ASERS

Journal of Environmental Management and Tourism

Quarterly
Volume XIV
Issue 5(69)
Fall 2023
ISSN 2068 – 7729
Journal DOI
https://doi.org/10.14505/jemt

ASERS Publishing

Fall 2023
Volume XIV
Issue 5(69)

ASERS Publishing
http://www.aserspublishing.eu
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt

Table of Contents:

Fall 2023
Volume XIV
Issue 5(69)

ASERS Publishing
http://www.aserspublishing.eu
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt

Call for Papers
Winter Issues 2023
Journal of Environmental Management and Tourism

Journal of Environmental Management and Tourism is an open access, peer-reviewed interdisciplinary research journal, aimed to publish articles and original research papers that contribute to the development of both experimental and theoretical nature in the field of Environmental Management and Tourism Sciences. The Journal publishes original research and seeks to cover a wide range of topics regarding environmental management and engineering, environmental management and health, environmental chemistry, environmental protection technologies (water, air, soil), pollution reduction at source and waste minimization, energy and environment, modelling, simulation and optimization for environmental protection; environmental biotechnology, environmental education and sustainable development, environmental strategies and policies.

Authors are encouraged to submit high quality, original works that discuss the latest developments in environmental management research and application with the certain scope to share experiences and research findings and to stimulate more ideas and useful insights regarding current best-practices and future directions in Environmental Management.

Also, this journal is committed to a broad range of topics regarding Tourism and Travel Management, leisure and recreation studies and the emerging field of event management. It contains both theoretical and applied research papers and encourages obtaining results through collaboration between researchers and those working in the tourism industry.

The journal takes an interdisciplinary approach and includes planning and policy aspects of international, national and regional tourism as well as specific management studies. Case studies are welcomed when the authors indicate the wider applications of their insights or techniques, emphasizing the global perspective of the problem they address.

This issue has a special importance for us, marking a new stage in the history of this journal. So, starting with Issue 5(69), Fall 2023 **Journal of Environmental Management and Tourism** will be published in Open Access system. Journal of Environmental Management and Tourism' articles are published under the Creative Commons Attribution 4.0 International License BB CY, which permits unrestricted use, distribution, and reproduction in any medium, provided the original authors and the source are credited.

Journal of Environmental Management and Tourism is indexed in SCOPUS, RePEc, CEEOL, ProQuest, EBSCO and Cabell Directory databases.

Details regarding the publication in this journal are here: https://journals.aserspublishing.eu/jemt/about

Deadline for submission:	21st October 2023
Expected publication date:	December 2023
Website:	https://journals.aserspublishing.eu/jemt
E-mail:	jemt@aserspublishing.eu

To prepare your paper for submission, please see full author guidelines in the following file:

JEMT_Full_Paper_Template.docx, then send it via email at jemt@aserspublishing.eu.

Journal of Environmental Management and Tourism

DOI: https://doi.org/10.14505/jemt.v14.5(69).05

Forty-Seven Years of Environmental Management Accounting Research: A Bibliometric Analysis

Chetanraj DB
GITAM School of Business Bengaluru, India
ORCID: 0000-0002-3504-4009; Researcher ID: JBJ-4397-2023
chetanrajdb@gmail.com; cdoddaul@gitam.in

Senthil Kumar JP
GITAM School of Business Bengaluru, India
ORCID: 0000-0001-5104-1185; Researcher ID: ADL-9515-2022
sjayapra@gitam.edu

Article info: Received 24 April 2023; Received in revised form 11 May 2023; Accepted for publication 31 July 2023; Published 1 September 2023.

Abstract: Environmental sustainability is considered as responsible engagement with the environment in order to prevent the depletion or degradation of natural resources and ensure long-term environmental quality. Environmental management accounting (EMA) is a tool that aids in enhancing environmental performance and environmental information management. EMA is a growing topic, but there hasn't been a complete analysis to pull everything together and make sense of it all. By adopting bibliometric review, through performance analysis, and science mapping, our research fills in this research gap. Biblioshiny in R and VOS viewer is used for conducting data analysis. Through an extensive study of 1,075 documents, this study discloses the publication and citation trend, top influential authors, journals, publications, and top productive institutions and countries. The study also identifies topic trends through temporal analysis. Different thematic clusters are identified through bibliographic coupling and Co-occurrence of the author's keywords (*i.e.* Social and environmental accounting, Environmental management accounting, Environmental performance, Carbon accounting, Sustainability, and sustainable development, Eco-system services, Environmental disclosure, and corporate social responsibility). Centrality measures are presented to show the impact of the author and keywords. The study concludes with suggestions for future study, and ways forward focusing on Circular economy, green accounting, material flow cost accounting, carbon accounting, sustainability, etc. The study is wholly dependent on the Scopus database, further studies can explore other databases like Web of science, google scholar, and others.

Keywords: environmental management; bibliometric; performance analysis; science mapping; temporal analysis.

JEL Classification: Q56; M41; M49; M10; M19.

Introduction

Humanity needs sustainable development, which has become a growing trend. Enterprises, particularly industrial firms, are indeed faced with the issue of acting in an environmentally sustainable and socially responsible manner while continuing everyday operations and enhancing economic performance (Wang, Ismail, and Abas 2022). Countries all across the world face difficulties related to environmental pollution and climate change. These issues threaten global sustainable development and lower people's quality of life. Therefore, many nations place a premium on green growth and environmental safeguards as they work towards sustainable economic and social progress (Nguyen 2022). Across the globe, in both developed and developing nations, it has been noticed that regulatory policies promoting ecologically friendly economic activity have typically centered on the manufacturing industry's largest companies (Javed *et al.* 2022). There is a need for any application or technique which caters to the need of organizations in both environmental and economic performance.

Management accounting (MA) is a blend of accounting, finance, and management consisting of several cutting-edge procedures that are essential to the efficient operation of a corporation (Collins *et al.* 2011). Since their inception, MAPs have undergone steady improvement to help better firms adapt to the ever-evolving demands of the environment (Scapens 1994). The field of environmental accounting, and environmental

management accounting (EMA) in particular, has received increasing interest in recent years from academics, non-governmental organizations (NGOs), professional accountants, and businesses (Schaltegger, Gibassier and Zvezdov 2013). EMA and other MAP-related advanced accounting techniques have been used as information producers and mediators to provide information for decision-making, planning, and control purposes, all with the end goal of maximizing economic benefits while reducing negative social and environmental impacts (Dasanayaka, Murphy, Nagirikandalage, and Abeykoon 2021). Accordingly, several researchers (López and Hiebl 2015) have asserted that using MAPs is one of the viable approaches for any kind of firm to continually revitalize itself to accomplish sustainability goals in a fast-changing environment.

Much research has been conducted to better our understanding and use of environmental management accounting due to its widespread applicability and significance in advancing the sustainability agenda. Previous research has focused on a narrow subset of EMA rather than the field as a whole. The extant literature is summarizing in Table 1 and 2. In this study, we aim to present an up-to-date overview of Environmental management accounting, considering all relevant elements and publications. As opposed to prior studies, the scope of this study encompasses the entirety of EMA, rather than focusing on a specific facet of the idea.

1. Literature Review

This literature review addresses some of the available previous literature analysis on Environmental management accounting in various databases like Scopus, EBSCO, Emerald, etc. Nine review studies from 2011 to 2021 are examined. There are few studies existing on Environmental management accounting published before 2011. In his research, the author (Schaltegger, Gibassier, and Zvezdov 2013), summarized major review studies on Environmental management accounting published between 1997 and 2011. And literature review of their research states that, although a few writers have carried out several qualitative review studies, there has not yet been a thorough quantitative analysis of EMA.

The study of Debnath, Bose, and Dhalla (2011) put importance on the methodological developments of EMA and reveals a lack of in-depth methodological development on EMA. Yet, there is more scope in the future research perspective to make approaches and processes understandable for decision-makers. Another research by Derchi, Burkert, and Oyon (2013) reveals unstudied areas that require research to complete the body of knowledge and suggests researchers may focus on the idea of environmental performance and the use of various EMA models inside of organizations.

The findings of Guenther, Endrikat, and Guenther (2013) review study suggest integrating Environmental control systems with EMA. (Soderstrom, Soderstrom, and Stewart 2012) His literature review found a significant focus on integrating sustainability with management accounting; most research is case studies and surveys. The analysis of Johnstone (2018) examined how social controls as elements of environmental management control systems have been presented. Another review on EMA (Johnstone 2020), from a management accounting and control perspective, thoroughly examines the motivations, implementation procedures, and performance results of environmental management systems in small to medium-sized firms.

The study (Dasanayaka *et al.* 2021) evaluates the existing literature on the use of management accounting procedures to promote the sustainability of family businesses and suggests potential directions for further research. The recent literature review (Nyakuwanika, van der Poll, and van der Poll 2021) on mining operations have discussed how environmental management accounting practices may be included in a conceptual framework to solve ecological issues. The research of Schaltegger, Gibassier, and Zvezdov (2013) is the only bibliometric analysis among the review publication identified in the present study. Their research revealed tendencies that indicate the EMA has grown as a discipline but still has a ways to go before it is more widely accepted in mainstream accounting and management research. The identified review publications are summarized in Table 1.

Table 1. Extant literature reviews on EMA

Author and Year	Type of paper	Focus	Published journal
Debnath *et al.* 2011	Literature review	Methodological aspects of EMA	International Journal of Business Insights and Transformation
Derchi *et al.* 2013	Literature review	The existing body of knowledge on EMA and to highlight the need for additional study.	Studies in Managerial and Financial Accounting
Stefan Schaltegger *et al.* 2013	Bibliometric analysis	To know whether EMA is developed as a discipline.	Meditari Accountancy Research

Author and Year	Type of paper	Focus	Published journal
Guenther *et al.* 2016	Literature review	How businesses may help our planet by contributing to its needs.	Journal of Cleaner Production
Soderstrom *et al.* 2017	Literature review	Recent EMA publications on corporate responsibility or sustainability in specific journals.	Advances in Management Accounting
Johnstone, 2018	Literature review	Systems of environmental management and control that include social mechanisms	Social and Environmental Accountability Journal
Johnstone, 2020	Literature review	Understanding management accounting controls in SMEs.	Journal of Cleaner Production
Dasanayaka *et al.* 2021	Literature review	Family business management accounting practices	Cleaner Environmental Systems
Nyakuwanika *et al.* 2021	Literature review	Material flow cost accounting, Life cycle costing, and Activity-based costing	Sustainability (Switzerland)

Furthermore, literature studies and bibliometric analysis were identified on EMA, concentrating on one specific EMA tool or technique. The summary of these reviews is presented in the following Table 2.

Table 2. Past reviews on specific EMA tools or techniques

Author and Year	Type of paper	Focus	Published journal
Kristin Stechemesser and Guenther, 2012	Literature review	Carbon Accounting	Journal of Cleaner Production
Stefan Schaltegger and Zvezdov, 2015	Literature review	Material flow cost accounting	Journal of Cleaner Production
Geng *et al.* 2017	Bibliometric analysis	Life cycle assessment	Renewable and Sustainable Energy Reviews
Miah *et al.* 2017	Literature review	Environmental life cycle assessment and life cycle costing	Journal of Cleaner Production
Hasan *et al.* 2019	Literature review	Green business value chain	Sustainable Production and Consumption
Manewa *et al.* 2021	Bibliometric analysis	Life cycle costing in construction	World Construction Symposium
Zheng *et al.* 2022	Bibliometric analysis	Carbon accounting	Environmental Science and Pollution Research
Luo *et al.* 2022	Bibliometric and content analysis	Low-carbon supply chain	Frontiers in Environmental Science
Kurniawan *et al.* 2022	Bibliometric analysis	Carbon accounting	International Journal of Energy Economics and Policy
Yin *et al.* 2022	Bibliometric analysis	Carbon accounting	Urban Climate
Gulotta *et al.* 2022	Literature review	Life cycle costing and life cycle assessment	Environmental Impact Assessment Review
Kokubu *et al.* 2023	Literature review	Material flow cost accounting contribution to SDGs	Journal of material cycles and waste management.

Existing reviews of the extant literature on EMA research reveal diverse perspectives on EMA. Still, their scope is limited, and the significance of the evaluation is qualitative (*e.g.*, systematic literature review and content analysis). This issue can be resolved by using a bibliometric study, which can handle a large corpus and combines quantitative and qualitative techniques to offer a holistic and notified overview of the field (Chandra *et al.* 2022).

In the existing bibliometric analysis, all the publications focused on specific EMA tools or techniques (*e.g.* Carbon accounting, life cycle costing, etc.) except one study concentrating on the broader picture of EMA (Schaltegger, Gibassier, and Zvezdov 2013). It focused only on performance analysis of EMA publications (*e.g.*, Journals with most publications, Authorship, Publications by countries, Most cited publications).

In the absence of an extensive review analyzing EMA in its entirety based on the literature review presented in table 1 and 2. Considering EMA practices plays a crucial role in cleaner production. The following research questions remained unanswered and, as a result, are the primary subject of investigation in this review:

RQ1. What is the publication and citation productivity of Environmental management accounting research?

RQ2. Which are the most productive authors, journals, and publications in environmental management accounting?

RQ3. Which are the most contributing institutions and countries in environmental management accounting?

RQ4. What are the leading topics and themes in environmental management accounting?

RQ5. What are the future research opportunities for environmental management accounting?

Based on the research questions presented, the research objectives and the mode of achieving are presented in the below Table 3.

Table 3. Objectives and analysis methods

Objective	Type of Bibliometric analysis	Unit of analysis	Software used
To analyze the success of environmental management accounting studies in terms of publication and citation.	Performance analysis	No. of documents and citations	Biblioshiny in R
To rank the most productive researchers, journals, and publications in environmental management accounting.	Performance analysis, Co-authorship with centrality measures	Authors, Journals and Documents	Biblioshiny in R and VOS Viewer
To identify the top contributing institutions and countries in environmental management accounting.	Performance analysis, Country collaboration	Institutions, Countries	Biblioshiny in R and VOS Viewer
To examine the fundamental themes raised by the literature on environmental management accounting.	Science mapping (Temporal analysis, Keyword Co-occurrence, Bibliographic coupling)	Author keywords, Documents	Biblioshiny in R and VOS Viewer
To suggest avenues for further study in the field of environmental management accounting.	Science mapping (Thematic strategic diagram)	Author keywords	Biblioshiny in R

The present study contributes in a variety of practical ways. As a first step, both novice and seasoned researchers in EMA can get a bird's eye view of the subject's current and historical publishing trends. Second, aspiring writers can track relevant sources (articles, journals) and possible collaborations (authors, institutions, countries). Third, this overview's uncovered themes and subjects might help aspiring authors set themselves apart from the current EMA research landscape by highlighting the uniqueness of their contributions. Finally, this curated list of study areas provides potential authors with a starting point for doing original and fruitful research in the field of EMA.

The remaining parts of the research are structured as follows. The section 2 describes the conceptual background of EMA. Followed by methodology of the study in the section 3. The detailed data analysis containing performance analysis in section 4 and science mapping in section 5. Way forward of EMA research is presented in section 6 through strategic diagram. Finally, research presents conclusion and limitations in section 7.

2. Conceptual Background

EMA is defined as "the creation, analysis, and utilisation of financial and non-financial information to enhance corporate environmental and economic performance and achieve sustainable business" (Johnstone 2018).

On an institutional level, for instance, the United Nations Division of Sustainable Development has encouraged EMA systems by furnishing government agencies, industry executives, accounting professionals, and others with specific application guidelines and frameworks (UNDSD 2001). This research (Gurarda 2014; UNDSD 2001) defines EMA as the design and implementation of accounting systems that identify and measure the whole range of physical and monetary, environment-related information to assist day-to-day business

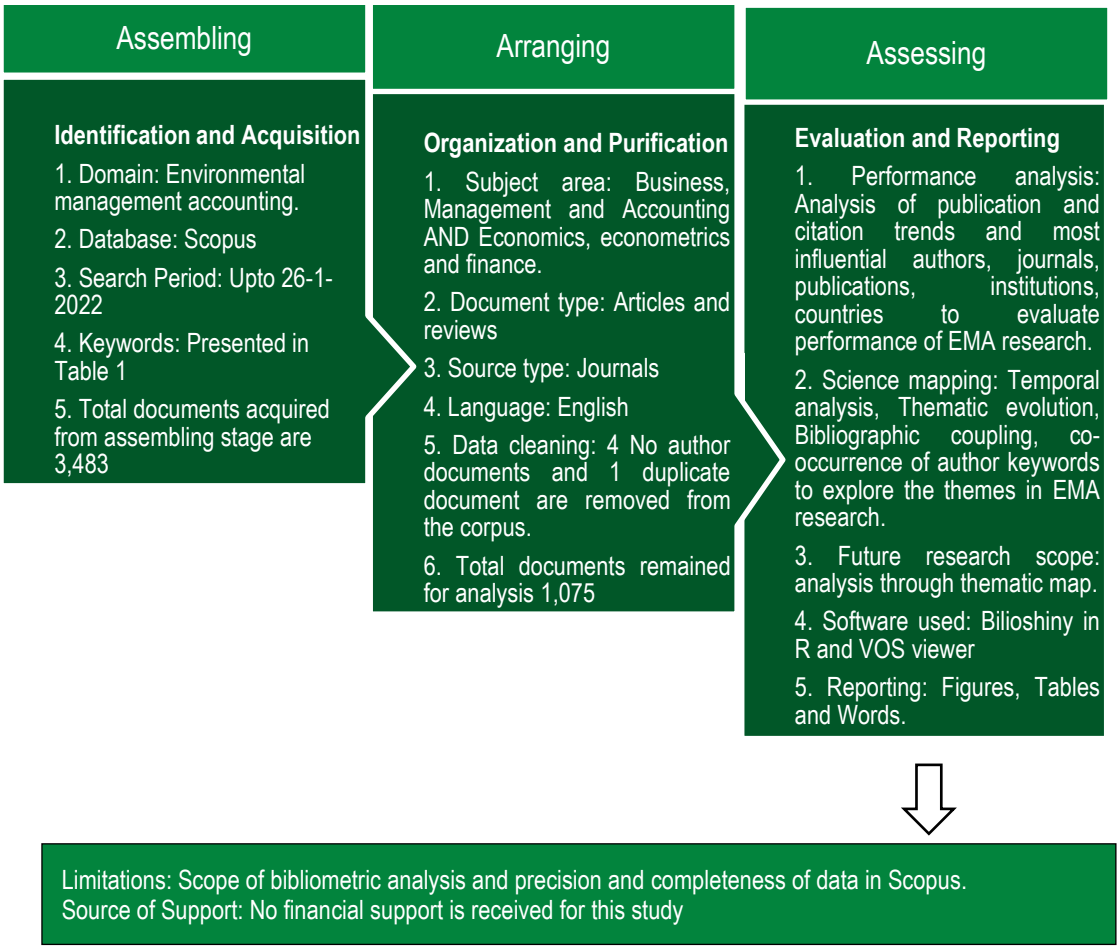
choices. The 'EMA' assists company managers in making capital budgeting decisions, costing judgments, process/product design approach, performance evaluations, and a variety of other future-oriented business decisions. Consequently, EMA serves an internal company role and is not a tool for reporting environmental expenses to external stakeholders. It is not constrained by rigorous rules, unlike financial accounting, and allows for consideration of the company's unique situations and requirements (UNDSD 2001).

If the corporate strategy for environmental sustainability is valid, organisations will be more inclined to create EMA systems to quantify the costs and benefits of proactive green management to support day-to-day business choices (Derchi, Burkert, and Oyon 2013). It makes reasonable that other countries and organisations would adapt EMA's general concepts, terminology, and methods to their own objectives. Due to the fact that EMA is a relatively developing field in comparison to traditional management accounting, experimentation and variety are also to be anticipated.

3. Methodology

This research uses a bibliometric method to examine the literature on Environmental management accounting. The bibliometric method is a quantitative way of assessing the efficacy and credibility of published works on a specific topic (Donthu *et al.* 2021). When compared to subjective methods (such as qualitative thematic analysis), this one stands out as the most objective (Donthu *et al.* 2021). Bibliometric reviews, a subset of systematic literature reviews, are held to the same standard and must establish, implement, and report on a comprehensive and open review process (Paul *et al.* 2021). In this respect, the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) protocol directs the choices and actions in data collecting, filtering, and analytic technique (Paul *et al.* 2021). Figure 1 summarises the SPAR4SLR protocol's three key stages: assembly, arrangement, and evaluation; these processes are further explained below.

Figure 1. Bibliometric review process adopted in the present study using SPAR-4-SLR protocol.



3.1 Assembling

In this section, you will read about the procedure followed to locate and acquire the necessary papers for evaluation.

The extant literature for review are identified in the Environmental management accounting domain published in journals and indexed in Scopus. The concentration on material published in journals is justifiable since they often undergo a higher level of peer-review scrutiny than alternative sources including books, book chapters, and conference proceedings. The use of Scopus is strategic because Scopus journals have met strict indexation standards (Paul *et al.* 2021). Scopus covers a lot of scientific papers and makes it easy to obtain and study bibliometric data and full texts (Donthu *et al.* 2021).

The bibliometric information of the publications are retrieved from scopus by using the keywords selected from the previous literature study (Schaltegger, Gibassier and Zvezdov 2013). The keywords are presented in Table 4. In total 3,483 documents are obtained from the assembling stage.

Table 4. Keywords used for the search of EMA publications

Keywords
Carbon Accounting
Environmental accounting
Environmental management accounting
Environmental management accounting practices
Ecological accounting
Green accounting
Material flow cost accounting
Total cost assessment
Water management accounting
Environmental life cycle costing

3.2 Arranging

In the arranging stage, organization and data cleaning of documents for review is conducted. The organization of documents relied on the refine results option available in the Scopus (*e.g.* Language, document type, source type and subject area). The first filter used to refine the results is subject area, Business, management and accounting and Economics, econometrics and finance. 1,394 documents are retrieved from this filter. Whereas, in the opinion of the writers, other academic fields are not included since they are not relevant to EMA research. Document type are limited to articles and review and retrieved 1,139 documents. Since editorials and notes are not subject to rigorous peer review they were left out (Chandra *et al.* 2022). Only journals are included in the source type and retrieved 1,113 documents. The documents were restricted English language and retrieved 1,080 documents. The inadequate quality of peer review was also a factor in the decision to exclude non-journal documents, conference papers (Chandra *et al.* 2022). In the data cleaning process four documents are removed because of insufficient author information and one duplicate document is removed. In total, 1,075 documents are finalized for the review. Figure 2 represents the search string of the final review documents.

Figure 2. Search string of documents retrieved for Bibliometric analysis

TITLE-ABS-KEY ("carbon accounting" OR "environmental accounting" OR "environmental management accounting" OR "environmental management accounting practices" OR "ecological accounting" OR "green accounting" OR "material flow cost accounting" OR "total cost assessment" OR "water management accounting" OR "environmental life cycle costing") AND (LIMIT-TO (SUBJAREA , "busi") OR LIMIT-TO (SUBJAREA , "econ")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "english"))

3.3 Assessing

In the assessing stage, documents retrieved are analysed and reported. In order to evaluate the 1075 documents on EMA that were kept for examination, this study used a variety of bibliometric analysis techniques. The performance analysis used in this study is specifically used to define the metrics describing publication and citation trends (RQ1), as well as the most influential authors, journals, and publications (RQ2) in EMA research and the most productive institutions and countries (RQ3). In addition, Science mapping analysis is undertaken in this paper. A bibliographic coupling, which groups papers with comparable references (Donthu *et al.* 2021) (RQ4). Temporal analysis of the documents is conducted to identify the themes in different time periods (Kumar *et al.* 2022). The fundamental themes characterising the underlying logic of EMA research were decomposed using co-word analysis, which clusters documents based on the co-occurrence of author's keywords (RQ4). Different centrality measures (network metrics) (Donthu *et al.* 2021) are used and interpreted to enhance the information of co-occurrence results. Importantly, network measures are frequently used to expand upon the discussion of study domains in bibliometric studies, and as such, they constitute a valid way for enhancing bibliometric evaluations (Kumar *et al.* 2022). The future research directions are analysed through thematic map (RQ5). The analysis is conducted using Biblioshiny in R and VOS Viewer software (Donthu *et al.* 2021).

This study uses a mix of tables, figures, and text to convey the results of the bibliometric studies conducted using Biblioshiny and VOS viewer. At the end of this paper, I discuss the review's limitations and make suggestions for future studies in the field of Environmental management accounting.

4. Performance of EMA Research

4.1 Publication and Citation Trend of EMA Research

The overview of performance for EMA research is presented in Table 5. Data from the table shows that there have been a total of 1075 publications (TP) on EMA, spread throughout 255 sources; of them, 1014 are articles (both conceptual and empirical) and 61 are reviews (*e.g.* Systematic literature review, bibliometric review, and meta-analysis). 967 articles (89.53% of the total) from EMA research have been cited by other researchers. Although the area was launched in 1976, it did not see its first publication until 1989, making its whole lifespan as a research field 34 years. Annual production is 10.25%. There are a total of 55822 references in the published literature. In terms of citation counts, EMA studies have amassed 41,240 in total (TC). An average of 38.36 citations per paper has been found. In terms of metrics for co-authorship, there are a total of 2118 authors involved, 216 of them are sole authors. Publications feature, on average, 2.64 authors. There are a total of 2,393 author keywords on file.

Table 5. Publication, Citation and Co-authorship Metrics

	Statistic
Publication Metrics	
Total Publications (TP)	1075
Total cited Publications (TCP)	967
Article	1013
Review	62
Number of Active Years (NAY)	34
Productivity per active year (PAY)	10.25%
Total References	55822
Citation metrics	
Total citations (TC)	41,240
Average citations per publication (TC/TP)	38.36
Coauthorship metrics	
Number of contributing authors (NCA)	2118
Authors of single-authored publications (ASA)	216
Co-Authors per Document	2.64
Author keywords	2393

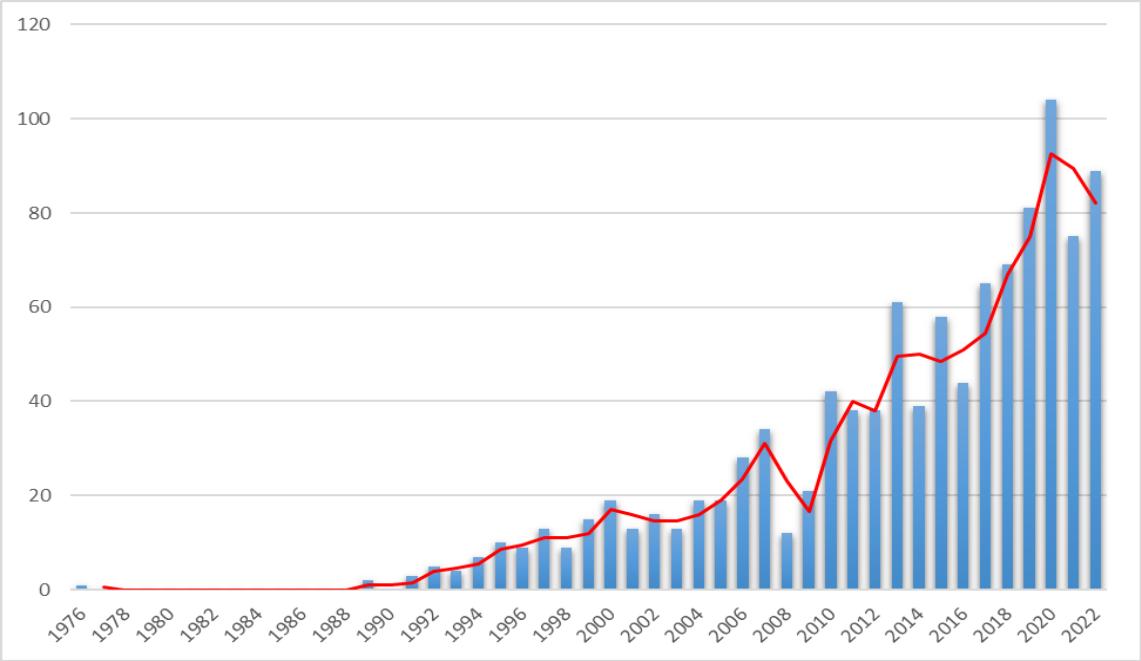
Table 6 shows the general upward trajectory of EMA research publications. The table shows that while the first publication on EMA emerged in 1976 (*i.e.*, one document), academic interest in the topic did not start up until 1989, growing significantly from 2 papers in 1989 to 104 and 89 documents in 2020 and 2022. A rising tendency can also be seen in the overall number of articles that are cited each year. Additionally, the overall number of citations has climbed from 43 in 1976 to 2789 in 2002, 4242 in 2007, 3457 in 2010, 2220 in 2013, and 2041 in 2018. The years 2002 (174.31), 2003 (102.23), and 2007 saw the highest average number of citations per document (124.76). The most significant number of citations was in 2007, however there is declining trend in citations till 2022. Since citations are time dependent, the fact that older publications often contain more citations than younger publications helps to explain the current trend of declining average citation counts (Chandra *et al.* 2022). The increasing number of publications in the EMA field indicates the sustained interest of academics and publishers in this area. The publication trend with moving average line is shown in figure 3.

Table 6. Publication and Citation trends

Year	TP	Avg. Citation Per article	TC	TCP
1976	1	43.00	43	1
1977 to 1988	0	0.00	0	0
1989	2	17.50	35	2
1990	0	0.00	0	0
1991	3	9.67	29	3
1992	5	35.60	178	4
1993	4	4.75	19	3
1994	7	68.86	482	7
1995	10	38.20	382	9
1996	9	49.22	443	9
1997	13	71.23	926	12
1998	9	13.89	125	8
1999	15	29.60	444	14
2000	19	35.89	682	19
2001	13	47.46	617	11
2002	16	174.31	2789	16
2003	13	102.23	1329	13
2004	19	94.74	1800	19
2005	19	89.95	1709	19
2006	28	72.32	2025	27
2007	34	124.76	4242	33
2008	12	73.17	878	12
2009	21	66.43	1395	20
2010	42	82.31	3457	41
2011	38	43.37	1648	34

Year	TP	Avg. Citation Per article	TC	TCP
2012	38	52.13	1981	34
2013	61	36.39	2220	59
2014	39	33.85	1320	38
2015	58	37.47	2173	56
2016	44	27.80	1223	43
2017	65	24.20	1573	61
2018	69	29.58	2041	67
2019	81	17.31	1402	79
2020	104	10.10	1050	97
2021	75	5.72	429	58
2022	89	1.70	151	39

Figure 3. Publication trend of EMA research



4.2 Most Influential Authors for EMA Research

The top twenty influential authors based on h-index for EMA research are presented in Table 7. From the data in the table, we can deduce that Burritt RL is the most cited author, having produced 18 works and receiving 1,241 citations (an h-index of 13 and a g-index of 18). It wasn't until 1995 that the author began publishing. One of his co-authored publication Environmental management accounting: the significance of contingent variables for adoption is one of the most influential publications published in 2013. With 11 papers to his name that have been cited 518 times and an h-index of 10 and a g-index of 11, Almeida CMVB has quickly risen to second place on the list of most prolific authors working in his field since 2006. At number three, Bebbington J. and Giannetti BF have produced 13 works with an 10 h-index, and 13 g-index. In contrast to Giannetti BF's 522 citations, Bebbington J's work has been cited 1,683 times. With ten works each, Brown J. and Patten DM. tie for fourth place. They share the same g-index of 10 and h-index of 9 respectively. In contrast to Brown J (1,148), Patten DM (1,547) has more citations. Followed by Schaltegger S and Cairns RD, who both have 9 publications but only 768 and 120 citations, respectively. Overall, Schaltegger S has been cited more times than Cairns RD, making him the more influential of the two. The h-index and the G-index are additional proofs of this. At number ten on the list, we find the writer

Gray R., who has produced 12 articles more than Almeida but whose h-index is only 9 and whose total citations amount to 1,290. Based on the total citaions the top influential author is Bebbington J, who started publishing from the year 1994.

Table 7. Most influential authors based on h-index

Authors	Articles (TP)	TC	h_index	g_index	PY_start
BURRITT RL	18	1241	13	18	1995
ALMEIDA CMVB	11	518	10	11	2006
BEBBINGTON J	13	1683	10	13	1994
GIANNETTI BF	13	522	10	13	2006
BROWN J	10	1148	9	10	2006
PATTEN DM	10	1547	9	10	2007
SCHALTEGGER S	9	768	9	9	2010
CAIRNS RD	9	120	8	9	2000
CHRIST KL	8	323	8	8	2013
GRAY R	12	1290	8	12	1994
LEHMAN G	9	450	8	9	1995
THOMSON I	10	629	8	10	1994
CHO CH	9	1409	7	9	2007
DILLARD J	8	555	7	8	2012
WANG X	8	123	7	8	2014
ROBERTS RW	6	607	6	6	2010
ULGIATI S	6	529	6	6	2002
BONILLA SH	5	256	5	5	2010
FREEDMAN M	5	486	5	5	2005
GUENTHER E	5	317	5	5	2012

This review does not just focus on the most influential researchers in the field; it also analyses the authors' co-authorship to see how often and with whom they collaborate Collaborations, according to previous study, are a great way to share expertise and produce ground-breaking new findings; also, the synergy that develops among researchers working together increases the prospect of having their work published in prestigious academic publications (Khanra *et al.* 2021). Networks of authors working together on at least three documents each were created using the VOS Viewer programme. Minimum 3 documents per author was the criteria fixed. Only 140 out of 2118 authors were chosen. There were gaps in the connections between some of the network's 140 authors. 66 authors form the largest possible network of authors that have worked together. The co-authorship or collaboration network of EMA researchers is depicted in Figure 4.

Ten groups of authors worked together frequently, according to the examination of their collaboration. Ten authors, including Burritt RL, Lehman G, Schaltegger S, Christ KL, Burritt R, Qian W, and others, make up the first important cluster (shown in red in fig 3). Brown J, Cho C.H, Dillard J, Roberts RW, Patten DM, Michelon G, and others constitute the second important cluster (shown in green in fig. 3). Ulgiati S, Geng Y, Wang Y, Brown MT, Chen X, Liu J, and others compensate the next major cluster (shown in blue in fig. 3). Larrinaga C, Correa C, Moneva JM, Scarpellini S, Garcia-toria N, Portillo-Tarragona P, and Aranda Uson A make up one group of seven authors (shown in yellow in fig. 3).

Figure 4. Co-Authorship network of authors of EMA research

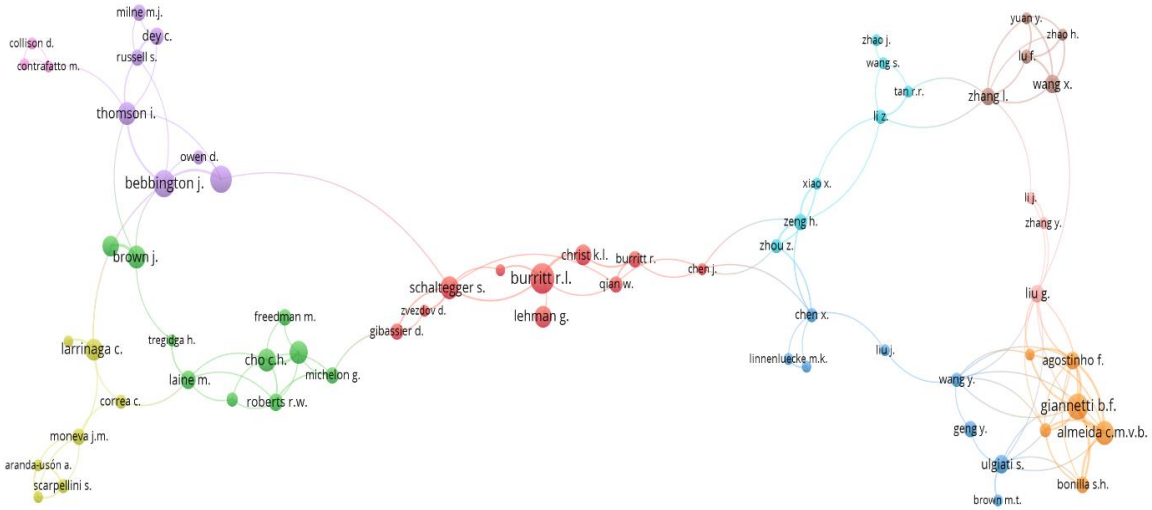


Table 8. Top influential authors based on centrality measures from different clusters

Author	Cluster	BC	CC	PR
Burritt RL		42.56	0.01250	0.04161
Schaltegger S		206.00	0.01538	0.02813
Gibassier D	1	114.00	0.01299	0.01555
Qian W		78.33	0.01282	0.02500
Chen J		46.00	0.01042	0.02343
Brown J		24.00	0.00990	0.02988
Cho CH		20.00	0.00917	0.04291
Patten DM	2	10.83	0.00909	0.03432
Roberts RW		14.17	0.00909	0.02718
Michelon G		100.00	0.01099	0.02306
Ulgiati S	3	7.17	0.09091	0.01790
Liu G		12.00	0.09091	0.01943
Larrinaga C	4	24.00	0.00971	0.01813
Bebbington J		95.41	0.01235	0.04527
Gray R		144.00	0.01408	0.02506
Thomson I	5	43.09	0.01220	0.03220
Dey C		3.26	0.00971	0.02298
Russell S		21.24	0.01000	0.03051
Wang X	8	7.00	0.06250	0.01761

BC=Betweenness centrality, CC=Closeness centrality, PR=Pagerank

Seven authors - Gray R, Bebbington J, Thomson I, Owen D, Russell S, Dey C, and Milne MJ - make up the fifth cluster (shown in purple in fig 3). Seven writers, including Zeng H, Wang S, Zhao J, Tan R R, Li Z, Xiao X, and Zhou Z, constitute the sixth cluster (shown in light blue in fig. 3). More nodes are concentrated in the seventh cluster, but just six authors (Giannetti BF, Almeida CMVB, Bonilla SH, Agostinho F, Huisingh d, and Sevegnani F) are represented. Three other groups of authors consist of 5, 3, and 3 writers, respectively. The most influential authors from the co-authorship analysis with different centrality measures are presented in Table 8.

More authors, including Schaltegger S (206), Gray R (144), Gibassier D (114), and Michelon G (100), have a high betweenness centrality. Then came Bebbington (95.41), Qian (78.33), Chen (46.00), Thomson (43.19), Burritt RL (42.56), and others. Who has the greater ability to create a link between the disconnected nodes (*i.e.* authors). The closeness centrality for the author Ulgiati S (0.09091), Liu G (0.09091), Wang X (0.06250), Schaltegger S (0.01538), Gibassier D(0.01299), and Qian W(0.01282) are greater than other authors in the network. These authors have strong ties to the network of co-authors. Authors Bebbington J (0.04527), Cho CH (0.4291), Burritt RL (0.04161), Patten DM (0.03432), Russell S (0.03051), and others in the table are deemed to be the most influential and prominent authors based on their page rank from the co-authorship network analysis.

In terms of citations, h-index, Clusters, Betweenness centrality, closeness centrality, and page rank, Burritt RL, Schaltegger S, Gray R, Bebbington J, and Patten DM are the most frequently cited authors. It is reasonable to call these writers the "leading lights" of EMA study.

4.3 Most Influential Journals for EMA Research

The most influential journals for EMA research in terms of productivity is presented in table 9. Based on the data in the table, the *Journal of cleaner production* is the most productive journal in the EMA research domain, having published 158 documents with the greatest h-index (46) and g-index (72) among EMA journals. The next most prolific journal is *Accounting, Auditing, and Accountability journal* (71 total articles, 44 h-index, 71 g-index). But, this publication is classified A* in ABDC and has more citations (6,993) than the Journal of cleaner production (6694). The *Social and Environmental Accountability Journal* is B-ranked in ABDC and has an h-index of 12 and a g-index of 23 from its 67 published journals. *Ecological economics* (60) and *Critical perspectives on accounting* (41) are the next most productive journals ranked A by ABDC. In addition, the table includes three A* journals that were placed lower in the ranking due to low output. *Journal of Environmental Economics and Management* (7), *Accounting, Organizations and Society* (12), and the *British Accounting Review (9)*. The other A ranked journals in the list are *Business strategy and the environment* (23), *Environmental and resource economics* (17), *Journal of business ethics* (12), and *Accounting education* (9). In addition to the aforementioned publications, the table also highlights six B-ranked publications, one C-ranked publication, and two that are not included in ABDC.

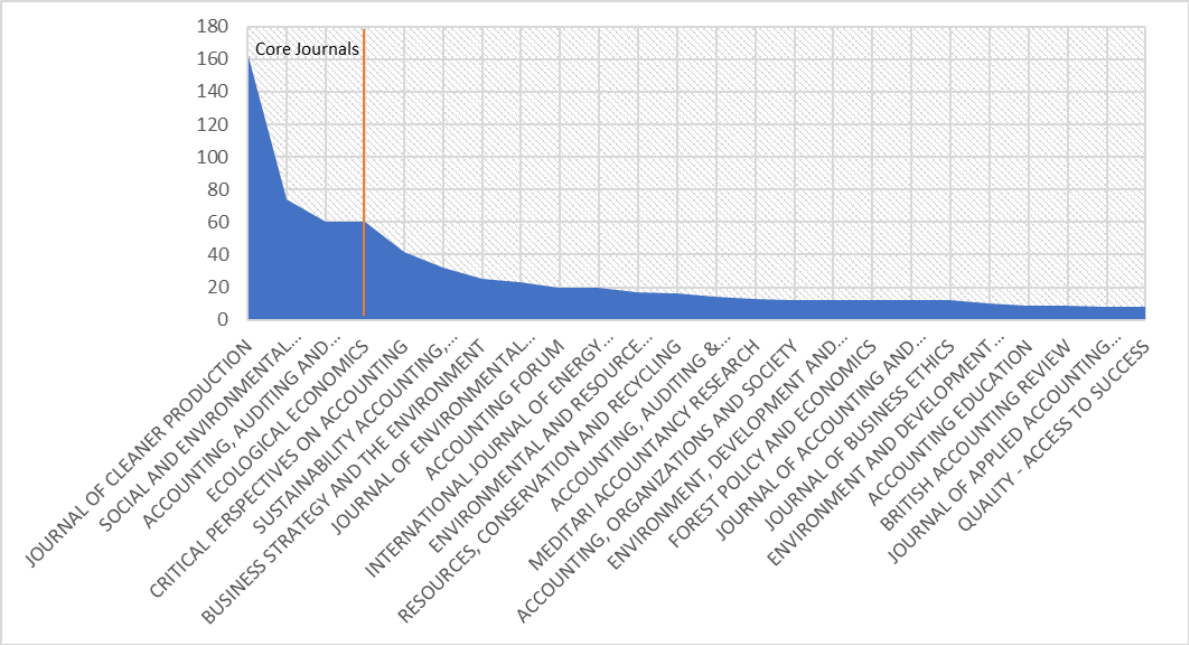
Table 9. Top 20 Journals based on Productivity

Sources	Articles (TP)	TC	ABDC Rank	h_index	g_index
Journal of Cleaner Production	158	6694	A	46	72
Accounting, Auditing and Accountability Journal	71	6993	A*	44	71
Social And Environmental Accountability Journal	67	718	B	12	23
Ecological Economics	60	3872	A	29	60
Critical Perspectives on Accounting	41	2655	A	28	41
Sustainability Accounting, Management and Policy Journal	30	559	B	14	23
Business Strategy and The Environment	23	1444	A	17	23
Accounting Forum	19	1113	B	13	19
Journal of Environmental Accounting and Management	18	190	Not Found	7	13
Environmental and Resource Economics	17	405	A	11	17
International Journal of Energy Economics and Policy	15	176	C	7	13

Sources	Articles (TP)	TC	ABDC Rank	h_index	g_index
Resources, Conservation and Recycling	13	478	Not Found	10	13
Accounting, Organizations and Society	12	2953	A*	12	12
Journal of Business Ethics	12	1450	A	9	12
Journal of Accounting and Organizational Change	11	250	B	9	11
Forest Policy and Economics	11	180	B	7	11
Environment and Development Economics	10	294	B	9	10
Accounting Education	9	277	A	8	9
British Accounting Review	9	455	A*	7	9
Journal of Environmental Economics and Management	7	425	A*	7	7

According to Bradford's Law, the simple geometric series 1:ns:n2s:n3s is formed by successive zones of journals holding the same number of articles on the subject, if the journals are placed in descending order of the number of articles they contained on the subject. Bradford identified a distinct area, the "first zone," where a cluster of publications focused solely on the topic existed. Figure 5 represents journals based on Bradford's law.

Figure 5. Core Journals based on Bradford's law



The zone one journals based on Bradford's law are Journal of cleaner production, Social and Environmental accountability journal, Accounting, Auditing and Accountability journal, and Ecological economics.

4.4 Most Influential Publications on EMA

Table 10 displays the top cited works on EMA according to Global citations. According to the table, Criagn Deegan's (2002) article on the theoretical foundations of legitimising effect of social and environmental disclosures has received the most citations worldwide, with a grand total of 1697; this is followed by the articles by James *et al.* (2007), which discuss eco systems and the need for standardised environmental accounting systems, and by Charles *et al.* (2007), which discuss environmental disclosures with a total of 1350 and 959 citations, respectively. The article by William (2003) entitled "Social accountability and corporate greenwashing" was cited 636 times, placing it in the top five most cited articles of all time. Compared to William's work, which has an average citation rate of 31.80, the article by Robgray (2010) on sustainability accounting, organization's

narratives investigation has been cited 631 times around the world with average citation per year of 48.54. Among these works, the most recent article Ralf Buckley's (2012) paper on sustainable tourism published in the journal Annals of tourist research has received the most citations (558) and the highest average citations per year (50.73). The credibility of environmental disclosures is the subject of the top first and third most-cited publications. Environmental and social responsibility are the topics of the fourth and eighth publications.

Table 10. Top influential publications based on Global citations

Title	Authors	Journal	TC	TC per Year
Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation	Deegan 2002	Accounting, Auditing and Accountability Journal	1697	80.81
What are ecosystem services? The need for standardized environmental accounting units☆	Boyd and Banzhaf 2007	Ecological Economics	1350	84.38
The role of environmental disclosures as tools of legitimacy: A research note	Cho and Patten 2007	Accounting, Organizations and Society	959	59.94
Social Accountability and Corporate Greenwashing	Laufer 2003	Journal of Business Ethics	636	31.8
Is accounting for sustainability actually accounting for sustainability…and how would we know? An exploration of narratives of organisations and the planet	Gray 2010	Accounting, Organizations and Society	631	48.54
Using content analysis as a research method to inquire into intellectual capital reporting	Guthrie, Petty, Yongvanich, and Ricceri 2004	Journal of Intellectual Capital	624	32.84
Sustainable tourism: Research and reality	Buckley 2012	Annals of Tourism Research	558	50.73
Social and environmental accountability research: A view from the commentary box	Parker 2005	Accounting, Auditing and Accountability Journal	454	25.22
Corporate Responses in an Emerging Climate Regime: The Institutionalization and Commensuration of Carbon Disclosure	Kolk, Levy, and Pinkse 2008	European Accounting Review	428	28.53
Twenty-five years of social and environmental accounting research: Is there a silver jubilee to celebrate?	Mathews 1997	Accounting, Auditing and Accountability Journal	400	15.38

4.5 Most Prolific Institutions

In table 11 we see the most prominent centres for EMA study. According to the data, Macquarie University in Sydney, Australia, has produced more research than any other institution. The University of South Australia came in second, with 28 publications published. On top of that, New Zealand's Victoria University of Wellington produced 24 articles. The University of St. Andrews in Scotland is ranked 4th among top universities for the number of articles it has produced (21 total). Furthermore, the fifth-ranked Parthenope University of Naples, Italy, and the sixth-ranked Universidade Paulista, Brazil, both produced 20 papers apiece. There are four Australian institutions and four Chinese institutions among the top 20. There are two major contributors to the number of papers in EMA research from the countries of New Zealand, Italy, Brazil, Scotland, and Spain. There are 15 publications from the institutions not reported.

Table 11. Top 20 Institutions for EMA Research

Institutions	Country	TP
Macquarie University	Australia	29
University of South Australia	Australia	28

Victoria University of Wellington	New Zealand	24
University of St Andrews	Scotland	21
Parthenope University of Naples	Italy	20
Universidade Paulista	Brazil	20
Beijing Normal University	China	19
University of Turin	Italy	19
Chinese Academy of Sciences	China	18
Rmit University	Australia	17
Shanghai Jiao Tong University	China	17
Central South University	China	15
Notreported		15
University of Zaragoza	Spain	15
Paulista University	Brazil	14
Universidad de Burgos	Spain	13
University of Bologna	Italy	13
University of Dundee	Scotland	13
Griffith University	Australia	12
University of Canterbury	New Zealand	12

4.6 Most Prolific Countries

The top contributing countries for EMA research are presented in the table 12. The table indicates that most prolific country is Australia with 298 documents, followed by United Kingdom, USA and China with 281, 263, and 244 articles respectively. With 6,642 and 6,698 citations, respectively, Australia and the United Kingdom emerge as the top two influential countries, and the United States follows closely behind as the third most influential country with 5,662 citations. However, with an average of 141.50 citations per publication, for 38 articles Netherlands contribution to the area had the highest average citation impact. Several nations have made substantial contributions to the EMA research field, including Italy (194), Spain (112), Germany (101) and Malasyia (100). New Zealand has been cited 2,557 times while contributing little articles. South Africa and India, which respectively contributed 60 and 59 publications, have received fewer citations.

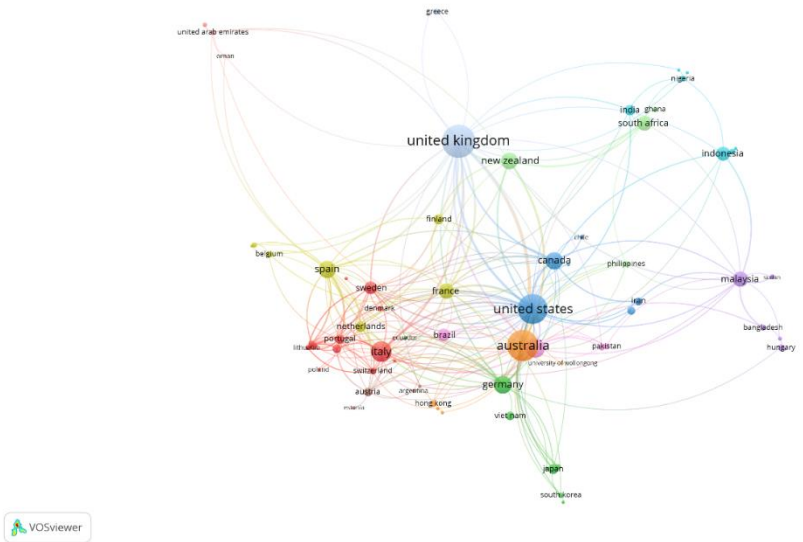
Table 12. Top countries contributing for EMA research

Countries	TP	TC	Avg. Article citation
Australia	298	6642	56.77
United Kingdom	281	6698	59.27
Usa	263	5662	60.23
China	244	1258	23.30
Italy	194	1566	28.47
Spain	112	1061	42.44
Germany	101	1424	44.50

Countries	TP	TC	Avg. Article citation
Malaysia	100	286	13.00
Indonesia	98	448	24.89
Brazil	91	879	35.16
Canada	79	1775	63.39
New Zealand	68	2557	88.17
France	62	506	28.11
South Africa	60	251	10.04
India	59	189	14.54
Finland	42	439	29.27
Sweden	41	393	20.68
Netherlands	38	1698	141.50
Portugal	36	410	31.54
Japan	29	276	21.23
Austria	23	312	52.00

This review does more than just rank the countries that produce the most research in a given field; it also conducts a co-authorship analysis of countries to highlight the nature and depth of collaboration between nations. Out of 102 nations included in the corpus, only 74 are connected when using the VOS Viewer programme to depict a collaboration network of leading countries with the parameter of one document published per country. This analysis identified a total of 12 groups of networks. Figure 6 shows that the United Kingdom has the most partnerships, as indicated by the largest node size, with countries like the United States, China, Australia, Germany, Italy, Spain, and Malaysia, and fewer partnerships with countries like Greece, the United Arab Emirates, Nigeria, Austria, Ireland, and others.

Figure 6. Co-Authorship collaboration network of countries



Australia comes in second with its extensive network of international partnerships that includes countries such as Italy, Spain, the Netherlands, Indonesia, the United Kingdom, New Zealand, Germany, Japan, and many more. The United States has a network of its own and is the world's second largest collaborator with the United

Kingdom, Australia, Italy, Sweden, France, Brazil, India, South Africa, and other countries. With the United Kingdom, the United States, and Australia as its primary network partners, Germany is well connected. In addition to these countries, Germany has ties to Japan, Italy, the Netherlands, Portugal, Canada, France, and the Philippines. In addition, Italy is linked to every major network partner. India's international network of partners in this area is extremely limited; the country has only worked with the United Kingdom, United States, South Africa, Sweden, and Nigeria. Many nations work closely together, including Malaysia, China, Canada, Italy, Indonesia, France, Spain, and South Africa.

5. Science Mapping of EMA Research

5.1 Temporal analysis

Articles covering EMA studies were divided into four-time intervals: 1976–1995, 1996–2005, 2006–2015, and 2016–2022. Word clouds in Figures 7, 8, 9, and 10 show the most important subjects throughout the different time periods that were uncovered by the chronological analysis. Tables 13, 14, 15 and 16 provide a summary of EMA research conducted during each time period.

Only 32 documents by 42 writers appeared between 1976 and 1995. Because there weren't enough author keywords for the analysis, titles were substituted in the word cloud field for the year 1976-1995. For this reason, the terms "sustainable development" (Steer and Lutz 1993) and "accounting issues" (Vanoli 1995) are more common than "environmental accounting" in the context of EMA studies. Every other word in the cloud is given the same importance. See Table 13 for a summary and see Figure 6 for a visualisation of the word cloud from 1976–1995.

Figure 7. EMA between 1976 to 1995

Table 13. EMA research overview 1976 to 1995

Time Span	1976:1995
Sources	19
Total Documents	32
Articles	29
Review	3
Annual growth rate %	12.88
Average Citation per doc	36.5
References	1008
Authors	47
Author's Keywords	2
Single authored docs	18
Co-authors per doc	1.72

Continued expansion of the term "sustainability" (Milne 1996) is shown from 1996 to 2005 in Figure 8. Research in the area of "social accounting" (Cooper, Taylor, Smith, and Catchpowle 2005) is accorded the same level of importance. The emphasis here is on "green accounting," (Jahamani 2003) which has considerable bearing on the matter. The fields of "disclosure," "environmental audit," "depletion," "forests," "material flow analysis," "national accounts," "national resources," and "social and environmental accounting" are among the new research areas investigated. There was a total of 145 publications, 124 articles and 21 reviews. There are now 197 people involved in EMA studies, and on average, each paper has 1.67 authors. Table 14 represents EMA research overview between 1996 to 2005.

Figure 8. EMA research between 1996 to 2005

Table 14. EMA research between 1996 to 2005

Time Span	1996:2005
Sources	59
Total Documents	145
Articles	124
Review	21
Annual growth rate %	8.66
Average Citation per doc	74.92
References	5135
Authors	197
Author's Keywords	263
Single authored docs	82
Co-authors per doc	1.67

Figure 9 depicts the sustained expansion of the term "sustainability" (Stasiškienė and Šliogerienė 2009) from 2006-2015, including the notable multiplication of research on topics like "green accounting," (Gray and Laughlin 2012) "social accounting" (Fraser 2012) "social and environmental accounting," and "sustainable development" that began in the previous decade. During this time, studies on "carbon accounting" (Ascui 2014) began to receive increased attention. Climate change, materials flow cost accounting, CSR, ecosystem services, environmental costs, management accounting, environmental reporting, sustainability accounting, cleaner production, financial reporting, legitimacy theory, carbon sequestration, and many more are among the emerging topics of study. There were 371 works published throughout this time, including 354 articles and 16 review papers. The number of authors who have made significant contributions has risen dramatically, up to 695. There

was a rise to an average of 2.37 authors per paper. Table 15 represents EMA research overview between 2006 to 2015.

Figure 9. EMA research between 2006 to 2015

Table 15. EMA research overview 2006 to 2015

Time Span	2006:2015
Sources	110
Total Documents	371
Articles	355
Review	16
Annual growth rate %	8.43
Average Citation per doc	57.52
References	18570
Authors	695
Author's Keywords	967
Single authored docs	95
Co-authors per doc	2.37

Figure 10. EMA research between 2016 to 2022

Figure 10 shows that with the launch of SDGs in 2015, "carbon accounting," "sustainability," "green accounting," "environmental performance," (Appiah *et al.* 2020) "sustainable development," "climate change," (Wu and Han

2020) "life cycle assessment," (De Menna *et al.* 2020) and "material flow cost accounting" (Sahu *et al.* 2021) all became major topics of discussion. Notable studies conducted and presented by EMA researchers over the past seven years include those on "ecosystem services," "sustainability accounting," "the circular economy," "corporate governance," "carbon footprint," "ecological accounting," "integrated reporting," "contingency theory," "carbon performance," "environmental costs," and "financial performance," among many others. A total of 527 works were published during this time, comprising 505 original works and 22 reviews. There are now 1335 authors' total. Overall, there are now 3.14 authors on average per paper. Table 16 represents EMA research overview between 2016 to 2022.

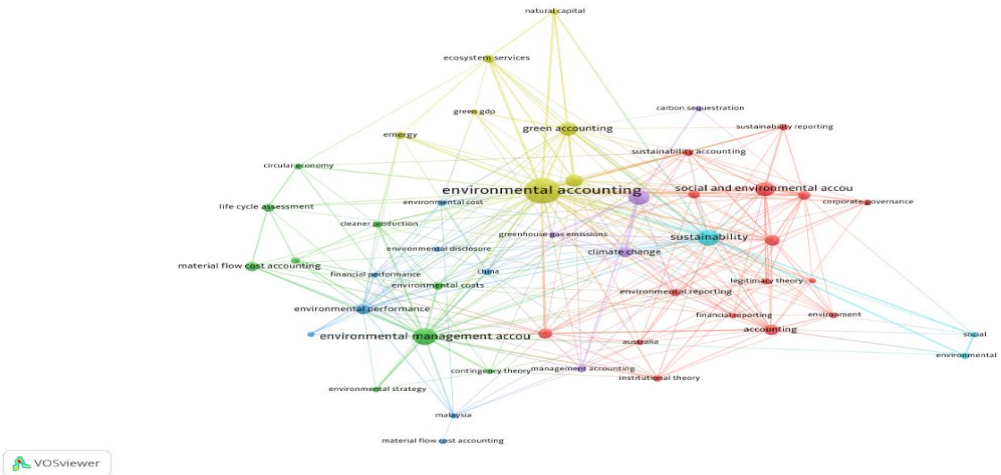
Table 16. EMA research overview 2016 to 2022

Time Span	2016:2022
Sources	170
Total Documents	527
Articles	505
Review	22
Annual growth rate %	12.46
Average Citation per doc	14.93
References	32466
Authors	1335
Author's Keywords	1525
Single authored docs	76
Co-authors per doc	3.14

5.2 Network Analysis through Co-Occurrence of Keywords in EMA Research

The network analysis uses across-the-board keyword co-occurrence to deconstruct the main ideas that have defined EMA research from its beginning in 1976 through 2022 (Kumar *et al.* 2022). As such, the major themes in the field of EMA can be better understood by the network analysis employing keyword co-occurences. There are a total of 48 keywords with a minimum of nine occurrences each, as determined by a co-occurrence analysis of the keywords authors identify in their works. Through VOS viewer, a network with 308 nodes, 6 clusters, and 718 link strengths was constructed. Figure 11 depicts the major themes discovered from the co-occurrences of keywords in the network analysis of the full corpus, while table 17 provides descriptive context.

Figure 11. Network of Author keywords Co-occurrences



Seven indicators, including, are reported to further enhance the findings of the co-occurrence study. The APY measures how recently a certain keyword was published on average. Average citation (AC), which shows how often a certain word is referenced in other documents; Indicative of how often a keyword appears in the corpus, occurrence (OC) The keyword's degree of centrality (DC), which reflects the amount of connections it has within the network; There are three measures of a keyword's significance within a cluster: its closeness centrality (CC), which shows how well it is connected to its neighbours, its betweenness centrality (BC), which shows how well it can spread information within the cluster, and its page rank (PR), which shows how important it is within the cluster based on the quality and quantity of links pointing towards it.

The next section employs sensemaking, in which keywords are arranged in a logical fashion to express the study substance of each issue, to analyse the six themes that emerged from the co-occurrence analysis and show the underlying conceptual structure of EMA research.

Table 17. Keyword co-occurrence clusters on EMA

Keyword	OC	DC	BC	CC	PR	AC	APY
Cluster 1: Social and Environmental Accounting (RED)							
accountability	21	10	0.7364	0.0101	0.0146	37.29	2018
accounting	36	23	16.8660	0.0110	0.0214	50.47	2013
Australia	10	12	3.5134	0.0093	0.0109	52.50	2013
corporate governance	12	8	0.2611	0.0096	0.0092	44.83	2016
corporate social responsibility	25	20	12.8419	0.0109	0.0253	47.08	2016
disclosure	9	11	0.0000	0.0092	0.0045	122.78	2010
environment	12	12	0.1198	0.0081	0.0080	85.00	2011
environmental management	31	17	32.4220	0.0114	0.0294	52.68	2013
environmental reporting	16	16	4.6637	0.0098	0.0099	51.75	2014
financial reporting	10	10	0.0000	0.0092	0.0051	20.50	2013
institutional theory	13	11	1.8355	0.0111	0.0152	37.69	2016
legitimacy theory	13	10	0.1958	0.0097	0.0080	70.15	2015
social accounting	35	18	23.3135	0.0112	0.0318	118.09	2011
social and environmental accounting	63	15	19.2108	0.0098	0.0337	32.56	2016
sustainability accounting	16	16	5.7784	0.0112	0.0186	27.19	2016
sustainability reporting	13	8	0.3264	0.0098	0.0115	48.77	2017
Cluster 2: Environmental Management Accounting (Green)							
circular economy	12	6	0.6774	0.0101	0.0104	38.00	2020
cleaner production	13	12	2.1762	0.0085	0.0127	40.85	2014
contingency theory	10	8	0.0000	0.0081	0.0092	24.20	2018
eco-efficiency	13	9	3.2444	0.0089	0.0138	47.08	2013
environmental costs	19	13	2.7282	0.0103	0.0138	21.32	2013
environmental management accounting	90	29	239.9392	0.0130	0.0797	29.61	2016
environmental strategy	9	5	0.0000	0.0081	0.0085	40.00	2018

Keyword	OC	DC	BC	CC	PR	AC	APY
life cycle assessment	22	7	3.7250	0.0097	0.0119	34.09	2018
material flow cost accounting	28	8	3.5182	0.0088	0.0145	22.54	2017
Cluster 3: Environmental Performance (Blue)							
china	13	14	0.0000	0.0106	0.0073	13.31	2016
energy efficiency	10	5	0.1500	0.0093	0.0099	12.60	2019
environmental cost	11	10	2.7282	0.0103	0.0138	19.27	2015
environmental disclosure	10	6	0.0000	0.0097	0.0081	54.60	2018
environmental performance	33	20	40.8136	0.0116	0.0287	16.85	2019
financial performance	10	10	1.2005	0.0083	0.0094	3.40	2020
malaysia	9	9	0.0000	0.0083	0.0078	12.78	2015
material flow cost accounting (mfca)	9	1	0.0000	0.0066	0.0070	28.00	2017
Cluster 4: Environmental Accounting (Yellow)							
ecosystem services	21	10	0.3153	0.0105	0.0226	105.81	2014
emergy	18	7	8.0668	0.0103	0.0149	27.22	2016
environmental accounting	206	41	537.9709	0.0159	0.1355	42.27	2013
green accounting	57	19	44.5277	0.0110	0.0405	15.35	2013
green gdp	9	6	0.0000	0.0095	0.0108	24.56	2011
natural capital	12	5	0.0509	0.0103	0.0183	25.42	2015
sustainable development	46	28	42.4540	0.0122	0.0357	44.17	2014
Cluster 5: Carbon Accounting (Purple)							
carbon accounting	75	14	56.9727	0.0098	0.0379	23.81	2017
carbon sequestration	9	3	0.0000	0.0068	0.0062	33.44	2012
climate change	33	17	8.5838	0.0104	0.0270	38.30	2016
greenhouse gas emissions	10	12	1.1469	0.0096	0.0111	62.10	2014
management accounting	13	11	13.1703	0.0112	0.0157	79.46	2012
Cluster 6: Sustainability (Sky Blue)							
environmental	13	4	0.9048	0.0087	0.0161	26.54	2016
social	10	6	0.0000	0.0084	0.0130	101.80	2013
sustainability	78	30	174.1356	0.0135	0.0721	45.59	2014

OC=Occurrence, DC=Degree of centrality, BC=Betweenness centrality, CC=Closeness centrality, PR=PageRank, AC=Average citations, APY=Average publication year.

Keyword cluster 1: Social and Environmental Accounting (Red Network)

Social and environmental accounting in environmental management make up the first cluster of related terms. The cluster's most popular terms include "social and environmental accounting" (OC=63), "accounting" (OC=36), "social accounting" (OC=35), "corporate social responsibility" (OC=25), and "accountability" (OC=21). Then comes environmental reporting (OC=16) and sustainability accounting (OC=16). Also highly ranked in the cluster

are the keywords (topics) social and environmental accounting (PR=0.0337), accounting (PR=0.0214), corporate social responsibility (PR=0.0253), and social accounting (PR=0.318), all of which point to the significance of these terms in EMA research. The keyword with the lowest average publication year is disclosure (APY=2010) and social accounting (APY=2011), showing that it is one of the old and well-researched topics in the cluster, and hence has the greatest average citation (AC=122.78) and social accounting (AC=118.09) counts. Accountability (APY=2018) and sustainability reporting (APY=2017) have lately received greater study interest than the other subjects in the cluster, as indicated by their higher APYs.

Keyword cluster 2: Environmental Management Accounting (Green network)

Among the nine keywords that make up the second cluster, material flow cost accounting (OC=28), life cycle assessment (OC=22), and environmental costs (OC=19) have the highest occurrence counts, with cleaner production (OC=13), eco-efficiency (OC=13), and the circular economy (OC=12) coming in at a distant fourth. According to PageRank, the most important areas of study in EMA are material flow cost accounting (PR=0.0145), eco-efficiency and environmental costs (PR=0.138), and cleaner production (PR=0.127). Eco-efficiency (AC=47.08), cleaner production (AC=40.85), and environmental strategy (AC=40.00) have all received a large number of citations, demonstrating their significance in EMA studies. Since average publication year 2020, the circular economy has been the hottest of much EMA investigation. Life cycle costing (CC=0.0097, BC=3.7250) plays a major role in EMA studies of the circular economy.

Keyword cluster 3: Environmental performance (Blue network)

Eight keywords that capture the essence of Environmental management accounting's focus on environmental performance make up the third cluster. The keywords "environmental performance" (OC=33, BC=40.8136, DC=20, CC=0.0116, PR=0.0287) "environmental cost" (OC=11, BC=2.7282, DC=10, CC=0.0103, PR=0.0138) and "financial performance" (OC=10, BC=1.2005, DC=10, CC=0.0083, PR=0.0094) have the highest degree of centrality, closeness centrality, betweenness centrality, and pagerank in the cluster, respectively Environment disclosure (AC=54.60), material flow cost accounting (mfca) (AC=28.00), and environmental cost (AC=19.27) are the most frequently cited terms in this cluster, whereas financial performance (APY=2020) is the most recently cited term in this group.

Keyword cluster 4: Environmental accounting (Yellow network)

Seven terms related to environmentally friendly accounting form the fourth group. Green accounting has the greatest OC (57), BC (44.5277), and PR (0.0405) in the cluster, followed by sustainable development (OC = 46, BC = 42.4540, PR = 0.0357). When looking at the average number of citations, studies on EMA find that eco-system services (AC=105.81) have the most influence. Emergy (APY=2016) is the most recent topic in the cluster. The cluster's APY=2013 average publication year also shows that green accounting is a popular area of study.

Keyword cluster 5: Carbon accounting (Purple network)

The fifth set of keywords deals specifically with carbon and gas emissions in EMA studies. The cluster's newest (APY=2017) research focus is on carbon accounting. It has the highest pagerank (PR=0.379), the most occurrences (OC=75), the highest betweenness centrality (BC=56.9727), the second most linkages between other terms (DC=14), and is the main centre of the cluster. Research into EMA is significantly impacted by climate change (OC=33, DC=17, BC=8.5838, CC=0.0104, PR=0.0270, AC=38.30) and greenhouse gas emissions (OC=10, DC=12, BC=1.1469, CC=0.0096, PR=0.0111, AC=62.10).

Keyword cluster 6: Sustainability (Sky blue)

Sixth, and final cluster deals specifically with sustainability in literature. The cluster first focused on social research (APY=2013), then moved on to sustainability (APY=2014) and is now focusing on environmental research (APY=2016). Sustainability in EMA research is currently the most prominent (OC=78, DC=30, BC=174.1356, CC=0.0135, PR=0.721, AC=45.59), although social publications have the highest average citation count (AC=101.80).

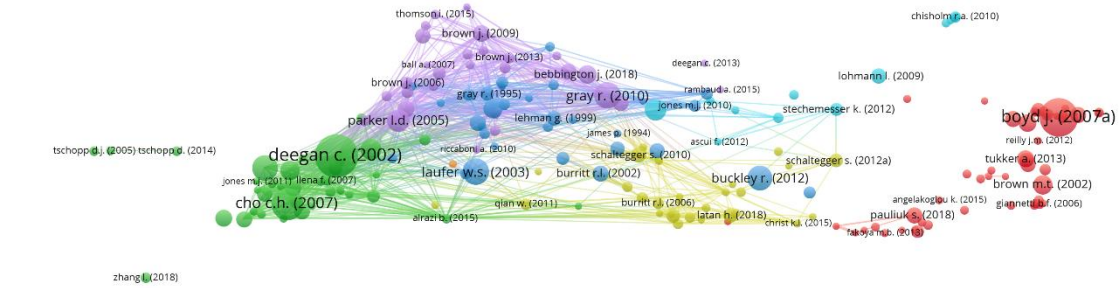
5.3 Bibliographic Coupling

When two or more documents share bibliographical references, they are considered bibliographically coupled. If both document A and document B cite document C, then documents A and B are bibliographically coupled, also known as retrospective coupling (Hjørland 2013). Bibliographic coupling identifies the semantic relationship between publications in order to unearth hidden research themes that will drive future research orientations (Chandra *et al.* 2022). Bibliographic coupling strengths are counts of the number of references a set of documents share, and it is assumed that a high coupling strength indicates a high degree of subject matter

similarity (Hjørland 2013). The thickness and intensity of the edges indicate the degree to which these publications are alike (Verma and Yadav 2021).

The use of bibliographic coupling to the review corpus resulted in the establishment of seven clusters that are sufficiently substantial to represent 208 documents in the review corpus significantly. For the bibliographic coupling analysis, Documents are used as unit of analysis. The bibliographic coupling map presenting different clusters are presented in the Figure 16. Seven separate bibliographic (thematic) clusters containing a total of 189 out of 1085 documents are revealed by the bibliographic coupling. The analysis is based on a minimum of 50 citations of a document that is being considered for coupling. The study and network only include 189 of the 208 documents that met the requirements. The network found 7 clusters, 4698 connections, and a total of 14,479 strength in the interconnections. Table 18 displays the most frequently cited publications for each bibliographic clusters.

Figure 17. Network representing bibliographic coupling of documents



VOSviewer

Bibliographic cluster 1: Eco-system services (Red)

The first cluster, consisting of 49 publications out of 1075, has a primary focus on eco-system services and circular economy. That have received an average of 534.40 citations per document (Total citations/Total publication) for a total of 26,186 citations. The earliest of these publications dates back to 1996, while the most recent is set to come out in 2020. Analysis of the most widely-cited papers in this domain reveals that they mostly address on eco-system services (Boyd and Banzhaf 2007; Howarth and Farber 2002), emergy evaluations (Brown and Ulgiati 2002), measuring the air pollution (Muller and Mendelsohn 2007) and environmental accounting for pollution (Muller, Mendelsohn and Nordhaus 2011) and environmental impacts of mega sporting events (Collins, Jones, and Munday 2009). The most cited publication in the present cluster is on eco-system services concentrating on the need for standardized environmental accounting units (Boyd and S. Banzhaf 2007).

Bibliographic cluster 2: Environmental disclosure (Green)

The second cluster capture research on environmental disclosure through 37 documents out of 1075. That have received an average of 699.33 per document (Total citations/Total publications) for a total of 27,274 citations. The first publication in this cluster published in 1999, while the most recent set to come in 2019. The most cited publications in the present cluster sheds light on the Environmental disclosures (Deegan 2002; Cho and D. M. Patten 2007; de Villiers and van Staden 2006; Monteiro and Aibar-Guzmán 2010; Freedman and Jaggi 2005; Huang and Kung 2010), Social and environmental accounting research (Chen and Roberts 2010), environmental capital expenditure (Clarkson, Li, and Richardson 2004), sustainability assurance (Kolk and Perego 2010) and intellectual capital reporting (Guthrie, Petty, Yongvanich, and Ricceri 2004). The highest cited publication in the present cluster is on environmental disclosures (Deegan 2002).

Bibliographic cluster 3: Social accounting (Blue)

The third cluster focuses on the research of social accounting through 31 publications that have amassed a total of 25,767 citations and average 831.19 citations per document (Total citations/Total publications). In the present cluster the publications was started from the year 1994, the latest publication came out in 2018. Around sixteen publications in this cluster are published during 2000 to 2006. In this cluster most cited publications concentrate on Social accountability and corporate greenwashing (Laufer 2003), sustainable tourism (Buckley 2012; Becken and Patterson 2006), corporate unsustainability (Moneva, Archel and Correa 2004), environmental management accounting in organizational change, comprehensive framework, institutional appropriation and future potential

(Gray, Walters, Bebbington, and Thompson 1995; Burritt, Hahn, and Schaltegger 2002; Larrinaga-Gonzalez and Bebbington 2001; Bartolomeo, *et al.* 2000). The highest citations in this cluster is for the paper by Laufer (2003) on social accounting.

Bibliographic cluster 4: Environmental management accounting (Yellow)

The fourth cluster concentrates on environmental management accounting with eco-efficiency, waste management, green and pleasant land and others through 29 documents with total citations of 20,126 and with 694 average citations per document. The first paper published in this cluster is in 2001 and the latest was published in 2018. The highly cited articles in this cluster sheds light on sustainability accounting (Schaltegger and Burritt 2010), environmental strategy and uncertainty (Latan *et al.* 2018), carbon accounting (Schaltegger and M. Csutora 2012), eco-efficiency (Burritt and Saka 2006), waste management (Qian, Burritt and Monroe 2018), significance of contingent variables on adoption of environmental management accounting (Christ and Burritt 2013) and environmental motivations into performance (Lisi 2015). The research on sustainability accounting of Schaltegger and Burritt (2010) has received highest citations of 226. Compared to other bibliographic clusters cluster 4 top cited publication has received less citations.

Bibliographic cluster 5: Sustainability and sustainable development (Purple)

The fifth cluster in bibliographic analysis concentrates on sustainability and sustainable development through environmental management accounting tools. 29 documents are identified in the present cluster. The cluster got 25,686 total citations with an average of 885.72 citations per document. The first document published in this cluster is 2004 and the latest publication came out in 2019. The most cited publication in the cluster sheds ligh on the accounting for sustainability (Gray 2010; Brown 2009), social and environmental accountability (Parker 2005) social and environmental accounting (Brown and Fraser 2006; Owen 2008), sustainable development goals (Bebbington and Unerman 2018), sustainable development (Bebbington and Larrinaga 2014). The highly cited publication in the present cluster is accounting for sustainability (Gray 2010).

Bibliographic cluster 6: Carbon accounting (Sky blue)

The sixth cluster in the analysis focuses on the research of carbon accounting through 13 documents with 1,582 total citations and average of 121.69 citations per document. The first document in the cluster was published in 2002 and the latest publication came out in 2012. 8 among 13 documents are published during 2010 to 2012. The most cited publication in the cluster concentrates on carbon disclosure (Kolk, Levy and Pinkse 2008), carbon in dio-diversity hotspot (Chisholm 2010), carbon accounting (Ascui and Lovell 2011; Cacho, Hean and Wise 2003; Bowen and Wittneben 2011), greenhouse gases (Latta, Adams, and McCarl 2010) and eco-system services (Chisholm 2010). The most cited publication is on carbon disclosure (Kolk, Levy, and Pinkse 2008).

Bibliographic cluster 7: Corporate social responsibility (Orange)

The bibliographic analysis identified only one document in the seventh cluster, the research is on corporate social responsibility and accountability regulation in care if business (Unerman and O'Dwyer 2007). The publication is cited 66 times. And it is published in the year 2007.

Table 18. Top ten highly cited articles based on bibliographic clusters

Publication	Author and year	Citations	Links	Total link strength
Cluster 1: Eco-system Services				
What are ecosystem services? The need for standardized environmental accounting units	Boyd and Banzhaf 2007	1350	12	26
Emergy evaluations and environmental loading of electricity production systems	M. T. Brown and Ulgiati 2002	340	7	8
Environmental accounting for pollution in the United States economy	Muller *et al.* 2011	281	7	11
EXIOPOL - DEVELOPMENT AND ILLUSTRATIVE ANALYSES OF A DETAILED GLOBAL MR EE SUT/IOT	Tukker *et al.* 2013	277	5	24
Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations	Pauliuk 2018	253	8	27
Measuring the damages of air pollution in the United States	Muller and Mendelsohn 2007	251	7	10
Weak and strong sustainability in the SEEA: Concepts and measurement	Dietz and Neumayer 2007	244	20	49

Publication	Author and year	Citations	Links	Total link strength
Assessing the environmental impacts of mega sporting events: Two options?	A. Collins *et al.* 2009	222	4	8
Towards a global multi-regional environmentally extended input-output database	Tukker *et al.* 2009	208	7	25
Accounting for the value of ecosystem services	Howarth and Farber 2002	181	19	31
Cluster 2: Environmental disclosure				
Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation	Deegan 2002	1697	102	646
The role of environmental disclosures as tools of legitimacy: A research note	Cho and Patten 2007	959	58	169
Using content analysis as a research method to inquire into intellectual capital reporting	Guthrie *et al.* 2004	624	63	182
Determinants of the adoption of sustainability assurance statements: An international investigation	Kolk and Perego 2010	394	73	196
Can less environmental disclosure have a legitimising effect? Evidence from Africa	de Villiers and van Staden 2006	346	83	366
The market valuation of environmental capital expenditures by pulp and paper companies	Clarkson *et al.* 2004	266	2	2
Determinants of environmental disclosure in the annual reports of large companies operating in Portugal	Monteiro and Aibar-Guzmán 2010	249	86	441
Toward a More Coherent Understanding of the Organization-Society Relationship: A Theoretical Consideration for Social and Environmental Accounting Research	Chen and Roberts 2010	234	79	320
Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries	Freedman and Jaggi 2005	232	58	181
Drivers of Environmental Disclosure and Stakeholder Expectation: Evidence from Taiwan	Huang and Kung 2010	224	70	330
Cluster 3: Social accounting				
Social Accountability and Corporate Greenwashing	Laufer 2003	636	65	136
Sustainable tourism: Research and reality	Buckley 2012	558	8	8
GRI and the camouflaging of corporate unsustainability	Moneva *et al.* 2006	337	84	223
Towards a comprehensive framework for environmental management accounting - Links between business actors and environmental management accounting tools	Burritt *et al.* 2002	247	62	101
Bringing the environment into bank lending: Implication for environmental reporting	Thompson and Cowton 2004	232	71	133
Measuring national carbon dioxide emissions from tourism as a key step towards achieving sustainable tourism	Becken and Patterson 2006	221	25	25
Disclosing new worlds: A role for social and environmental accounting and auditing	Lehman 1999	189	89	265
Accounting change or institutional appropriation? - A case study of the implementation of environmental accounting	Larrinaga-Gonzalez and Bebbington 2001	188	44	66
The greening of enterprise: An exploration of the (NON) role of environmental accounting and environmental accountants in organizational change	Gray *et al.* 1995	167	83	297
Environmental management accounting in Europe: current practice and future potential	Bartolomeo *et al.* 2000	156	68	123
Cluster 4: Environmental management accounting				
Sustainability accounting for companies: Catchphrase or decision support for business leaders?	S Schaltegger and Burritt 2010	226	108	302
Effects of environmental strategy, environmental	Latan *et al.* 2018	193	51	141

Publication	Author and year	Citations	Links	Total link strength
uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting				
Carbon accounting for sustainability and management. Status quo and challenges	S Schaltegger and Csutora 2012	172	57	145
Environmental management accounting and innovation: An exploratory analysis	Ferreira *et al.* 2010	170	63	159
Environmental management accounting applications and eco-efficiency: case studies from Japan	Burritt and Saka 2006	126	69	132
Environmental management accounting in local government: A case of waste management	Qian *et al.* 2018	122	91	274
Environmental management accounting: Roadblocks on the way to the green and pleasant land	Burritt 2004	116	70	166
Environmental management accounting: The significance of contingent variables for adoption	Christ and Burritt 2013	111	81	268
Environmental management systems as an embedding mechanism: A research note	Pérez *et al.* 2007	107	87	229
Translating environmental motivations into performance: The role of environmental performance measurement systems	Lisi 2015	105	64	148
Cluster 5: Sustainability and sustainable development				
Is accounting for sustainability actually accounting for sustainability...and how would we know? An exploration of narratives of organisations and the planet	Gray 2010	631	99	411
Social and environmental accountability research: A view from the commentary box	Parker 2005	454	95	441
Achieving the United Nations Sustainable Development Goals: An enabling role for accounting research	Bebbington and Unerman 2018	328	66	201
Chronicles of wasted time?: A personal reflection on the current state of, and future prospects for, social and environmental accounting research	Owen 2008	278	108	683
Democracy, sustainability and dialogic accounting technologies: Taking pluralism seriously	J. Brown 2009	261	80	479
Accounting and sustainable development: An exploration	Bebbington and Larrinaga 2014	241	116	473
Theorizing engagement: The potential of a critical dialogic approach	Bebbington *et al.* 2007	233	83	374
Integrated reporting: On the need for broadening out and opening up	J. Brown and Dillard 2014	223	56	158
Approaches and perspectives in social and environmental accounting: An overview of the conceptual landscape	J. Brown and Fraser 2006	165	88	341
A discussion of the political potential of Social Accounting	Cooper *et al.* 2005	149	55	135
Cluster 6: Carbon Accounting				
Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure	Kolk *et al.* 2008	428	20	26
Toward a different debate in environmental accounting: The cases of carbon and cost-benefit	Lohmann 2009	216	22	33
Carbon accounting: A systematic literature review	K Stechemesser and Guenther 2012	165	59	139
Trade-offs between ecosystem services: Water and carbon in a biodiversity hotspot	Chisholm 2010	120	3	3
As frames collide: Making sense of carbon accounting	Ascui and Lovell 2011	105	95	219

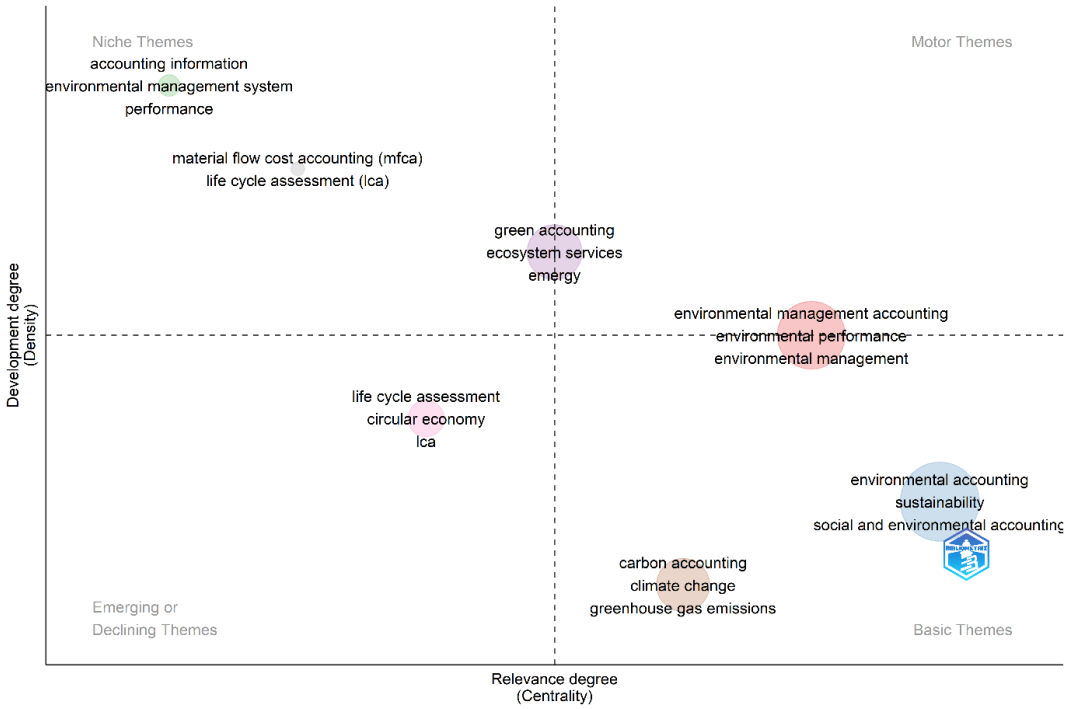
Publication	Author and year	Citations	Links	Total link strength
The costs of public involvement: Everyday devices of carbon accounting and the materialization of participation	Marres 2011	83	9	11
Climate change accounting research: keeping it interesting and different	Milne and Grubnic 2011	78	45	123
Carbon-accounting methods and reforestation incentives	Cacho *et al.* 2003	78	3	4
Carbon accounting: Negotiating accuracy, consistency and certainty across organisational fields	Bowen and Wittneben 2011	67	21	40
Mitigating greenhouse gases: The importance of land base interactions between forests, agriculture, and residential development in the face of changes in bioenergy and carbon prices	Alig *et al.* 2010	66	2	2
Cluster 7: Corporate Social responsibility				
The business case for regulation of corporate social responsibility and accountability	Unerman and O'Dwyer 2007	66	55	83

5.6 Way Forward for Environmental Management Accounting Research

The thematic clusters from the co-occurrence of the author's keywords and bibliographic coupling convergence between the clusters by indicating the major themes and clusters are similar to each other irrespective of the cluster number. It proves the credibility and veracity of essential ideas.

This study uses author keywords as inputs to construct a strategic diagram with impact and centrality as its y-axis and x-axis (Liu, Cobo, Herrera-Viedma, and Herrera 2013) using the simple center algorithm in Biblioshiny in R to acquire a better picture of the future of EMA research. Centrality reflects the significance of topics, whereas impact indicates their growth and influence in the field. Using the typology outlined in Figure 5 given by Cahlik (2000) (Chandra *et al.* 2022), the graphic depiction of the strategic diagram is divided into four quadrants.

Figure 17. Strategic diagram of Environmental management accounting



The keywords represented in the upper-right quadrant are regarded as high-centrality, high-impact motor subjects. The keyword in this quadrant is "environmental management accounting". The keywords "Green accounting", "Ecosystem services" and "emergy" are the part of motor themes. These keywords are well-developed and provide essential insights for the study of Environmental management accounting. These keywords also represent the thematic cluster four in co-occurrence of author keywords. Therefore, future

research on Environmental management accounting should always consider the effects of any proposed solutions for green accounting, emergy, and eco-system services on the EMA.

These keywords are known as transversal themes with high centrality but low impact. The keywords in this quadrant are “environmental management”, “environmental accounting”, “sustainability”, “social and environmental accounting”, “carbon accounting”, “climate change” and “greenhouse gas emissions”. The topics in this quadrant have low impact but high centrality on EMA research. Therefore, future research is more likely to benefit from utilising the concepts represented by these keywords to enable new research across the thematic clusters highlighted in this evaluation. The research on these topics will empower and enhance the existing knowledge of EMA research. These keywords represent the thematic cluster 5 of co-occurrence of keywords.

The keywords in the upper left quadrant are considered to be niche themes with high impact but with low centrality. The keywords in this quadrant are “accounting information”, “environmental management system”, “performance”, “material flow cost accounting (mfca)” and “life cycle assessment (lca)”. The keywords “Green accounting”, “Ecosystem services” and “emergy” partly represent the quadrant. These topics represent issues that are well-developed and have a significant impact on the area, despite remaining specialised topics. Future research in these areas is likely to be fruitful because they have the potential to make a significant contribution to the field, and they are likely to be sought after by both mainstream and specialty (*e.g.*, Journal of cleaner production, Sustainability) journals that welcome niche insights on EMA.

Due to their low centrality and minimal influence, the terms in the lower left quadrant are classified as emerging or declining themes. The keywords in this quadrant are “life cycle assessment”, “circular economy”, and “lca”. The research on these topics indicate possible study areas that would benefit from innovative and original ideas. In recent times as noted by the researchers, research on circular economy is gaining more importance.

Conclusion and Limitations

This study utilises bibliometric analysis and a systematic literature evaluation to shed light on the performance and science of Environmental management accounting. This study contributes in a novel way by leveraging the power of big data analytics through machine learning — and increasing visibility to it in the process — to identify the most influential articles and top contributing journals, authors, institutions, and countries, as well as by revealing the temporal evolution of topics and the major themes underlying the intellectual structure of Environmental management accounting research. The study also underpins the way forward the future scope of Environmental management accounting. In order to accomplish this, we provide a summary important insight and their corresponding consequences from this state-of-the-art assessment of 1075 works on Environmental management accounting published over the past four decades (1976-2022).

First, the performance analysis indicates the growth of publication and citation trend in the field of the EMA research. There is a annual growth rate of 10.25% in the publication, in the year publications are at its peak by 104 documents. There is also a growing trend in the citations of the publications. In addition, performance analysis indicates Burritt RL is the top author based on h-index and he also collaborates more with other authors. Furthermore, Journal of cleaner production is the most productive journal with 158 publications in the corpus and second influential author based on citations. Where, Accounting, Auditing and accountability journal is the first influential with highest citations. Performance analysis also revealed most influential publication by Craig Deegan globally, and publication by Lee D. Parker in the local file. Macquarie University from Australia and the country Australia are the most productive in EMA research.

Second, science mapping of EMA research has conducted. To begin with, Temporal analysis revealed the significant themes concentrated in different four time periods. With the overview of EMA research in that period. Sustainable development and accounting issues in 1976-1995 to Carbon accounting in 2016-2022. In addition, Co-occurrence of author keywords and bibliographic coupling underpinned the intellectual structure of EMA research through different thematic clusters. Noteworthily, all the clusters in the co-occurrence network and bibliographic coupling triangulate and presented almost same results irrespective of cluster number. Most influential publications based on bibliographic clusters are also presented in the analysis.

Third, future scope of EMA research is also identified with the help of strategic diagram. Which provides directions for the potential researchers in the field of environmental management accounting. It is identified that, research on material flow cost accounting, life cycle assessment, accounting information are the niche topics and have high scope for future research. Circular economy is a emerging theme which may contribute significantly on EMA. Life cycle costing is also present in declining or emerging theme, it can be considered as declining as there are few papers published in recent times. Green accounting, ecosystem services and emergy are the part of niche themes and also motor themes which are very much significant to the field of study. Carbon accounting,

social and environmental accounting, green house gas emissions and other are more transversal, and will empower the future study.

Finally, this study, despite its merits, has significant limitations which may lead to further research should be considered when interpreting its findings. We limited our inclusion to works found in the Scopus database. It is advised that future studies compare these findings to those found in other databases like Web of Science and google scholar. Our co-word metrics were developed using author keywords. We advise scholars to reproduce our strategic diagrams using alternative indexing techniques, such as keyword plus, to evaluate the validity of our findings. Such evaluations are valuable because they will either produce fresh insights into the scientific framework of EMA research or confirm the veracity of our conclusions. Finally, bibliometric software programmes and algorithms are continually improving. Researchers with an interest in this area can test the reproducibility of the strategic diagrams presented in this paper using other software tools, such as SciMAT, or they can assess the state-of-the-art in research on EMA from different perspectives using other units of analysis in bibliometric coupling (*e.g.*, sources, organisations, countries).

Acknowledgments

I would like to express my heartfelt gratitude to my research supervisor, Dr. Senthil Kumar J.P., Associate professor, for their unwavering support and guidance throughout the process of writing my research paper.

Credit Authorship Contribution Statement

Chetanraj D.B: investigation, software, formal analysis, writing – original draft, data curation, validation, visualization.
Senthil Kumar J.P: conceptualization, methodology, project administration, supervision, writing – review and editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Alig, R., G. Latta, D. Adams, and B. McCarl 2010. Mitigating greenhouse gases: The importance of land base interactions between forests, agriculture, and residential development in the face of changes in bioenergy and carbon prices," *For. Policy Econ.*, vol. 12, no. 1, pp. 67–75. DOI: 10.1016/j.forpol.2009.09.012

[2] Appiah, B. K., Z., Donghui, S. C., Majumder, and M. P., Monaheng 2020. Effects of environmental strategy, uncertainty and top management commitment on the environmental performance: Role of environmental management accounting and environmental management control system. *Int. J. Energy Econ. Policy* 10(1): 360–370. DOI: 10.32479/ijeep.8697

[3] Ascui, F. 2014. A review of carbon accounting in the social and environmental accounting literature: What can it contribute to the debate? *Soc. Environ. Account. J.* 34(1): 6–28. DOI: 10.1080/0969160X.2013.870487

[4] Ascui, F. and H. Lovell 2011. As frames collide: Making sense of carbon accounting. *Accounting, Audit. Account. J.*, vol. 24, no. 8, pp. 978–999. DOI: 10.1108/09513571111184724

[5] Baker, H. K., S. Kumar, and D. Pattnaik 2021. Twenty-five years of the Journal of Corporate Finance: A scientometric analysis. *J. Corp. Financ.*, vol. 66. DOI: 10.1016/j.jcorpfin.2020.101572

[6] Bartolomeo, M., M. Bennett, J. J. Bouma, P. Heydkamp, P. James, and T. Wolters 2000. Environmental management accounting in Europe: current practice and future potential. *Eur. Account. Rev.*, vol. 9, no. 1, pp. 31–52. DOI: 10.1080/096381800407932

[7] Bebbington J. and C. Larrinaga 2014. Accounting and sustainable development: An exploration. *Accounting, Organ. Soc.*, vol. 39, no. 6, pp. 395–413. DOI: 10.1016/j.aos.2014.01.003

[8] Bebbington, J. and J., Unerman 2018. Achieving the United Nations Sustainable Development Goals: An enabling role for accounting research. *Accounting, Audit. Account. J.*, vol. 31, no. 1, pp. 2–24. DOI:10.1108/AAAJ-05-2017-2929

[9] Bebbington, J., J. Brown, B. Frame, and I. Thomson 2007. Theorizing engagement: The potential of a critical dialogic approach," *Accounting, Audit. Account. J.*, vol. 20, no. 3, pp. 356–381. DOI:10.1108/09513570710748544

[10] Becken, S. and M. Patterson 2006. Measuring national carbon dioxide emissions from tourism as a key step towards achieving sustainable tourism. *J. Sustain. Tour.*, vol. 14, no. 4, pp. 323–338. DOI: 10.2167/jost547.0

[11] Bowen, F. and B. Wittneben 2011. Carbon accounting: Negotiating accuracy, consistency and certainty across organisational fields. *Accounting, Audit. Account. J.*, vol. 24, no. 8, pp. 1022–1036. DOI:10.1108/09513571111184742

[12] Boyd J. and S. Banzhaf 2007. What are ecosystem services? The need for standardized environmental accounting units," *Ecol. Econ.* 63 (2–3): 616–626. DOI: 10.1016/j.ecolecon.2007.01.002

[13] Brown J. and J. Dillard 2014. Integrated reporting: On the need for broadening out and opening up. *Accounting, Audit. Account. J.*, vol. 27, no. 7, pp. 1120–1156. DOI: 10.1108/AAAJ-04-2013-1313

[14] Brown, J. 2009. Democracy, sustainability and dialogic accounting technologies: Taking pluralism seriously. *Crit. Perspect. Account.*, vol. 20, no. 3, pp. 313–342. DOI: 10.1016/j.cpa.2008.08.002

[15] Brown, J. and M., Fraser 2006. Approaches and perspectives in social and environmental accounting: An overview of the conceptual landscape. *Bus. Strateg. Environ.*, vol. 15, no. 2, pp. 103–117. 10.1002/bse.452

[16] Brown, M. T. and S., Ulgiati 2002. Emergy evaluations and environmental loading of electricity production systems. *J. Clean. Prod.* 10(4): 321–334. DOI: 10.1016/S0959-6526(01)00043-9

[17] Buckley, R. 2012. Sustainable tourism: Research and reality. *Ann. Tour. Res.* 39(2): 528–546. DOI:10.1016/j.annals.2012.02.003.

[18] Burritt R. L. 2004. Environmental management accounting: Roadblocks on the way to the green and pleasant land. *Bus. Strateg. Environ.*, vol. 13, no. 1, pp. 13–32. DOI: 10.1002/bse.379

[19] Burritt, R. L. and C. Saka 2006. Environmental management accounting applications and eco-efficiency: case studies from Japan. *J. Clean. Prod.*, vol. 14, no. 14, pp. 1262–1275. DOI: 10.1016/j.jclepro.2005.08.012

[20] Burritt, R. L., T. Hahn, and S. T. Schaltegger 2002. Towards a comprehensive framework for environmental management accounting - Links between business actors and environmental management accounting tools. *Aust. Account. Rev.*, vol. 12, no. 27, pp. 39–50. DOI: 10.1111/j.1835-2561.2002.tb00202.x

[21] Cacho, O. J., R. L. Hean, and R. M. Wise 2003. Carbon-accounting methods and reforestation incentives. *Aust. J. Agric. Resour. Econ.*, vol. 47, no. 2, pp. 153–179. DOI: 10.1111/1467-8489.00208

[22] Chandra, S., S. Verma, W. M. Lim, S. Kumar, and N. Donthu 2022. Personalization in personalized marketing: Trends and ways forward. *Psychol. Mark.*, 39(8): 1529–1562. DOI: 10.1002/mar.21670

[23] Chen, J. C. and R. W. Roberts 2010. Toward a More Coherent Understanding of the Organization-Society Relationship: A Theoretical Consideration for Social and Environmental Accounting Research. *J. Bus. Ethics* 97(4): 651–665. DOI: 10.1007/s10551-010-0531-0

[24] Chisholm, R. A. 2010. Trade-offs between ecosystem services: Water and carbon in a biodiversity hotspot. *Ecol. Econ.*, vol. 69, no. 10, pp. 1973–1987. DOI: 10.1016/j.ecolecon.2010.05.013

[25] Cho C. H. and D. M. Patten 2007. The role of environmental disclosures as tools of legitimacy: A research note," *Accounting, Organ. Soc.* 32(7–8():639–647. DOI: 10.1016/j.aos.2006.09.009

[26] Christ, K. L. and R. L., Burritt 2013. Environmental management accounting: The significance of contingent variables for adoption. *J. Clean. Prod.*, vol. 41, pp. 163–173. DOI: 10.1016/j.jclepro.2012.10.007

[27] Clarkson, P. M., Y. Li, and G. D. Richardson 2004. The market valuation of environmental capital expenditures by pulp and paper companies. *Account. Rev.*, vol. 79, no. 2, pp. 329–353. DOI:10.2308/accr.2004.79.2.329

[28] Collins, A., C. Jones, and M. Munday 2009. Assessing the environmental impacts of mega sporting events: Two options? *Tour. Manag.* 30(6): 828–837. DOI: 10.1016/j.tourman.2008.12.006

[29] Collins, E., S. Lawrence, J. Roper, and J. Haar 2011. Sustainability and the Role of the Management Accountant. *Cima*, 7(14): 14. Available at: https://www.cimaglobal.com/Documents/Thought_leadership_docs/SustainabilityandClimateChange/Management-control_NZICA.pdf

[30] Cooper, C., P. Taylor, N. Smith, and L. Catchpowle 2005. A discussion of the political potential of Social Accounting. *Crit. Perspect. Account.* 16(7): 951–974. DOI: 10.1016/j.cpa.2003.09.003.

[31] Dasanayaka, C. H., D. F. Murphy, P. Nagirikandalage, and C. Abeykoon 2021.The application of management accounting practices towards the sustainable development of family businesses: A critical review. *Clean. Environ. Syst.*, 3 no. October, p. 100064. DOI: 10.1016/j.cesys.2021.100064

[32] De Menna, F., J. Davis, K. Östergren, N. Unger, M. Loubiere, and M. Vittuari 2020. A combined framework for the life cycle assessment and costing of food waste prevention and valorization: an application to school canteens. *Agric. Food Econ.* 8(1). DOI: 10.1186/s40100-019-0148-2

[33] de Villiers, C. and C. J., van Staden 2006. Can less environmental disclosure have a legitimising effect? Evidence from Africa. *Accounting, Organ. Soc.* 31(8): 763–781. DOI: 10.1016/j.aos.2006.03.001

[34] Debnath, S., S. K. Bose, and R. S. Dhalla, Environmental Management Accounting: An Overview of its Methodological Development. *Int. J. Bus. Insights Transform.* 5(1): 44–57, 2011. http://search.ebscohost.com/login.aspx?direct=trueanddb=bthandAN=75377471andlang=pt-brandsite=ehost-live

[35] Deegan, C. 2002. Introduction: The legitimising effect of social and environmental disclosures – a theoretical foundation," *Accounting, Audit. Account. J.* 15(3): 282–311. DOI: 10.1108/09513570210435852

[36] Derchi, G. B., M. Burkert, and D. Oyon, *Environmental management accounting systems: A review of the evidence and propositions for future research*, vol. 26. Emerald Group Publishing Limited, 2013.

[37] Dietz, S. and E., Neumayer 2007. Weak and strong sustainability in the SEEA: Concepts and measurement. *Ecol. Econ.*, vol. 61, no. 4, pp. 617–626. 10.1016/j.ecolecon.2006.09.007

[38] Donthu, N., S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim 2021. How to conduct a bibliometric analysis: An overview and guidelines. *J. Bus. Res.*, 133, no. April: 285–296. 10.1016/j.jbusres.2021.04.070

[39] Ferreira, A., C. Moulang, and B. Hendro 2010. Environmental management accounting and innovation: An exploratory analysis. *Accounting, Audit. Account. J.*, vol. 23, no. 7, pp. 920–948. DOI:10.1108/09513571011080180.

[40] Fraser, M. 2012. Fleshing out an engagement with a social accounting technology/ *Accounting, Audit. Account. J.* 25(3): 508–534. DOI: 10.1108/09513571211209626.

[41] Freedman, M. and B., Jaggi 2005. Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *Int. J. Account.* 40(3): 215–232. DOI:10.1016/j.intacc.2005.06.004

[42] Geng, S., Y. Wang, J. Zuo, Z. Zhou, H. Du, and G. Mao. 2017. Building life cycle assessment research: A review by bibliometric analysis. *Renew. Sustain. Energy Rev.* 76, no. March: 176–184.10.1016/j.rser.2017.03.068

[43] Gray, R. 2010. Is accounting for sustainability actually accounting for sustainability...and how would we know? An exploration of narratives of organisations and the planet. *Accounting, Organ. Soc.* 35(1): 47–62. DOI:10.1016/j.aos.2009.04.006

[44] Gray, R. and R., Laughlin 2012. It was 20 years ago today: Sgt Pepper, Accounting, Auditing andAccountability Journal, green accounting and the Blue Meanies. *Accounting, Audit. Account. J.* 25(2): 228–255. DOI: 10.1108/09513571211198755

[45] Gray, R., D. Walters, J. Bebbington, and I. Thompson 1995. The greening of enterprise: An exploration of the (NON) role of environmental accounting and environmental accountants in organizational change. *Crit. Perspect. Account.*, vol. 6, no. 3, pp. 211–239. DOI: 10.1006/cpac.1995.1021

[46] Guenther, E., J. Endrikat, and T. W. Guenther 2016. Environmental management control systems: a conceptualization and a review of the empirical evidence. *J. Clean. Prod.* 136: 147–171. DOI:10.1016/j.jclepro.2016.02.043

[47] Gulotta, T. M., R. Salomone, F. Lanuzza, G. Saija, G. Mondello, and G. Ioppolo 2022. Life Cycle Assessment and Life Cycle Costing of unitized regenerative fuel cell: A systematic review. *Environ. Impact Assess. Rev.,* 92, no. August 2021: 106698. DOI: 10.1016/j.eiar.2021.106698

[48] Gurarda, S. 2014. *Environmental management accounting*, no. August.

[49] Guthrie, J., R. Petty, K. Yongvanich, and F. Ricceri 2004. Using content analysis as a research method to inquire into intellectual capital reporting. *J. Intellect. Cap.* 5(2): 282–293. DOI: 10.1108/14691930410533704

[50] Hasan, M. M., M. Nekmahmud, L. Yajuan, and M. A. Patwary 2019. Green business value chain: a systematic review. *Sustain. Prod. Consum.* 20: 326–339. DOI: 10.1016/j.spc.2019.08.003

[51] Hjørland, B. 2013. Citation analysis: A social and dynamic approach to knowledge organization. *Inf. Process. Manag.* 49(6): 1313–1325. DOI: 10.1016/j.ipm.2013.07.001

[52] Howarth, R. B. and S., Farber 2002. Accounting for the value of ecosystem services. *Ecol. Econ.* 41(3). DOI:10.1016/S0921-8009(02)00091-5

[53] Huang, C.-L. and F.-H. Kung 2010. Drivers of Environmental Disclosure and Stakeholder Expectation: Evidence from Taiwan. *J. Bus. Ethics*. 96(3). DOI: 10.1007/s10551-010-0476-3

[54] Jahamani, Y. F. 2003. Green accounting in developing countries: The case of U.A.E. and Jordan. *Manag. Financ.* 29(8): 37–45. DOI: 10.1108/03074350310768418

[55] Javed, F., K. Yusheng, N. Iqbal, Z. Fareed, and F. Shahzad 2022. A Systematic Review of Barriers in Adoption of Environmental Management Accounting in Chinese SMEs for Sustainable Performance. *Front. Public Heal.*, 10, no. May: 1–15. DOI: 10.3389/fpubh.2022.832711

[56] Johnstone, L. 2018. Theorising and Modelling Social Control in Environmental Management Accounting Research. *Soc. Environ. Account. J.* 38(1): 30–48. DOI: 10.1080/0969160X.2017.1422778

[57] Johnstone, L. 2020. A systematic analysis of environmental management systems in SMEs: Possible research directions from a management accounting and control stance. *J. Clean. Prod.* 244. DOI:10.1016/j.jclepro.2019.118802

[58] Khanra, S., A. Dhir, P. Kaur, and M. Mäntymäki 2021. Bibliometric analysis and literature review of ecotourism: Toward sustainable development. *Tour. Manag. Perspect.*, vol. 37, no. October 2020. DOI:10.1016/j.tmp.2020.100777

[59] Kokubu, K., H. Kitada, K. Nishitani, and A. Shinohara 2023. How material flow cost accounting contributes to the SDGs through improving management decision-making. *J. Mater. Cycles Waste Manag*. DOI:10.1007/s10163-023-01696-7

[60] Kolk, A. and P. Perego 2010. Determinants of the adoption of sustainability assurance statements: An international investigation. *Bus. Strateg. Environ.*, vol. 19, no. 3, pp. 182–198. DOI: 10.1002/bse.643

[61] Kolk, A., D. Levy, and J. Pinkse 2008. Corporate responses in an emerging climate regime: The institutionalization and commensuration of carbon disclosure. *Eur. Account. Rev.* 17(4): 719–745. DOI:10.1080/09638180802489121

[62] Kumar, S., D. Sharma, S. Rao, W. M. Lim, and S. K. Mangla. 2022. Past, present, and future of sustainable finance: insights from big data analytics through machine learning of scholarly research. *Ann. Oper. Res.* DOI:10.1007/s10479-021-04410-8

[63] Kurniawan, H. Subowo, and I. Firmansyah, 2022. Bibliometric Analysis of Carbon Accounting Research. *Int. J. Energy Econ. Policy*, 12(3): 482–489. DOI: 10.32479/ijeep.12992

[64] Larrinaga-Gonzalez, C. and J. Bebbington 2001. Accounting change or institutional appropriation? - A case study of the implementation of environmental accounting. *Crit. Perspect. Account.*, vol. 12, no. 3. DOI:10.1006/cpac.2000.0433

[65] Latan, H., C. J. Chiappetta Jabbour, A. B. Lopes de Sousa Jabbour, S. F. Wamba, and M. Shahbaz 2018. Effects of environmental strategy, environmental uncertainty and top management's commitment on corporate environmental performance: The role of environmental management accounting. *J. Clean. Prod.*, vol. 180. DOI: 10.1016/j.jclepro.2018.01.106

[66] Laufer, W. S. 2033. Social Accountability and Corporate Greenwashing. *J. Bus. Ethics* 43(3): 253–261. DOI:10.1023/A:1022962719299

[67] Lavia López O. and M. R. W. Hiebl 2015. Management Accounting in Small and Medium-Sized Enterprises: Current Knowledge and Avenues for Further Research. *J. Manag. Account. Res.* 27(1): 81–119. DOI:10.2308/jmar-50915

[68] Lehman, G. 1999. Disclosing new worlds: A role for social and environmental accounting and auditing. *Accounting, Organ. Soc.*, vol. 24, no. 3. DOI: 10.1016/S0361-3682(98)00044-0

[69] Lisi, I. E. 2015. Translating environmental motivations into performance: The role of environmental performance measurement systems. *Manag. Account. Res.*, vol. 29. DOI: 10.1016/j.mar.2015.06.001

[70] Liu, X. M. J. Cobo, E.Herrera-Viedma, and F.Herrera 2013. Science Mapping Software Tools: Review, Analysis, and Cooperative Study AmongTools," *J. Am. Soc. Inf. Sci. Technol.*, vol. 64, no. July.

[71] Lohmann, L. 2009. Toward a different debate in environmental accounting: The cases of carbon and cost-benefit. *Accounting, Organ. Soc.*, vol. 34, no. 3–4, pp. 499–534. DOI: 10.1016/j.aos.2008.03.002

[72] Luo, J., M. Huang, and Y. Bai 2022. Visual analysis of low-carbon supply chain: Development, hot-spots, and trend directions. *Front. Environ. Sci.*, vol. 10, no. September: 1–21. DOI: 10.3389/fenvs.2022.995018

[73] Manewa, A., M. Siriwardena, and C. Wijekoon 2021. Life cycle costing in construction: Current trends and emerging directions," *World Constr. Symp.*, no. July: 403–412. DOI: 10.31705/WCS.2021.35

[74] Marres, N. 2011. The costs of public involvement: Everyday devices of carbon accounting and the materialization of participation. *Econ. Soc.*, vol. 40, no. 4, pp. 510–533. DOI:10.1080/03085147.2011.602294

[75] Mathews, M. R. 1997. Twenty-five years of social and environmental accounting research: Is there a silver jubilee to celebrate? *Accounting, Audit. Account. J.* 10(4): 481–531. DOI: 10.1108/EUM0000000004417

[76] Miah, J. H., S. C. L. Koh, and D. Stone 2017. A hybridised framework combining integrated methods for environmental Life Cycle Assessment and Life Cycle Costing. *J. Clean. Prod.* 168: 846–866. DOI:10.1016/j.jclepro.2017.08.187

[77] Milne M. J. and S. Grubnic 2011. Climate change accounting research: keeping it interesting and different. *Accounting, Audit. Account. J.*, vol. 24, no. 8, pp. 948–977. DOI: 10.1108/09513571111184715

[78] Milne, M. J. 1996. On sustainability; the environment and management accounting. *Manag. Account. Res.* 7(1): 135–161. DOI: 10.1006/mare.1996.0007

[79] Moneva, J. M., P. Archel, and C. Correa 2006. GRI and the camouflaging of corporate unsustainability. *Account. Forum*, vol. 30, no. 2, pp. 121–137. DOI: 10.1016/j.accfor.2006.02.001

[80] Monteiro, S. M. S. and B., Aibar-Guzmán 2010. Determinants of environmental disclosure in the annual reports of large companies operating in Portugal. *Corp. Soc. Responsib. Environ. Manag.* 17(4): 185–204. DOI: 10.1002/csr.197

[81] Muller, N. Z. and R., Mendelsohn 2007. Measuring the damages of air pollution in the United States. *J. Environ. Econ. Manage.*, 54(1): 1–14. DOI: 10.1016/j.jeem.2006.12.002

[82] Muller, N. Z., R. Mendelsohn, and W. Nordhaus 2011. Environmental accounting for pollution in the United States economy. *Am. Econ. Rev.* 101 (5): 1649–1675. DOI: 10.1257/aer.101.5.1649

[83] Nguyen, T. H. 2022. Factors affecting the implementation of environmental management accounting: A case study of pulp and paper manufacturing enterprises in Vietnam. *Cogent Bus. Manag.* 9(1). DOI:10.1080/23311975.2022.2141089

[84] Nyakuwanika, M., H. M. van der Poll, and J. A. van der Poll. 2021. A conceptual framework for greener goldmining through environmental management accounting practices (Emaps): The case of zimbabwe. *Sustain.*, 13(18). DOI: 10.3390/su131810466

[85] Owen, D. 2008. Chronicles of wasted time?: A personal reflection on the current state of, and future prospects for, social and environmental accounting research. *Accounting, Audit. Account. J.*, vol. 21, no. 2, pp. 240–267. DOI: 10.1108/09513570810854428

[86] Parker, L. D. 2005. Social and environmental accountability research: A view from the commentary box. *Accounting, Audit. Account. J.* 18(6): 842–860. DOI: 10.1108/09513570510627739.

[87] Paul, J., W. M. Lim, A. O'Cass, A. W. Hao, and S. Bresciani 2021. Scientific procedures and rationales for systematic literature reviews. *Int. J. Consum. Stud.*, no. April, pp. 1–16. DOI: 10.1111/ijcs.12695

[88] Pauliuk, S. 2018. Critical appraisal of the circular economy standard BS 8001:2017 and a dashboard of quantitative system indicators for its implementation in organizations. *Resour. Conserv. Recycl.*, vol. 129, no. September 2017, pp. 81–92. DOI: 10.1016/j.resconrec.2017.10.019

[89] Pérez, E. A., C. C. Ruiz, and F. C. Fenech 2007. Environmental management systems as an embedding mechanism: A research note. *Accounting, Audit. Account. J.*, vol. 20, no. 3, pp. 403–422. DOI:10.1108/09513570710748562

[90] Qian, W., R. L., Burritt, and G. S. Monroe 2018. Environmental management accounting in local government: Functional and institutional imperatives. *Financ. Account. Manag.*, vol. 34, no. 2, pp. 148–165. DOI:10.1111/faam.12151

[91] Sahu, A. K., R. K. Padhy, D. Das, and A. Gautam 2021. Improving financial and environmental performance through MFCA: A SME case study. *J. Clean. Prod.* 279, p. 123751. DOI: 10.1016/j.jclepro.2020.123751

[92] Scapens, R. W. 1994. Never mind the gap: towards an institutional perspective on management accounting practice. *Manag. Account. Res.*, 5(3): 301–321. DOI: https://doi.org/10.1006/mare.1994.1019

[93] Schaltegger, S. and D. Zvezdov 2015. Expanding material flow cost accounting. Framework, review and potentials. *J. Clean. Prod.* 108: 1333–1341. DOI: 10.1016/j.jclepro.2014.08.040

[94] Schaltegger, S. and M. Csutora 2012. Carbon accounting for sustainability and management. Status quo and challenges. *J. Clean. Prod.*, vol. 36, pp. 1–16. DOI: 10.1016/j.jclepro.2012.06.024

[95] Schaltegger, S. and R. L. Burritt 2010. Sustainability accounting for companies: Catchphrase or decision support for business leaders? *J. World Bus.*, vol. 45, no. 4, pp. 375–384. DOI: 10.1016/j.jwb.2009.08.002

[96] Schaltegger, S., D. Gibassier, and D. Zvezdov. 2013. Is environmental management accounting a discipline? A bibliometric literature review. *Meditari Account. Res.*, 21(1): 4–31. DOI: 10.1108/MEDAR-12-2012-0039

[97] Soderstrom, K. M., N. S. Soderstrom, and C. R. Stewart 2017. Sustainability/csr research in management accounting: A review of the literature. *Adv. Manag. Account.* 28: 59–85. DOI:10.1108/S1474-787120170000028003

[98] Stasiškienė, Ž. and J., Šliogerienė 2009. Sustainability assessment for corporate management of energy production and supply companies for lithuania. *Int. J. Strateg. Prop. Manag.* 13(1): 71–81. DOI:10.3846/1648-715X.2009.13.71-81

[99] Stechemesser K. and E. Guenther 2012. Carbon accounting: A systematic literature review. *J. Clean. Prod.*, vol. 36, pp. 17–38. DOI: 10.1016/j.jclepro.2012.02.021

[100] Stechemesser, K. and E. Guenther. 2012. Carbon accounting: A systematic literature review. *J. Clean. Prod.* 36: 17–38. DOI: 10.1016/j.jclepro.2012.02.021

[101] Steer, A. and E., Lutz 1993 Measuring environmentally sustainable development. *Finance Dev.* 30(4): 20–23. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-0027758266andpartnerID=40andmd5=fa60636b40386629b3d3624aa5997251

[102] Thompson P. and C. J. Cowton 2004. Bringing the environment into bank lending: Implication for environmental reporting. *Br. Account. Rev.*, vol. 36, no. 2, pp. 197–218. DOI: 10.1016/j.bar.2003.11.005

[103] Tukker A. *et al.* 2013. EXIOPOL - Development And Illustrative Analyses of a Detailed Global Mr Ee Sut/Iot. *Econ. Syst. Res.*, vol. 25, no. 1, pp. 50–70. DOI: 10.1080/09535314.2012.761952

[104] Tukker, A. *et al.* 2009. Towards a global multi-regional environmentally extended input-output database. *Ecol. Econ.*, vol. 68, no. 7, pp. 1928–1937. DOI: 10.1016/j.ecolecon.2008.11.010

[105] UNDSD, "Environmental Management Accounting Procedures and Principles," *Outlook*, vol. 145, no. 12, p. 153, 2001, [Online]. Available: www.un.org/esa/sustdev/publications/proceduresandprinciples.pdf

[106] Unerman J. and B. O'Dwyer 2007. The business case for regulation of corporate social responsibility and accountability. *Account. Forum*, vol. 31, no. 4, pp. 332–353. DOI: 10.1016/j.accfor.2007.08.002

[107] Vanoli, A. 1995 Reflections on Environmental Accounting Issues. *Rev. Income Wealth* 41(2): 113–137. DOI: 10.1111/j.1475-4991.1995.tb00104.x

[108] Verma, S. and N., Yadav 2021. Past, Present, and Future of Electronic Word of Mouth (EWOM). *J. Interact. Mark.* 53: 111–128. DOI: 10.1016/j.intmar.2020.07.001

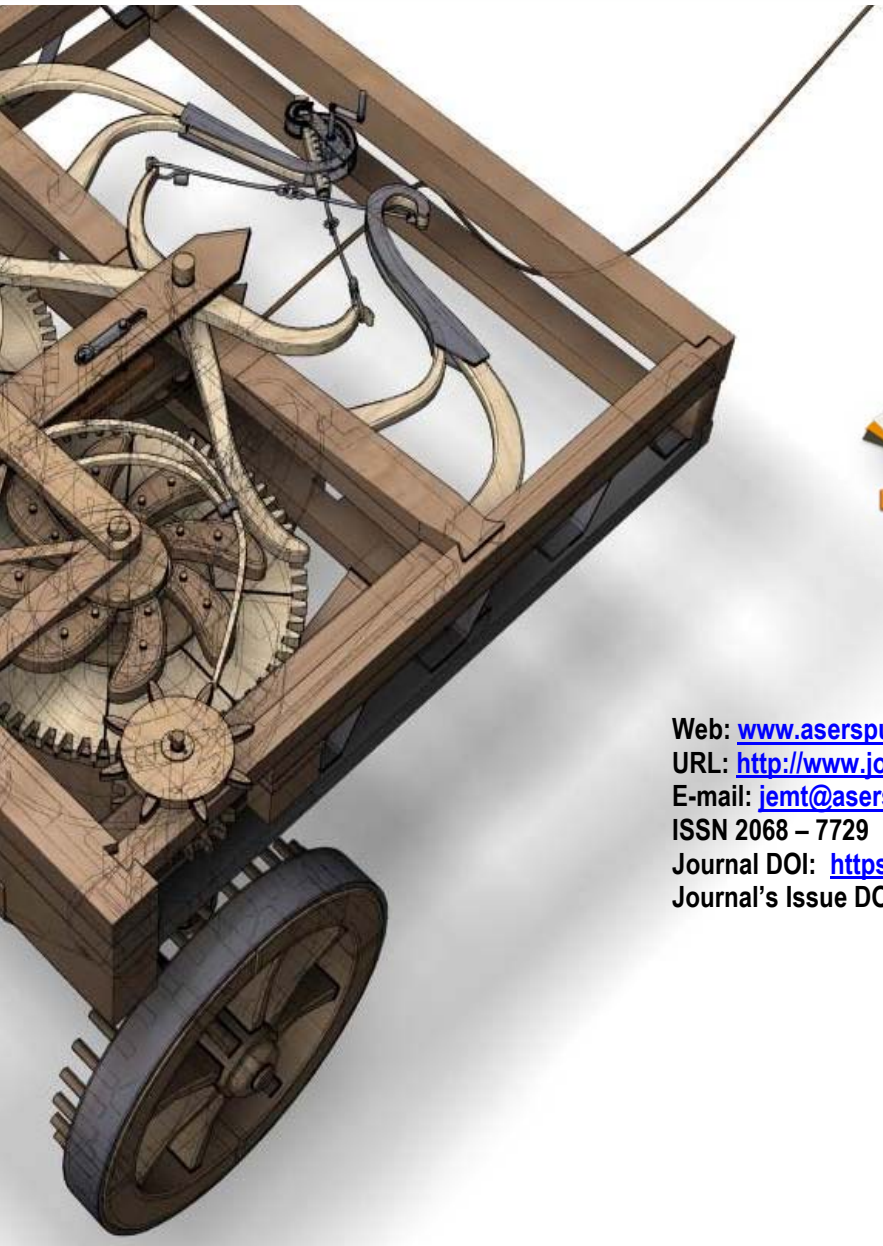
[109] Wang, T. and K. Ismail, and K. S. Abas Azmi 2022. The Rise of MCS and EMA in the Sustainable Field: A Systematic Literature Analysis. *Sustain.* 14(24). DOI: 10.3390/su142416532

[110] Wu, S. and H., Han 2020. Sectoral changing patterns of China's green GDP considering climate change: An investigation based on the economic input-output life cycle assessment model. *J. Clean. Prod.* 251. 10.1016/j.jclepro.2019.119764

[111] Yin, L., A. Sharifi, H. Liqiao, and C. Jinyu 2022. Urban carbon accounting: An overview. *Urban Clim.*, 44(June): 101195. DOI: 10.1016/j.uclim.2022.101195.

[112] Zheng, Y., H. Yu, and Y. Zhang. 2022. A bibliometric review on carbon accounting in social science during 1997–2020. *Environ. Sci. Pollut. Res.* 29(7): 9393–9407. DOI: 10.1007/s11356-021-17600-5

ASERS



ASERS Publishing

Web: www.aserspublishing.eu
URL: http://www.journals.aserspublishing.eu/jemt
E-mail: jemt@aserspublishing.eu
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt
Journal's Issue DOI: https://doi.org/10.14505/jemt.v14.5(69).00