analisis Bibliometrik Studi Perkembangan Metode Service Quality pada Database Google Scholar Menggunakan Vosviewer (Studi Literatur Tahun 2016–2020). SMATIKA JURNAL, 12(1), 85–93.

12) Sangadi, P. ibn. (2022). Blibliometric Analysis. Subject Guide UGM.

13) Supriyanto, E. E., Bakti, I. S., & Furqon, M. (2021). The Role Of Big Data In The Implementation Of Distance Learning. PAEDAGORIA Jurnal Kajian Penelitian Dan Pengembangan Kependidikan, 12(1), 61–68.

14) Syafitri, R., Arasuli, & Sembiring, B. (2017). The Students' Ability In Using Conjunctions (A Descriptive Quantitative Study Of The Sixth Semester Studentsof English Study Program Bengkulu University). Journal of English Education and Teaching (JEET), 1(1), 58–64.

15) Taqi, M., Rusydiana Slamet, A., Kustiningsih, N., & Firmansyah, I. (2021). Environmental Accounting: A Scientometric using Biblioshiny. International Journal of Energy Economics and Policy. https://doi.org/https://doi.org/10.32479/ijeep.10986

16) Waltman, N. J. van E. and L. (2022). VOSviewer Manual. Universiteit Leiden.