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Environmental Management Control Tools: A Bibliometric Analysis Review

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Purpose: This study provides a comprehensive bibliometric analysis of the environmental management control tools literature. It seeks to summarize this body of literature's growth and identify the most influential authors, journals, and articles in this field. The main objective of this article is to determine which tools are most prominent in the literature. Methodology/approach: The study examined 541 articles published in 126 academically indexed journals in the Scopus database. The analyzed timeframe covers the period from 2011 to 2023. We used VOSviewer software for statistical calculations to map the collaborations among authors and journals and to develop a conceptual and intellectual map of the field. Results: Our findings show that the literature on environmental management control tools is flourishing. The authors who dominated this period are mainly Schaltegger, Sala, and Ulgiati. The Journal of Cleaner Production is the primary source of publications, with an astounding 241 documents. The United States attained the leading position in terms of publication with 86 documents, which explains its willingness to collaborate with other countries, followed by China and Australia with 70 and 66 papers, respectively. Finally, bibliometric analysis shows that "life cycle assessment", "cost-benefit analysis", and "sustainability reporting" are the most prominent tools in research on this topic. Originality/value: This article provides several starting points for researchers and practitioners investigating environmental management control tools. It contributes to broadening the field's vision and then offers recommendations for future studies.

Keywords: environmental management control, life cycle assessment, cost-benefit analysis, sustainability reporting, bibliometric analysis review

Introduction

Environmental management control, particularly environmental management accounting, has garnered considerable attention from academics and practitioners, proven by the wealth of academic research on this subject. This field, which started as a niche subject in the late 1990s and early 2000s, has evolved into a widely recognized topic today. Some of the studies are normative in laying the conceptual foundations of environmental management control about, and in extension of, the field of classical management control. In contrast, other studies are interrogations on the involvement of professions in the way environmental accounting and

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environmental management control are taught, and some others address the construction of environmental accounting tools. Therefore, it is pertinent to ask: "How has research into management control tools evolved, and how could it progress further?"

To answer this question, a bibliometric review was carried out in two stages, using statistical methods to synthesize the existing literature. This study makes several contributions to the field. First, it highlights key historical milestones, including the most influential authors, journals, and countries. Second, leveraging mega-data technology, it examines co-authorship and co-occurrence networks. Collectively, these contributions offer valuable insights that expand the scope of this research.

Conceptual Framework

Environmental Strategy as a Translation of CSR Commitment

The concept of corporate social responsibility (CSR) is broad and not very stable (Saulquin & Schier, 2007). Definitions of CSR fall into two main branches: academic and institutional.

At the academic level (Bowen, 1953), the founding father of CSR (Carroll, 1999, pp.268-270) defines CSR in his book *Social Responsibilities of the Businessman* as "the obligations of businessmen to pursue those policies, to make those decisions, or to follow those lines of action which are desirable in terms of the objectives and values of our society".

At the institutional level, ISO 26000 has defined CSR as an organization's responsibility for the impact of its decisions and activities on society and the environment through ethical and transparent behavior that:

- Contributes to sustainable development, including the health and well-being of society;
- Takes account of stakeholders' expectations;
- Complies with applicable laws and international standards of behavior;
- Is integrated throughout the organization and implemented in its relationships.

Generally speaking, CSR is built around three dimensions that can be illustrated in the figure below.

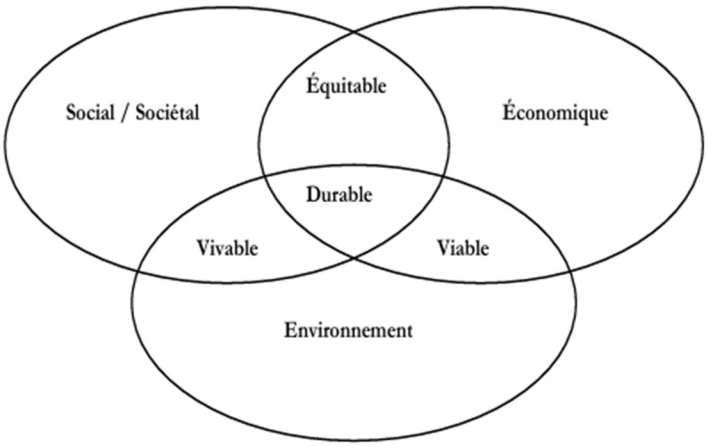

Figure 1. CSR at the intersection of three key dimensions. Source: Brundtland, 1987.

CSR provides a broad framework of organizational responsibilities toward society and the environment, emphasizing ethical behavior, stakeholder engagement, and sustainable development. Within this broad framework, environmental strategy emerges as a focused concept, defining how companies manage their interactions with the natural environment (Aragón-Correa & Sharma, 2003). This strategy encompasses specific

goals, plans, and mechanisms that range from compliance-based approaches to proactive initiatives aimed at reducing environmental impact and enhancing sustainability (Hart, 1995; Sharma, 2000). Thus, while CSR outlines general principles, environmental strategies offer a structured pathway for achieving eco-efficiency and aligning corporate practices with ecological concerns (Klassen & Angell, 1998; Marshall, Cordano, & Silverman, 2005). CSR commitment leads the company to mobilize its skills and innovate in order to be able to internationalize the consequences of its activities and decide on the environment (Mokhtari & Asdiou, 2017).

An environmental strategy can be seen as a focused concept that defines a company's "strategy to manage the interface between its business and the natural environment" (Aragón-Correa & Sharma, 2003). Environmental strategies consist of goals, plans, and mechanisms that determine how organizations respond to environmental concerns (Klassen, 2001). Existing literature identifies various types of environmental strategies, generally situated along a proactive-reactive spectrum (Sharma, 2000). Companies with reactive environmental strategies limit their efforts to meeting legal requirements and pollution controls, aiming to avoid sanctions and protect their reputation. In contrast, companies pursuing a proactive environmental strategy (PES) actively work to protect the environment by reducing waste, energy, and material consumption at the source (Russo & Fouts, 1997; Sharma, 2000). These firms are better equipped to address new environmental challenges, capitalize on emerging opportunities, anticipate public concerns, and undertake voluntary environmental initiatives across multiple functions (González-Benito, 2008; Klassen & Angell, 1998; Nath & Ramanathan, 2016). Proactive firms treat regulatory compliance as a minimum standard and strive to exceed it (Marshall et al., 2005). When PES is robust, firms prioritize redesigning products, processes, and business models to minimize environmental impact across the entire operations lifecycle and value chain (Hart, 1995). Consequently, firms with PES integrate environmental criteria into decision-making and are expected to measure, monitor, and report on environmental as well as economic performance (P. Sharma & S. Sharma, 2011). They implement eco-control systems to support their PES and to achieve both environmental and financial outcomes.

Environmental Management Control Tools

The transition to an environmental strategy may require a profound reassessment of the business model, and striking a balance between environmental objectives and financial imperatives can represent a complex challenge for companies (El Hmieche & Asdiou, 2024). With the growing institutional and social pressure, harmonizing "management control" and "natural environment" became vital for corporate environmental responsibility. This situation originated in the 1970s with the introduction of the internalization of environmental externalities generated by the economic activity of companies' accounting as a concept in the United States and Switzerland (Christophe, 1995; Richard, 2009). We are talking about the birthplace of environmental accounting, also known as green accounting. Since the groundbreaking work of Christophe (1995) and Gray (1992), this new theme has first gained scope in the accounting and reporting literature, then extended to management control (Asdiou & Mokhtari, 2019; Cormier & Magnan, 2007; Déjean & Martinez, 2009; Depoers, 2010; Gray & Bebbington, 2001; Gray & Milne, 2007; Quairel, 2004; Rivière-Giordano, 2007).

Prior studies have acknowledged the significance of the Management Control System (MCS) in overseeing environmental concerns and accomplishing sustainability objectives. According to Gond, Grubnic, Herzig, and Moon (2012), MCS is necessary to incorporate social and environmental activities into a company's goals, organizational processes, and strategy. Gond and Herrbach (2006) demonstrate that to incorporate sustainability into an organization, formal management control systems are required. Meanwhile, Burritt and Schaltegger (2010)

conclude that managers can evaluate relevant risks, and opportunities, and provide information on the use and cost of environmental resources thanks to the MCS. But, Jansson, Nilsson, and Rapp (2000) argue that for a business to be eco-friendly, environmental concerns must be included in MCS, management approaches, and attitudes. Riccaboni and Luisa Leone (2010) in their study on Procter & Gamble (P&G) find that using both formal and informal controls, as well as integrating environmental concerns into their planning and monitoring processes, is key success factor for adopting sustainability.

In light of these developments, management control in light of environmental developments has recently adjusted to deliver a more comprehensive view of performance as well as to integrate and provide new management tools related to environmental concerns (Essid, 2009; Essid & Berland, 2011; Maurel & Tensaout, 2014), hence the emergence of environmental management control tools. Antheaume (2013) has conducted a literature review based on the publications of the EMAN (Environmental Management Accounting Network), the Journal of Cleaner Production, theses, and articles written in French about the subject of environmental accounting. This research pinpointed nine tools of environmental management control: sustainability balanced scorecard, investment decision, environmental cost calculation, physical flow accounting, cost-effectiveness accounting, full cost accounting, environmental impact/ecological footprint indicators, life cycle analyses (LCA), and life-cycle costs (LCC).

In his book *Environmental Management, Management, and Control* (Renaud, 2015), he segments the tools of environmental management control into three phases: finalization, piloting, and post-evaluation. The finalization phase comes before any environmental action, it sets performance & strategic targets and includes evaluations such as the Carbon Footprint & Life Cycle Assessment (LCA), and it also contains environmental programs and green budgets. During the piloting phase, goals are tracked and actions are adjusted via internal audits and reporting, resulting in performance gaps to be filled and experiential learning to be encouraged. On the other hand, post-evaluation enhances credibility and supports the renewal of certifications such as ISO 14001 through the overall examination of environmental performance, while highlighting strengths and areas for improvement to ensure continuous standard-compliance improvement.

Methodology

Our study is founded on a bibliometric approach; this specific method of documentary research applies mathematical and statistical tools to analyze materials such as scientific articles (Ferrante, 1978). The bibliometric data were fetched from the Scopus database and processed by VOSviewer as the main tool for analysis and representation of the results.

Data Collection

The identification phase takes into account several key elements, consisting of source type, search engine, categories, language, period, and keywords (Díaz Tautiva, Huaman, & Ponce Oliva, 2024).

Concerning the search engine, we rely solely on the Scopus database in this analysis, which is a globally acclaimed repository of high-quality articles from renowned publishers (Alves & Mariano, 2018; Dangelico, 2016; Ochoa, Alvarez, & Acevedo, 2019). The notable distinction between Scopus and WoS lies in the fact that the former gives full access to its content on a single subscription without any modulation, and offers a global coverage that Web of Science (WoS) (Pranckutė, 2021). This facilitates the generation of future studies' results. Our research covers the period between 2011 and 2023.

In this study, we targeted journal articles exclusively, not including other types of publications such as books, book chapters, and conference papers on account of their limited contribution to empirical and theoretical discussions (Harsanto & Firmansyah, 2023). Within the spectrum of research categories, this study emphasizes the areas of commerce, management, and accounting, and to avoid any linguistic bias, the search language is purely English and French (Alatawi, Ntim, Zras, & Elmagrhi, 2023; Gulluscio, Puntillo, Luciani, & Huisingh, 2020; Stechemesser & Guenther, 2012). These decisions are designed to guarantee a comprehensive and high-quality review (Ibrahim et al., 2022).

Therefore, the query used is Title-abs-Key ("carbon assessment" or "life cycle assessment" or "LCA" or "life cycle costing" or "LCC" or "green budgeting" or "environmental reporting" or "sustainability reporting" or "sustainability balanced scorecard" or "environmental audit" and "accounting") and pubyear > 2010 and pubyear < 2024 and (limit-to (subjarea, "busi")) and (limit-to (doctype, "ar")) and (limit-to (language, "English")) and (limit-to (srctype, "j") and (limit-to (pubstage, "final")).

Data Processing and Analysis: 30/03/2024

In our study, we started by choosing a sample of 3,297 scientific contributions. Subsequently, a selection was made based on specific identification criteria. This selection process took into consideration several aspects: the year of publication (N = 725 excluded), the field of study (N = 1,857 excluded); the type of document (N = 153 excluded); the language (n = 4 excluded), the source type (N = 6); and the publishing phase (N = 11), thus resulting in a total of 541 documents picked. The feasibility phase entailed a thorough examination of titles, keywords, and abstracts to confirm the relevance of the selected articles to our research focus on environmental management control tools. This step also involved verifying data accuracy to ensure suitability for bibliometric analysis, with no exclusions (N = 0). Subsequently, the inclusion phase, conducted independently as the final stage, reinforced the robustness and validity of the preceding steps. A preliminary statistical analysis was then performed to extract key insights. Finally, a comprehensive bibliometric analysis was carried out, utilizing VOSviewer as the primary tool and Java as a secondary tool for visualization.

Table 1

Inclusion and Exclusion Criteria

Inclusion criteria (IC)	Exclusion criteria (EC)
• Studies published before 2024; • Subject area: "Business, Management and Accounting" and "Economics, Econometrics and Finance"; • Document type: Articles only; • Language: English only; • Source type: Journal only; • Publication stage: Final only.	• Studies published in 2024; • Subject area: Environmental Science, Energy, Engineering, etc.; • Document type: Conference papers, reviews, books, book chapters, etc.; • Language: Chinese, German, Spanish, etc.; • Source type: Conference proceeding, book series, trade journal; • Publication stage: Article in press.

Source: Authors.

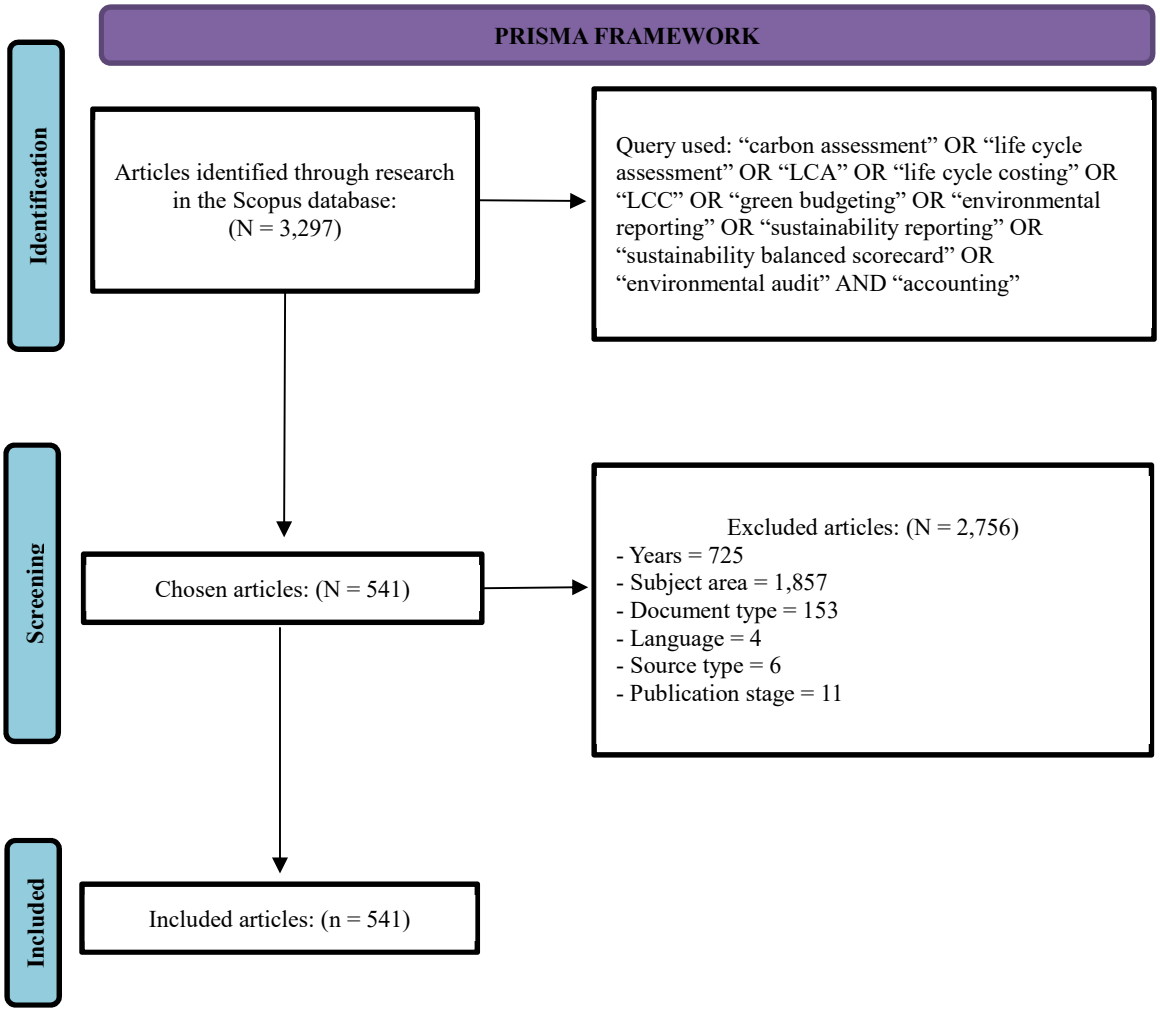

Figure 2. PRISMA framework. Source: Authors.

Results and Discussions

In this section, we present the results of our bibliographic analysis. We split it into two parts: The first covers the descriptive results, and the second looks into the analysis of co-authorship and co-occurrence networks using the VOSviewer software.

Descriptive Analysis of Results

During this period, we have noticed an increase in the number of publications on environmental management control tools, which reflects the growing enthusiasm for environmental management in the field of management accounting and control. Between 2011 and 2023, the number of publications increased significantly, going from 16 in 2011 to 60 in 2023, with an average annual growth rate of 14%.

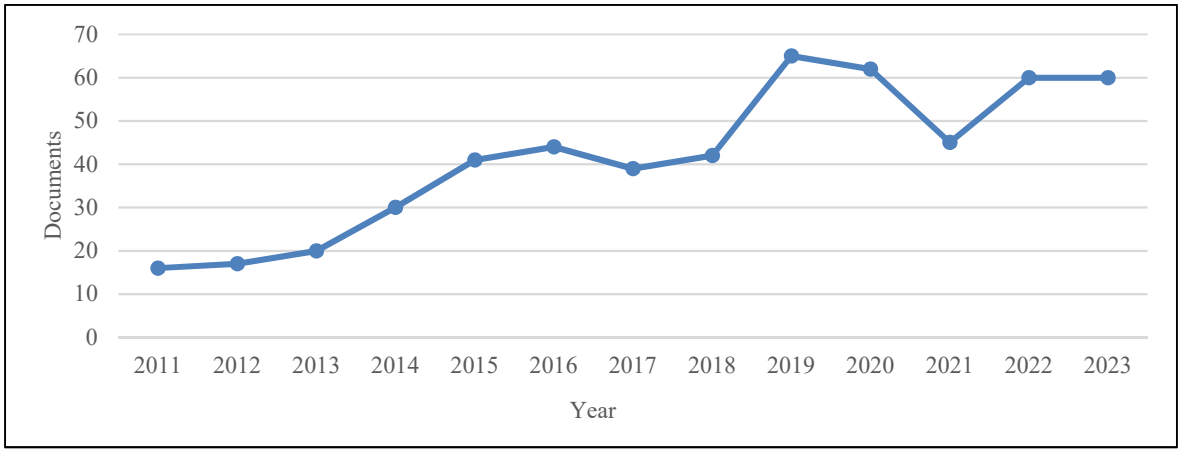

Figure 3. Yearly evolution in annual publication counts. Source: Authors.

Over the years, this pattern has shown a pretty constant increasing trend, with some periods of stagnation, such as the period between 2016 and 2018. In 2011 and 2016, the growth seems to be relatively moderate, from 16 to 44. However, that's not the case between 2018 and 2023, as we notice a significant escalation of this growth, with more significant increases from year to year; for instance, the document count went from 42 in 2018 to 65 in 2019.

When it comes to growth, 2021 seems to have been a unique year. There was a discernible drop in publications to 45 papers, which is 17 fewer articles than in the year prior (n = 62; 2020).

Table 2

Top 10 Influential Reviews in This Field

Journal	Documents	TP	TC	Cite score	Publisher
Journal of Cleaner Production	241	19,022	351,758	18.5	Elsevier
Accounting, Auditing and Accountability Journal	40	356	2,719	7.6	Emerald Publishing
Sustainability Accounting, Management and Policy Journal	23	191	1,340	7.0	Emerald Publishing
Business Strategy and the Environment	11	831	14,826	17.8	Wiley-Blackwell
Journal of Environmental Accounting and Management	11	118	213	1.8	L & H Scientific Publishing, LLC
Social and Environmental Accountability Journal	11	62	182	2.9	Taylor & Francis
Meditari Accountancy Research	10	234	1,162	5.0	Emerald Publishing
Journal of Accounting and Organizational Change	7	136	391	2.9	Emerald Publishing
Journal of Applied Accounting Research	7	156	606	3.9	Emerald Publishing
Journal of Business Ethics	7	1,413	16,948	12.0	Springer Nature

Source: Authors.

We notice that the Journal of Cleaner Production clearly stands out with an impressive 241 papers during that period, a CiteScore of 18.5, and a total citation of 351,758, demonstrating its central role in the field. The Accounting, Auditing, and Accountability Journal follows with 40 papers (CiteScore = 7.6), illustrating a significant but not as significant a presence compared to Journal of Cleaner Production. Likewise, the Sustainability Accounting, Management, and Policy Journal offers 23 papers, highlighting the persistent interest in environmental management in specific fields such as industry, management, accounting, and audit. Moreover, the presence of Emerald Publishing as the main publisher for half of these Top 10 journals is noticeable.

Table 3

Top 10 Most Productive Authors in this Field

Authors	Documents	First year of publishing	TP	TC	h-index	Current affiliation	Countries
Schaltegger, S.	7	1994	156	13,941	60	Leuphana Universität Lüneburg	Germany
Sala, S.	6	2002	154	10,362	53	European Commission Joint Research Centre	Belgium
Ulgiati, S.	6	1996	277	17,567	62	Beijing Normal University	China
Larrinaga, C.	5	1997	72	3,794	28	Universidad de Burgos	Spain
James, M. L.	4	2007	20	93	5	The California State University	United States
Maroun, W.	4	2011	89	2,002	27	University of the Witwatersrand	South Africa
Patten, D. M.	4	1995	70	9,439	40	Illinois State University	United States
Unerman, J.	4	1998	59	5,737	35	Royal Holloway, University of London	United Kingdom
De Villiers, C.	4	1995	92	5,737	38	The University of Auckland Business School	New Zealand
Atkins, J.	3	2014	43	941	14	Cardiff Business School	United Kingdom

Source: Authors.

The biggest contributing authors in this field include Schaltegger, Sala, and Ulgiati, with 7, 6, and 6 documents, with an h-index equal to 60, 53, and 62 respectively. Schaltegger's research emphasizes on CSR, Sustainability Reporting and Business Model Innovation. For instance, among his most cited articles, we find "Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions", "The Sustainability Balanced Scorecard—Linking Sustainability Management to Business Strategy", and "Business Cases for Sustainability: The Role of Business Model Innovation for Corporate Sustainability" with 1,050, 744, and 735 quotes, respectively.

Table 4

Top 10 Most Cited Articles in this Field

Title of the article	Authors	Journal	Year	TC
Integrated reporting: Insights, gaps and an agenda for future research	De Villiers, C., Rinaldi, L., Unerman, J.	Accounting, Auditing and Accountability Journal	2014	503
Sustainability reports as simulacra? A counter-account of A and A+ GRI reports	Boiral, O.	Accounting, Auditing and Accountability Journal	2013	447
Environmental reporting and its relation to corporate environmental performance	Clarkson, P. M., Overell, M. B., Chapple, L.	Abacus	2011	408
Seeking legitimacy for new assurance forms: The case of assurance on sustainability reporting	O'Dwyer, B., Owen, D., Unerman, J.	Accounting, Organizations and Society	2011	390
Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A literature review	Ghisellini, P., Ripa, M., Ulgiati, S.	Journal of Cleaner Production	2018	351
Integrated reporting and internal mechanisms of change	Stubbs, W., Higgins, C.	Accounting, Auditing and Accountability Journal	2014	296
Integrated reporting: On the need for broadening out and opening up	Brown, J., Dillard, J.	Accounting, Auditing and Accountability Journal	2014	271
Mandatory CSR and sustainability reporting: Economic analysis and literature review	Christensen, H. B., Hail, L., Leuz, C.	Review of Accounting Studies	2021	225
Integrating corporate sustainability assessment, management accounting, control, and reporting	Maas, K., Schaltegger, S., Crutzen, N.	Journal of Cleaner Production	2016	220
Evidence in development of sustainability reporting: A case of a developing country	Amran, A., Haniffa, R.	Business Strategy and the Environment	2011	203

Source: Authors.

According to the number of citations, the period between 2011 and 2014 had the majority of the Top 10 most influential articles (70%). The following three researches: “Integrated Reporting: Insights, Gaps, and an Agenda for Future Research”, “Sustainability Reports as Simulacra? A Counter-Account of A and A+ GRI Reports”, and “Environmental Reporting and Its Relation to Corporate Environmental Performance” are the most quoted, with 503, 447, and 408 respectively. It is worth noting that 40% of these articles were published in the Accounting, Auditing, and Accountability Journal.

Table 5

Top 10 Most Influential Countries in this Field

Countries	Documents	Citations	Most influential university
United States	86	3,074	University of Chicago
China	70	2,486	Beijing Normal University
Australia	66	2,659	University of Tasmania
United Kingdom	64	4,193	Queen’s University Belfast
Italy	62	2,561	University of Bologna
Spain	45	1,777	Universitat Autònoma de Barcelona
Germany	35	1 378	Leuphana University
France	28	1,857	KEDGE Business School
Canada	26	1,221	Université Laval
Netherlands	26	2,053	University of Amsterdam

Source: Authors.

In this field, the United States stands out as the leading country, with a total of 86 published documents, followed by China and Austria, which have produced 70 and 66 documents, respectively. Contributions come from 74 countries, with publication volumes ranging from one to 86 documents. Among the continents with the highest publication output, Europe leads with a substantial total of 260 documents, followed by North America (N = 112), Asia (N = 70), and Australia (N = 66). Despite a relatively low number of publications, the United Kingdom holds the highest citation count, with 4,193 citations, highlighting the significant impact of its research. The United States follows closely with 3,074 citations.

Regulations requiring the disclosure of environmental compliance information have had an impactful influence on this high number of publications. For example, in the United States, the Environmental Protection Agency (EPA)’s mandatory Greenhouse Gas Reporting Rule (GHG Reporting Rule) was introduced in 2019 under the 1970 Clean Air Act. In China, the National Development and Reform Commission (CNDR) implemented regulations in 2014. Meanwhile, Australia has enforced the National Greenhouse Gas and Energy Reporting Scheme (NGER). Finally, in 2013, the UK launched the regulation of strategic reporting in its Companies Act.

Bibliometric Analysis

Scopus data were treated in the VOSViewer software to generate bibliometric co-authorship and co-occurrence networks.

Co-citation networks analysis. We started off with an analysis of co-authorship—author by setting the minimum publication count to two and the minimum author quote to two, which brings about 125 authors out of 1,772 complying with the criteria.

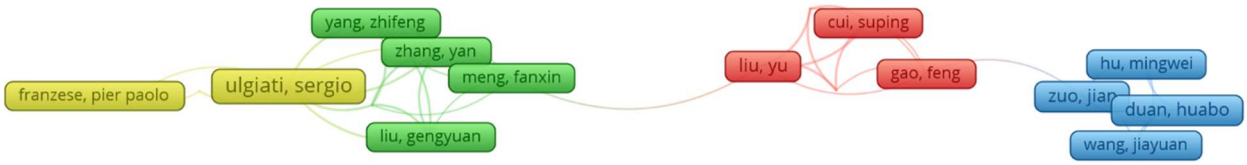

Figure 4. Graphical representation of co-authorship networks—authors. Source: VOSviewer.

Following the concept of bibliographic coupling, the cluster of the same color represents a shared area of research. We can set apart four clusters after a surface reading. Cluster 1 in yellow, portrayed by Ulgiati, Franzese, Ghisellini, and Viglia, who are interested in environmental accounting. The article by Viglia and Franzese, entitled "Integrating Environmental Accounting, Life Cycle, and Ecosystem Services Assessment", is one product of their collaborations.

Cluster 2 in green, represented by Yang, Zhang, Meng, and Liu, which are mostly interested in exploring the carbon balance and analysis of greenhouse gas emissions. The core article for this cluster is "Structural Analysis of Embodied Greenhouse Gas Emissions From Key Urban Materials: A Case Study of Xiamen City, China".

Cluster 3 in red, represented by Liu, Cui, and Gao, mainly covers topics related to life cycle assessment. We give the example of the article: "Comparative Life Cycle Assessment of Different Fuel Scenarios and Milling Technologies for Ceramic Tile Production: A Case Study in China".

At last, Cluster 4 in blue is represented by Hu, Zuo, Duan, and Wang, sharing an interest in the topics of life cycle assessment and carbon balance. Among their most cited articles, we find "Quantification of Carbon Footprint of Urban Roads via Life Cycle Assessment: A Case Study of a Megacity in Shenzhen, China".

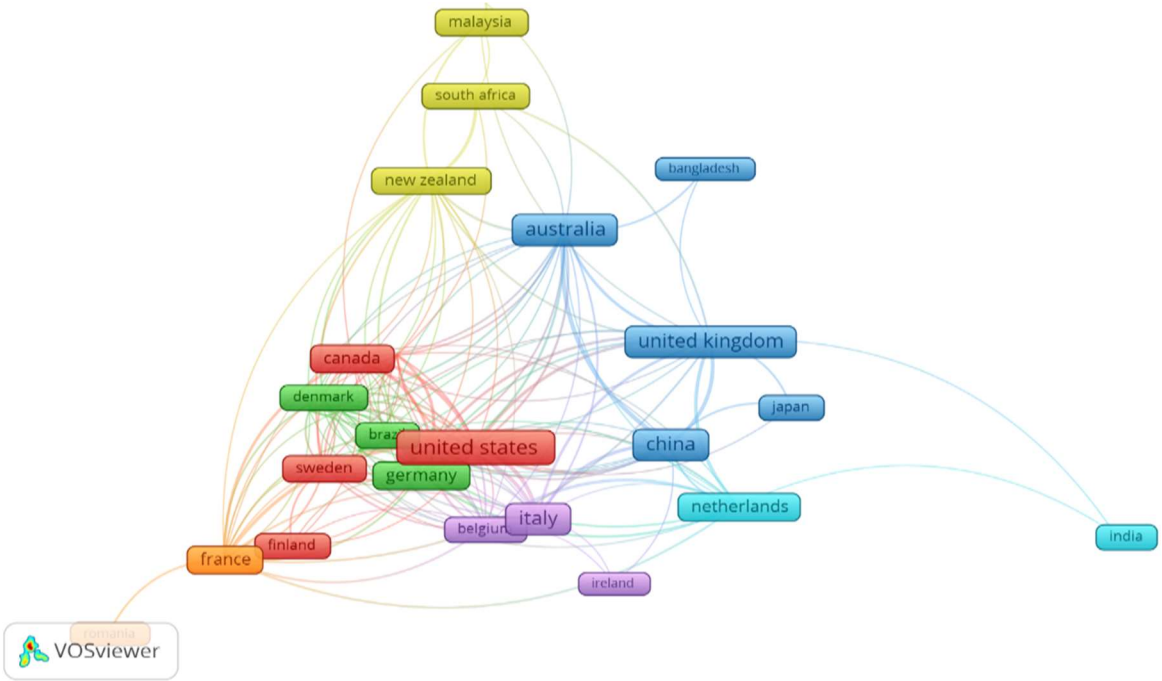

Figure 5. Graphical representation of co-authorship networks—countries. Source: VOSviewer.

Firstly, we notice that the blue and red clusters are well defined with distinct positions. The red cluster is more centered, between the green, purple, and orange ones. Their connection is clear, with the United States as the central partner country. Apart from Finland, all cluster countries collaborate with countries outside the grouping, such as the United Kingdom, Australia, and New Zealand.

The five countries in the blue cluster have several ongoing internal and external collaborations. We can clearly notice the importance of the United Kingdom for this cluster, because it is not only central to the blue cluster; it's also core to all collaborations. China, the United States, and Australia have the most significant ties with this group. We can partly explain the importance of the United Kingdom with the number of documents published. Finally, we discover that, in contrast to the other nations, Bangladesh only collaborates within the blue cluster.

Based on this analysis, we can draw some interesting conclusions. The United States, the UK, and Australia dominate collaborations and are connected to every cluster. This is due to a higher number of publications compared to other countries.

Co-occurrence network analysis. In bibliometrics, key co-occurrence analysis is widely known as the technique used to determine the most commonly associated and relevant terms for a particular research area (Ellegaard & Wallin, 2015). Therefore, these types of analyses are the way to go when looking to identify the critical trends and themes of a particular discipline.

In order to identify the most important environmental management control tools, we analyzed 3,416 keywords. The resulting co-current map was generated by taking into account keywords that appear a minimum of five times in all collected documents. A total of 176 keywords that were linked to each other fit our criteria.

To visualize the scientific literature on environmental management control tools, we used the powerful Vosviewer's "time view" feature. This feature facilitates the identification of emerging topics and provides a complete way to analyze the field in a nuanced and sophisticated way.

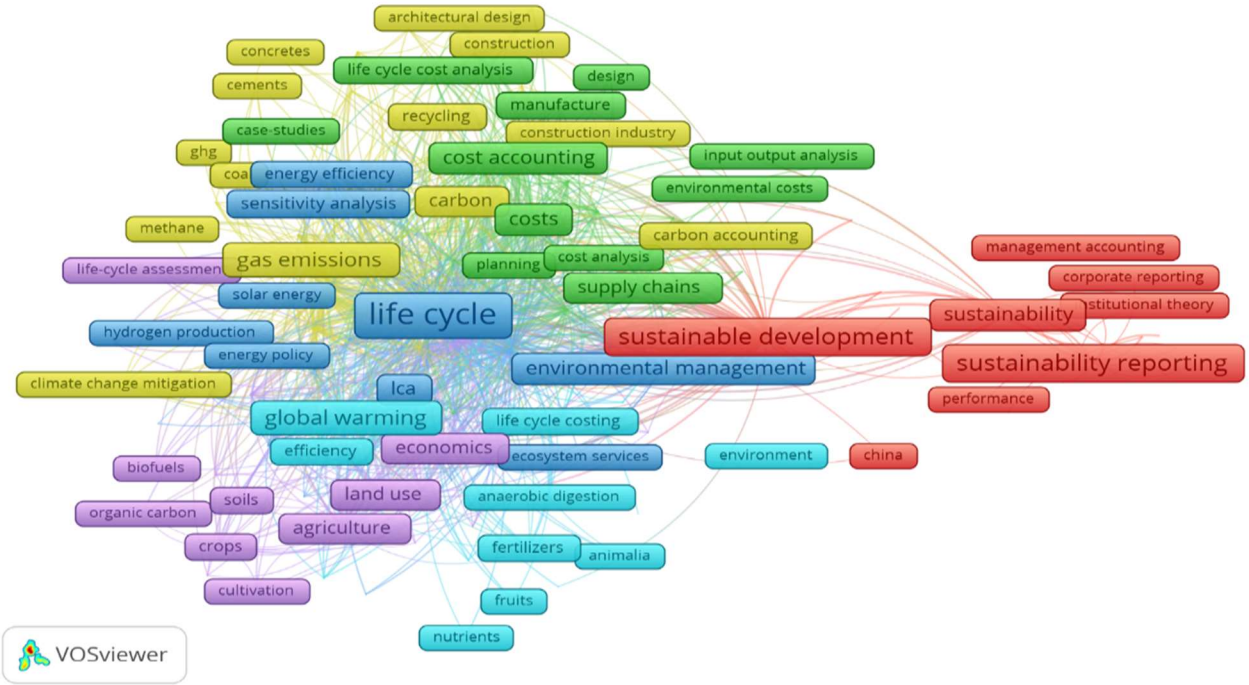

Figure 6. Graphical representation of the keyword co-occurrence network. Source: VOSviewer.

This figure highlights the most regularly used keywords in literature. We can observe that “life cycle assessment”, “cost benefit analysis”, and “sustainability reporting” are the tools with the highest number of appearances.

The color of the nodes stands for the keyword groups, which often contain simultaneous words and can be interpreted as broad research topics in the field. The groups can be divided into six broad clusters, each of which summarizes a theme of interest in the field of environmental management control research tools.

Cluster 1, in blue, has the keyword “life cycle” (logically very linked to the other clusters), associated with the terms “Life Cycle Assessment (LCA)”, “environmental management”, and “environmental impact”. In order to help businesses implement their environmental management systems and lessen the environmental impact of their operations, these documents investigate life cycle assessment (LCA), a systematic tool for evaluating potential environmental impacts associated with all stages of a product, service, or process life, starting from the extraction of raw materials to its expiration.

In the green color (Cluster 2), which does not have a real dominant keyword, we can notice the strong presence of the notion of “cost”. Granted as examples, “cost benefit analysis,” “cost accounting”, “environmental costs”, and “life cycle cost analysis”. These studies take a shot at providing, each with its own tools, different perspectives to assess the financial and environmental impact of decisions taken by companies. It’s in the context of respecting environment and fulfilling the goals in terms of sustainable development.

Cluster 3, in red, has the central notion of “sustainability reporting”, which we consider the title of this cluster, and is associated with the terms “environmental reporting”, “corporate reporting”, and “corporate social responsibility”. This group focuses on environmental reporting as a crucial tool for communicating and disclosing information on enterprise efforts in terms of sustainable development (SD) and corporate social responsibility (CSR). This cluster is recognized by its limited collaborations, which are sometimes even null. With the exception of “sustainable development” and “sustainability”, all other keywords have no connection with keywords in the other clusters.

Furthermore, the presence of keywords such as “environmental impact”, “Environmental management”, and “environmental performance” highlights their importance in the field of environmental management control. These keywords provide in-depth insights into the role and impact of these environmental management control tools in reaching the Sustainable Development Goals.

Moreover, the inclusion of the keywords “greenhouse gases”, “gas emissions”, and “global warming” in the yellow cluster emphasizes their importance as environmental management control tools. These keywords offer in-depth analyses of the function and impact of these tools in reducing the effects of climate change, and show how environmental management control has evolved into a number of different fields in response to the changing demands and difficulties faced by the corporate sector.

Conclusion

This bibliometric analysis of the existing literature on environmental management control tools reveals the following findings:

The research community is growing: The growing number of publications and journals (from 16 papers annually in 2011 to 60 papers in 2023) proves that this field is developing considerably. In fact, the discipline of environmental management control has established itself as a sub-discipline of management control in academic literature since the early 2000s. Moreover, the authors interested in the tools of environmental management

control are constantly increasing, proving the attractivity of this subject in the academic community. The overwhelming quantity of articles with a wide range of co-authors demonstrates the interdisciplinary character of environmental management control study.

Authors and dominating countries in academic discussion: Schaltegger, Sala, and Ulgiati, are the authors who have influenced and continue to impact the literature most. On the other hand, the countries where the discussion is most fruitful are the United States, China, Australia, and the United Kingdom. This proves that environmental management control tools are a topic of interest on different continents. However, these countries did not box themselves in; instead, they developed some strong collaborations, even with other emerging countries in this field of research. Finally, Journal of Cleaner Production is the best in terms of publications in this field of research with 241 papers (sixfold the 2nd journal, which is Accounting, Auditing, and Accountability Journal with only 40 papers).

Life cycle assessment, sustainability reporting, and cost benefit analysis are emerging as the most studied tools in the literature. Life Cycle Analysis (LCA) is a method for assessing the environmental impacts associated with every stage of a product, service, or process's life cycle, from raw material extraction to its end of life. There are many objectives behind the use of LCA. Firstly, it aims to identify and quantify of environmental burdens, thus enabling a comprehensive understanding of environmental impacts. Secondly, LCA allows you to compare alternatives and then find the most sustainable options while making sure the decisions are taking into consideration the product design, manufacturing, and management. Thirdly, it helps detect the critical points in the life cycle, creating opportunities to improve environmental efficiency and reduce negative impacts. In order to study the economic and financial viability of a project, policy or decision, the cost-benefit analysis method comes in clutch as it allows us to calculate the benefits and costs. There is a variety of reasons behind implementing this method. First, it looks to quantify and compare total costs, including direct and indirect costs, with the total benefits, such as financial gains, improvements in well-being and environmental benefits. Secondly, the LCA determines the profitability of an investment by calculating key indicators such as the Internal Return Rate (IRR) or Net Present Value (NPV), which makes good decision-making easier. Thirdly, it helps optimize resource allocation through prioritizing the projects and investments that offer the best cost-benefit.

Thus, we can draw the conclusion that life cycle analysis (LCA) and cost-benefit analysis are integral complementary tools for improving the environmental and financial performance of companies. As a result, we can see that the literature on Environmental Management Control Tools seeks to justify whether these tools really help companies improve their environmental and financial performance, and if so, how can their connections be modeled?

Limitations and Perspectives

It is essential to recognize the limitations of this study. First, articles written in languages other than English, such as Spanish, German, or Chinese, were excluded from the analysis to avoid potential biases and errors in the bibliometric process. Future research could address this gap by analyzing non-English literature separately to enrich the field.

Second, certain types of documents, including books, book chapters, letters, and conference proceedings, were not considered. Moreover, the bibliometric analysis was confined to the Scopus database due to its recognized reliability, quality, and prior use in similar studies. Expanding future research to other databases, such as Web of Science, could provide a broader perspective.

Third, bibliometric analysis focuses solely on structured bibliometric data (e.g., keywords, titles, abstracts, citations, and affiliations). Future studies could complement this approach with systematic literature reviews to examine methodologies, theoretical frameworks, and causal relationships that bibliometric analysis does not capture.

Finally, this study relied exclusively on VOSviewer for analysis, leveraging its strengths in co-authorship and co-occurrence network visualization. Future research could integrate VOSviewer with R-based analytics to offer a more comprehensive graphical representation of the field's development.

References

Alatawi, I. A., Ntim, C. G., Zras, A., & Elmagrhi, M. H. (2023). CSR, financial and non-financial performance in the tourism sector: A systematic literature review and future research agenda. *International Review of Financial Analysis, 89*, 102734. Retrieved from https://doi.org/10.1016/j.irfa.2023.102734

Alves, M. W. F. M., & Mariano, E. B. (2018). Climate justice and human development: A systematic literature review. *Journal of Cleaner Production, 202*, 360-375. Retrieved from https://doi.org/10.1016/j.jclepro.2018.08.091

Antheaume, N. (2013). Le contrôle de gestion environnemental. État des lieux, état de l'art. *Comptabilité Contrôle Audit, 19*(3), 9-34. Retrieved from https://doi.org/10.3917/cca.193.0009

Aragón-Correa, J. A., & Sharma, S. (2003). A contingent resource-based view of proactive corporate environmental strategy. *The Academy of Management Review, 28*(1), 71-88. Retrieved from https://doi.org/10.2307/30040690

Asdiou, A., & Mokhtari, B. (2019). The indicators of the corporate social responsibility: A search for efficiency or a concern for legitimacy towards stakeholders? A proposed explanatory model. *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET), 10*(1), 62-76. Retrieved from https://doi.org/10.4018/IJSSMET.2019010105

Bowen, H. R. (1953). *Social responsibilities of the businessman*. Iowa City: University of Iowa Press. Retrieved from https://doi.org/10.2307/j.ctt20q1w8f

Brundtland. (1987). *Our common future.* New York: Office des Nations Unies.

Burritt, R. L., & Schaltegger, S. (2010). Sustainability accounting and reporting: Fad or trend? *Accounting, Auditing & Accountability Journal, 23*(7), 829-846. Retrieved from https://doi.org/10.1108/09513571011080144

Carroll, A. B. (1999). Corporate social responsibility: Evolution of a definitional construct. *Business & Society, 38(3)*, 268-295. Retrieved from https://doi.org/10.1177/000765039903800303

Christophe, B. (1995). *La comptabilité verte: De la politique environnementale à l'écobilan*. Paris: De Boeck Université.

Cormier, D., & Magnan, M. (2007). The revisited contribution of environmental reporting to investors' valuation of a firm's earnings: An international perspective. *Ecological Economics, 62*(3-4), 613-626. Retrieved from https://doi.org/10.1016/j.ecolecon.2006.07.030

Dangelico, R. M. (2016). Green product innovation: Where we are and where we are going. *Business Strategy and the Environment, 25*(8), 560-576. Retrieved from https://doi.org/10.1002/bse.1886

Déjean, F., & Martinez, I. (2009). Communication environnementale des entreprises du SBF120: Déterminants et conséquences sur le coût du capital actions. *Comptabilité Contrôle Audit, 15*(1), 55-77. Retrieved from https://doi.org/10.3917/cca.151.0055

Depoers, F. (2010). Gouvernance et qualité de l'information sur les gaz à effet de serre publiée par les sociétés cotées. *Comptabilité Contrôle Audit, 16*(3), 127-151. Retrieved from https://doi.org/10.3917/cca.163.0127

Díaz Tautiva, J. A., Huaman, J., & Ponce Oliva, R. D. (2024). Trends in research on climate change and organizations: A bibliometric analysis (1999-2021). *Management Review Quarterly, 74*(1), 227-261. Retrieved from https://doi.org/10.1007/s11301-022-00298-1.

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, 105, 1809-1831.

El Hmieche, S., & Asdiou, A. (2024). Les pratiques du contrôle de gestion environnemental dans les entreprises marocaines composantes de l'indice MASI ESG. *Alternatives Managériales Economiques, 6*(Spécial 1), 105-124. Retrieved from https://doi.org/10.48374/IMIST.PRSM/ame-v6iSp%C3%A9cial%201.46896

Essid, M. (2009). Les mecanismes de controle de la performance globale: Le cas des indicateurs non financiers de la rse (Thèse, Université Paris Sud, 2009). Retrieved from https://hal.science/tel-00473794v1

Essid, M., & Berland, N. (2011). Les impacts de la RSE sur les systèmes de contrôle. *Comptabilité Contrôle Audit, 17*(2), 59-88.

Retrieved from https://doi.org/10.3917/cca.172.0059

Ferrante, B. K. (1978). Bibliometrics: Access in the library literature. *Collection Management, 2*(3), 199-204. Retrieved from https://doi.org/10.1300/J105v02n03_02

Gond, J.-P., Grubnic, S., Herzig, C., & Moon, J. (2012). Configuring management control systems: Theorizing the integration of strategy and sustainability. *Management Accounting Research, 23*(3), 205-223. Retrieved from https://doi.org/10.1016/j.mar.2012.06.003

Gond, J. P., & Herrbach, O. (2006). Social reporting as an organisational learning tool? A theoretical framework. *Journal of Business Ethics*, 65, 359-371.

González-Benito, J. (2008). The effect of manufacturing pro-activity on environmental management: An exploratory analysis. *International Journal of Production Research, 46*(24), 7017-7038. Retrieved from https://doi.org/10.1080/00207540701474021

Gray, R. (1992). Accounting and environmentalism: An exploration of the challenge of gently accounting for accountability, transparency and sustainability. *Accounting, Organizations and Society, 17*(5), 399-425. Retrieved from https://doi.org/10.1016/0361-3682(92)90038-T

Gray, R., & Bebbington, J. (2001). *Accounting for the environment*. London: SAGE Publications Ltd.

Gray, R. H., & Milne, M. (2007). Future prospects for sustainability reporting. In *Sustainability accounting and accountability* (pp. 184-208). London: Routledge Taylor & Francis Group.

Gulluscio, C., Puntillo, P., Luciani, V., & Huisingh, D. (2020). Climate change accounting and reporting: A systematic literature review. *Sustainability, 12*(13), 5455. Retrieved from https://doi.org/10.3390/su12135455

Harsanto, B., & Firmansyah, E. A. (2023). A twenty years bibliometric analysis (2002-2021) of business economics research in ASEAN. *Cogent Business & Management, 10*(1), 2194467. Retrieved from https://doi.org/10.1080/23311975.2023.2194467

Hart, S. L. (1995). A natural-resource-based view of the firm. *The Academy of Management Review, 20*(4), 986-1014. Retrieved from https://doi.org/10.2307/258963

Ibrahim, A. E. A., Hussainey, K., Nawaz, T., Ntim, C., & Elamer, A. (2022). A systematic literature review on risk disclosure research: State-of-the-art and future research agenda. *International Review of Financial Analysis, 82*, 102217. Retrieved from https://doi.org/10.1016/j.irfa.2022.102217

Jansson, Å., Nilsson, F., & Rapp, B. (2000). Environmentally driven mode of business development: A management control perspective. *Scandinavian Journal of Management, 16*(3), 305-333. Retrieved from https://doi.org/10.1016/S0956-5221(99)00022-6

Klassen, R. D. (2001). Plant-level environmental management orientation: The influence of management views and plant characteristics. *Production and Operations Management, 10*(3), 257-275. Retrieved from https://doi.org/10.1111/j.1937-5956.2001.tb00374.x

Klassen, R. D., & Angell, L. C. (1998). An international comparison of environmental management in operations: The impact of manufacturing flexibility in the U.S. and Germany. *Journal of Operations Management, 16*(2-3), 177-194. Retrieved from https://doi.org/10.1016/S0272-6963(97)00037-5

Marshall, R. S., Cordano, M., & Silverman, M. (2005). Exploring individual and institutional drivers of proactive environmentalism in the US Wine industry. *Business Strategy and the Environment, 14*(2), 92-109. Retrieved from https://doi.org/10.1002/bse.433

Maurel, C., & Tensaout, M. (2014). Proposition d'un modèle de représentation et de mesure de la performance globale. *Comptabilité Contrôle Audit, 20*(3), 73-99. Retrieved from https://doi.org/10.3917/cca.203.0073

Mokhtari, B., & Asdiou, A. (2017). La RSE est-elle une source d'innovation? Cas de la PME marocaine. In *La RSE au Maroc: Vue par des chercheurs en sciences de gestion coordonné par J. IGALENS* (Vol. 1, pp. 57-72). Caen: Edition EMS, Collection Management & Prospective.

Nath, P., & Ramanathan, R. (2016). Environmental management practices, environmental technology portfolio, and environmental commitment: A content analytic approach for UK manufacturing firms. *International Journal of Production Economics, 171*, 427-437. Retrieved from https://doi.org/10.1016/j.ijpe.2015.09.040

Ochoa, G. V., Alvarez, J. N., & Acevedo, C. (2019). Research evolution on renewable energies resources from 2007 to 2017: A comparative study on solar, geothermal, wind and biomass energy. *International Journal of Energy Economics and Policy, 9*(6), 242-253. Retrieved from https://doi.org/10.32479/ijeep.8051

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: The titans of bibliographic information in today's academic world. *Publications, 9*(1), 12. Retrieved from https://doi.org/10.3390/publications9010012

Quairel, F. (2004). Responsable mais pas comptable: Analyse de la normalisation des rapports environnementaux et sociaux. *Comptabilité Contrôle Audit, 10*(1), 7-36. Retrieved from https://doi.org/10.3917/cca.101.0007

Renaud, A. (2015). Chapitre 5. Les outils du contrôle de gestion environnemental. In *Management et contrôle de gestion environnemental* (pp. 97-130). EMS Editions; Cairn.info. Retrieved from https://www.cairn.info/management-et-controle-de-gestion-environnemental--9782847696714-p-97.htm

Riccaboni, A., & Luisa Leone, E. (2010). Implementing strategies through management control systems: The case of sustainability. *International Journal of Productivity and Performance Management, 59*(2), 130-144. Retrieved from https://doi.org/10.1108/17410401011014221

Richard, J. (2009). Comptabilités environnementales. In *Dictionnaire critique de la RSE* (pp. 60-65). Retrieved from https://doi.org/10.4000/books.septentrion.6711

Rivière-Giordano, G. (2007). Comment crédibiliser le reporting societal? *Comptabilité Contrôle Audit, 13*(2), 127-147. Retrieved from https://doi.org/10.3917/cca.132.0127

Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal, 40*(3), 534-559. Retrieved from https://doi.org/10.2307/257052

Saulquin, J.-Y., & Schier, G. (2007). Responsabilité sociale des entreprises et performance: Complémentarité ou substituabilité? *La Revue des Sciences de Gestion, 223*(1), 57. Retrieved from https://doi.org/10.3917/rsg.223.0057

Sharma, P., & Sharma, S. (2011). Drivers of proactive environmental strategy in family firms. *Business Ethics Quarterly, 21*(2), 309-334. Retrieved from https://doi.org/10.5840/beq201121218

Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal, 43*(4), 681-697. Retrieved from https://doi.org/10.2307/1556361

Stechemesser, K., & Guenther, E. (2012). Carbon accounting: A systematic literature review. *Journal of Cleaner Production, 36*, 17-38. Retrieved from https://doi.org/10.1016/j.jclepro.2012.02.021