

(Research/Review) Article

Carbon Accounting and Sustainable Accounting: A Review

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Abstract: This study reviews eight selected research articles on carbon accounting and sustainable accounting published between 2010 and 2024. The reviewed works explore various themes, including third-party roles in climate governance, adaptation strategies, environmental management accounting, corporate carbon reporting, net-zero carbon emissions, and sustainability integration in accounting frameworks. Despite differences in scope, sectoral focus, and methodological approach, all studies converge on three key insights: (1) the need to enhance understanding and management of carbon emissions and sustainability issues; (2) the importance of integrating sustainability metrics and strategies into business operations, reporting standards, and educational curricula; and (3) the urgency for more research and enabling frameworks that support the transition to a low-carbon economy. Notably, the studies vary in their contributions. Some adopt interdisciplinary perspectives, while others concentrate on sector-specific or methodological challenges, such as transparency, accountability, and the operationalization of sustainability practices. The research also reveals inconsistency in addressing research gaps—some areas remain predominantly empirical and require clearer definitions of causal relationships, whereas others demand theoretical development or applied knowledge for practical implementation. These gaps reflect the evolving nature of sustainability in accounting and highlight critical opportunities for future inquiry. Addressing these issues can support more effective carbon accounting practices and foster informed, strategic pathways toward sustainability.

Keywords: Carbon Accounting; Corporate Sustainability Reporting; Environmental Accounting; Review; Sustainable Accounting;

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1. Introduction

Carbon accounting and sustainability accounting are two increasingly important accounting practices in today's global context, especially in addressing the challenges of climate change and sustainability. Carbon accounting refers to the process of recording and reporting greenhouse gas (GHG) emissions, while sustainability accounting focuses on corporate efforts to improve environmental and social performance. Both play a crucial role in measuring, monitoring, and managing carbon impacts generated by economic activities and serve as the foundation for informed and sustainable decision-making.

Despite their recognized significance, the implementation of carbon accounting within sustainability management faces numerous complex challenges. These include the need for more integrated strategies to reduce global GHG emissions, varying information needs across sectors, and the lack of established policies and guidelines for integrating diverse forms of carbon accounts. Moreover, the difficulty in establishing pathways, metrics, and indicators to track and allocate carbon emissions across supply chains further complicates the practice.

In response to these challenges, new approaches to carbon reporting have emerged. One such approach is the business model-based disclosure, which emphasizes the importance of reporting carbon-material stakeholder relationships. This approach aims to generate more relevant metrics and incentives while avoiding the limitations of disclosures constrained by organizational boundaries. It is believed that such an alternative approach can enhance transparency and accountability and better align reporting with the operational characteristics of reporting entities.

Collaboration between academics and practitioners is a crucial element in addressing the gap between scientific knowledge and practical application. This collaboration enables the development of tools and instruments that can be used to manage business impacts on the environment and promote cleaner production. However, several obstacles remain, including the slow adoption of sustainability issues by accounting professionals, lack of ethical responsibility, and inadequate capacity among graduates to apply sustainability accounting principles.

Therefore, carbon accounting contributes significantly to sustainability management by providing useful information for transparent and accountable decision-making. Strengthening this approach through theoretical development, practical instruments, and synergy between academia and professional practice is expected to address contemporary challenges and help shape more effective pathways toward a low-carbon economy.

Objective of study

This review aims to:

- Analyze research gaps in eight selected articles on carbon accounting and sustainability accounting
- Identify similarities and differences among the selected articles in their focus areas, scope and approach in terms of the research gaps.
- Implication of Identified Research Gaps for Future Research.

2. Methodology

This review used a qualitative content analysis method.

In total, eight research articles were selected from a range of academic journals published between the years of 2012 and 2024 focused on carbon accounting and sustainability accounting. We chose the articles based on their relevance and contribution to the field. The research gaps found in each article were extracted and compared across each selected article. The significant similarities and differences were identified and the common areas which the gaps focused on, used as scope and approach were discussed. Discussion on the implications of the identified research gaps for the future research in carbon accounting and sustainability accounting, in a table 1 that included name paper, Name the journal, Research gap, weaknesses, and strengths.

No	Paper	Authors	Name the journal	Year	Research gap	weaknesses	strengths
1.	"Climate mitigation and adaptation strategies in the transport sector: An empirical investigation in Germany"	(Melkonyan et al., 2024)	Transportation Research Interdisciplinarity Perspectives	2024	The study reveals the scarcity of research on the complementary roles of climate adaptation and mitigation strategies across transport modes, particularly the intersections of road, rail and maritime freight transport. It highlights the growing importance for more research in this area to inform appropriate climate-focused policy responses.	These weaknesses are due to unreliable statistics of economic losses caused by climate-related risks in the transportation sector, insufficient risk assessments concerning the potential for such companies, and a lag in understanding the degree of various risk exposures in logistics companies. Further, there is underinvestment in climate neutral technologies while the timing, maturity level and cost-effective deployment are still uncertain in climate change mitigating scenarios. Finally, there is a lack of cross-modal and cross-sectoral assessments of climate change impacts in freight transport.	-Several specific strengths of logistics companies in Germany are identified in the study: climate mitigation measures are implemented, and climate adaptation is recognized as important, and readiness to invest in climate protection measures is also high. The study also highlights, that companies can contribute through the use of low-carbon technologies, improved energy efficiency, and the 'demand for low-carbon solutions' in new business segments enhancing company resilience and competitiveness in the logistics sector.
2.	"Environmental management accounting and its effects on carbon management and disclosure quality"	(Qian et al., 2018)	Journal of Cleaner Production	2018	The resulting research gap that is empirically explored in this study refers to whether or not EMA serves as an enabler for improving emissions management and tackling climate change at the business level. The study seeks to explore the relationship between various EMA tools and carbon management and disclosure, offering implications for business managers to appreciate the application of different EMA tools for corporate carbon management.	The limitations of the study include the exclusion of any tools that may have been relevant for corporate carbon management, the focus on quantity not quality with respect to tools applied, and the potential bias in data from companies that participate in the voluntary exercises and report to the CDP. Moreover, the examination does not touch upon all motivational aspects that might promote the use of EMA tools, e.g. various legal contexts, sectors, and countries.	The unique contributions of EMA tools are supporting that they have a positive impact on the quality of corporate carbon disclosure and carbon management quality. Audit and control tools, in particular, have been shown to considerably affect the quality of carbon management and disclosure. By contrast, measurement tools do not meaningfully impact quality of carbon management and disclosure.
3.	"Corporate carbon reporting: Improving transparency and accountability"	(Comello et al., 2023)	One Earth	2023	The research problem tackled in the paper is the existing lack of transparency and accountability in the corporate carbon reporting. The work introduces the time-consistent corporate carbon reporting (TCCR) standard, which builds credibility in net zero claims by calling on firms to report certain corporate carbon footprint variables on an annual basis, forecast future trajectories, and revise these forecasts periodically. The TCCR standard seeks to bridge the gap between commitments and deliverables and end the general lack of corporate accountability of	Some corporate carbon reporting weaknesses are lack of net-zero pledge comparability, scope 3 emissions accounting difficulty and greenwashing in corporate commitments. There are claims of carbon leakage from companies that divest themselves from carbon activities and there is a transaction cost associated with adopting the TCCR standard.	-The TCCR standard would establish an integrated system of performance assessment that enables firms to monitor actual emissions relative to milestone targets. It also rewards self-selecting targets that are realistic and not overly ambitious. Moreover, By allowing for 5-year time spans to be adjusted, the TCCR structure has a democratic flexibility without undermining accountability.

No	Paper	Authors	Name the journal	Year	Research gap	weaknesses	strengths
					existing reporting mechanisms.		
4.	"Towards net-zero carbon emissions: A systematic review of carbon sustainability reporting based on GHG protocol framework"	(Sharaf-Addin, 2024)	Environmental and Sustainability Indicators	2024	Research Gap: (It is an area within a given field of study in which a research element is missing or contains research data that is not significant enough.) It is generally accepted as one of the core components of a systematic literature review since this enables the identification of knowledge gaps and new studies' contributions.	For the SLR limitations, one of the most relevant limitations is that it looks exclusively at the Oil and Gas industry and GHG Protocol framework which limits the ability to extrapolate findings towards other industries or sustainability reporting frameworks. In addition, reliance upon published literature could introduce a publication bias that is, ignoring negative or null results. Moreover, the restriction of publication in the English language only may also cause the omission of some studies relevant for this systematic review and a language bias.	Reasons for Contribution ³⁵ -The merits of systematic literature review are the comprehensive nature of carbon sustainability reporting in the oil and gas industry with reference to the GHG protocol framework, useful recommendations for progressive initiatives toward a carbon-neutral future and determination of how reporting practices can indeed drive us to net-zero emissions possibilities.
5.	"Integration of sustainability issues into management accounting textbooks"	(Vanini & Bochert, 2024)	Journal of Accounting Education	2024	The study, therefore, found that existing management accounting textbooks have not fully integrated SMA concepts and techniques. The study revealed that SMA education lacks institutionalization and is at the stage of a pilot or non-formal education, where sustainability issues are treated as an add-on rather than being part of a broader vision. Such gaps are linked to barriers such as the technical nature of accounting, sustainability being seen an 'add-on' to the curriculum, and curriculum overload. The study also highlights the low level of integration of sustainability aspects in management accounting education in general. The gaps covered in the study show that SMA concepts and SMA methods are not integrated into the management accounting textbooks. That is because sustainability issues are treated as optional extras, when they should be deeply integrated, and the focus remains too often on the frameworks for financial reporting. Another weak part is the	The weaknesses specified are free lack of consideration of concepts and methods of sustainability management accounting (SMA) in management accounting textbooks. This is because sustainability issues are treated as add-ons, not deeply integrated, and because the focus is narrow on financial reporting frameworks. Another limitation is the absence of teaching materials to prepare for and implement the courses efficiently.	This study is strengthened by quantitative and qualitative content analysis, focusing on the coverage of sustainability management accounting (SMA) topics in commonly used management accounting textbooks. The paper also presents some explanations for not integrating SMA issues in the accounting curricula and recommendations to integrate SMA issues into managerial accounting textbooks.

No	Paper	Authors	Name the journal	Year	Research gap	weaknesses	strengths
					absence of teaching contents to prepare and execute a course in an effective manner.		
6.	"Forging cleaner production: the importance of academic-practitioner links for successful sustainability embedded carbon accounting"	(Burritt & Tingey-Holyoak, 2012)	Journal of Cleaner Production	2012	Knowledge generation has little in common with knowledge application in practice. In the context of the document, this gap refers specifically to the knowledge generation of sustainability embedded carbon accounting and the use of tools for cleaner production. To investigate this gap and find out how to introduce changes to fill the gap is the aim of this research.	-We find that academic accounting research suffers from a lack of effective critique with a focus on short-term pressures and a lack of ethical inculcation for graduates leading to under theorizing. Moreover, accounting graduates also did not have the skills to account for sustainability measures like carbon accounting. These weaknesses contribute to a disconnect between sustainability embedded carbon accounting research and practice.	The strengths of academic-practitioner links for sustainability embedded carbon accounting were identified as: reaching out to business/society to come closer to sustainability; forces that bridge strategic/operational decision making in relation to different kinds of capital; and the capacity to challenge at least to some extent both academics and practitioners with new ideas, insights and knowledge.
7.	"Carbon accounting for the translation of net-zero targets into business operations"	(Carrión et al., 2024)	The British Accounting Review	2024	Next is research gap, which means there isn't much knowledge or already done research in that area. It is frequently recognized as an important problem in research that could be further studied in order to expand beyond the available knowledge. In the context of the document the research gap is recognized through the limitations of the study which identifies the need for future research to tackle the accounting issues present in the work and the additional challenges raised by the transition to a net-zero economy	Weakness of the research report High-level perspective based on long-term views creation of emission counterpart in the financial thoughts framing of the entity deliberates the unexplored concepts which can vividly be interesting in terms of finding counter measure to the rebound effect and its related problem; though there is heavy reliance on to variety of intensity method to capturing the series of defined emissions dent; least of the monitoring mechanism which only mimic that of the ex-post so-called & the vermin of green wash may very likely to be another problem. Such weaknesses inhibit the conversion of global decarbonization objectives into effective net-zero targets.	Qualities and GiftsScientific basis targets initiative (SBTi)'s strengths are providing a systematic and coherent framework for examining accounting for net zero emissions, differentiating guidance for corporate efforts to mitigate emissions, and enhancing corporate leadership in the transition to a low-carbon economy.
8.	"Carbon accounting management in complex manufacturing supply chains: A structured framework approach"	(Kaur et al., 2022)	Procedia CIRP	2022	The research gap identified in the study is that current life cycle carbon accounting methods for enterprises are not detailed enough and that there is no unified practical framework yet. This study from an industry-agnostic perspective attempts to examine the components of carbon accounting and shine light on this research gap.	-Focus on how present methods of carbon accounting fail to adequately address needs essential to aerospace manufacturing, including standardization, in-depth search into the emissions, and the development of a coherent practical systems. Moreover, all the stakeholders in the supply chain ecosystem need to work together and standardize their approach for better integration. The current methods also have a lack of clarity regarding its scope, approach, and the process overall that contributes to the overall efficiency of the carbon accounting method.	What are the overall strengths of the proposed carbon accounting framework? Also, it holds the scope steady early in the process to account for end-to-end greenhouse gas emissions, thus raising the likelihood of overall efficiency of the carbon accounting approach.

Differences in Research Gaps

These papers highlight gaps in research across different subclasses of sustainability and carbon management. While some research is sector-specific (e.g., transport sector, oil and gas industry), others are cross-cutting, such as EMA tools, corporate reporting, and embedding sustainability and SSCM into accounting education. The gaps vary, too, in their breadth. Some highlight broad issues of transparency and accountability; others methodological or practical issues such as the absence of integrated frameworks or improved representation of sustainability dimensions in accounting. Additionally, the research gap is approached differently. Some studies suggest there is space for empirical studies exploring relationships or effects, while others emphasize the need for theory development or application of knowledge in practice.

Similarities in Research Gaps

Although the research gaps have their particularities in focus, scope, and approaches, there are some commonalities. The need to better understand and manage carbon emissions and sustainability challenges, in all the different facets of society, is at the core of all the studies. They further emphasize adopting sustainability measures in all areas of the firm, from operations and reporting to the curriculum of MBA programs. Furthermore, the articles highlight the importance of further research as well as the development of practical tools and frameworks to enable the transition to a low carbon economy.

Overview of the Gaps: Similarities and Differences

Through eight studies published in peer-reviewed academic journals, this analysis looks at the similarities and differences in research gaps around sustainability and carbon management.

Similarities

Although their areas of research may differ, these studies have one thing in common: they all highlight the need for improved comprehension and control of carbon emissions and sustainability issues. They allow them to integrate sustainability considerations into different aspects on a global company — operations and reporting, and education. They also call for increasing research and new tools and frameworks needed to support practical movements towards a low-carbon economy.

A Comparative Analysis of the Researched Similarities and Differences including Author Details

This study compared the research gaps highlighted in eight studies from the academic literature on **sustainability and carbon management**.

Similarities

These various articles, though on disparate lines of study, have one commonality: each of these studies is crying for a need for better understanding and management of carbon emissions and sustainability issues. And they underscore how sustainability can and should be integrated into everything from operations to reporting to education. Moreover, they request further RD&D/ demonstration/ deployment of practical tools and frameworks to enable the low carbon transition.

Similarities and Differences in Research Gaps

Comparative analysis of eight studies about sustainability and carbon management across different journals about their research gaps

Similarities

While each study has its own set of targets and indicators, they are all unified by a chorus of themes: Improved monitoring and control of carbon emissions and sustainability-related concerns is needed. It combines sustainability and corporate social responsibility as key factors impacting business practices, reporting, and education. They also demand more

research and development of actionable tools and frameworks to help the transition to a low-carbon economy.

Differences

Differences in Focus Area: The studies vary in terms of the areas of sustainability and carbon management they are concentrating on. A few focus on distinct sectors, like:

- Melkonyan et al. (2024) – Climate Mitigation and Adaptation Strategies in the Transport Sector: An Empirical Investigation in Germany (Transportation Research Interdisciplinary Perspectives, 2024): This research discusses the intersection of climate mitigation and adaptation strategies within the German transport sector.
- Sharaf-Addin (2024) — Alternative Energy: Towards Net-Zero Carbon Emissions: A Systematic Review of Carbon Sustainability Reporting Based on GHG Protocol Framework (Environmental and Sustainability Indicators, 2024): This paper explores carbon sustainability reporting practices in the oil and gas sector.
- **Comparative Study of Research Gaps with Author Details**

2. Results

This analysis compares research gaps identified in eight studies, published in different academic journals and are oriented towards sustainability (sustainable carbon management).

Similarities

Although they differ in topics, all of these studies share one commonality: they respond to the demand for a better understanding and management of carbon emissions and sustainability challenges. They advocate for sustainability to be included in operations, reporting, and education within their respective fields. These goals will require much more applied research and development of all technologies on an economy-wide scale necessary to help them to transfer the economies to low carbon.

Differences

Field of study: The studies vary across specific area of focus in sustainability/carbon management. Some focus on certain sectors, such as:

Melkonyan et al. (2024) - Climate mitigation and adaptation strategies in the transport sector: an empirical analysis of Germany (Transportation Research Interdisciplinary Perspectives, 2024): This article explores the interplay and overlap of climate mitigation and adaptation strategies as the climate crisis escalates within the German transport sector.

Sharaf-Addin (2024) - Towards Net-Zero Carbon Emissions: A Systematic Review of Carbon Sustainability Reporting Based on GHG Protocol Framework (Environmental and Sustainability Indicators, 2024): The study reviews carbon sustainability reporting practices within the oil and gas industry.

Others dive into cross-cutting themes such as:

Qian et al. “**Environmental Management Accounting and its Effects on Carbon Management and Disclosure Quality**” (Journal of Cleaner Production, 2018) – This research examines the association between EMA instruments and carbon management. Comello et al. (2023) “**Corporate Carbon Reporting: Improving Transparency and Accountability**” (One Earth, 2023): “**Addressing the transparency and accountability in corporate carbon reporting**”. Vanini & Bochet (JAE, 2024) Integration of Sustainability Issues into Management Accounting Textbooks. Burritt Tingey-Holyoak (2012) – “**Forging Cleaner Production: Academic-Practitioner Links and the Future of Sustainability Embedded Carbon Accounting**” (Journal of Cleaner Production, 2012): Academic-practitioner knowledge gaps in sustainability embedded carbon accounting.

Carrión et al. (2024) – “**Carbon Accounting for Translating Net-Zero Targets into Business Operations**” (The British Accounting Review, 2024): Based on the premise that accounting issues need to be prioritized in the transition to a net-zero economy, this research suggests further accounting investigation in this field.

Kaur et al. Carbon “**Accounting Management in Complex Manufacturing Supply Chains: A Structured Framework Approach**” (Procedia CIRP, 2022) (2022) - In this work, the elements of carbon accounting are analyzed and a structured framework approach is proposed.

Scope: Research gaps vary with regard to scope. Some articles speak to broader issues of transparency and accountability, and others to specific methodological or practical difficulties.

Context: The studies begin in different places. Some point out the need for empirical work exploring relationships or impacts, while others focus on building theory or applying knowledge.

3. Conclusions

The research gaps explained by these studies give insights for challenges and opportunities in the field of sustainability and carbon management. Future research can help bring this understanding, by eliminating these gaps and solving these issues, thereby assisting in developing the strategies needed to ensure a sustainable future. There were eight research articles on carbon accounting and sustainability accounting identified for this review which indicated the research gaps and commonalities and differences between the studies reviewed. The studies cover a range of topics in sustainability and carbon management, but reflect several common motifs, including the need for improved understanding and management of carbon emissions and sustainability issues, mainstreaming sustainability into business practices, reporting and education; and the need for more research and development of practical approaches and tools to facilitate the transition to a low-carbon economy. All these studies vary by focus, breadth of scope as well as the means chosen to tackle the identified research voids, which demonstrate the dynamic character of this field and the plurality of perspectives that can be taken.

Limitations of the Study

There are some limitations to this review. Firstly, only eight research articles were included in the review, and may not represent the full breadth of research in the arena of carbon accounting and sustainability accounting. Second, as the review was around research gaps, rather than providing a comprehensive assessment of the strengths and weaknesses of the included studies. Third, this review was based on articles published in journals only, and did not include other kinds of publications, including book, proceedings and reports.

Recommendations

Therefore, the following recommendations for future development in the area of carbon accounting and sustainability accounting are drawn from the results of this review:

- How this topic should be developed: The future research areas are the research of carbon accounting should expand their scope to include other sustainable accounting related topics. These may include the social and environmental impacts of carbon emissions, the role technology plays in carbon accounting, and the emergence of new integrated reporting frameworks. More empirical studies: There is a need for more empirical studies that test and validate the theoretical frameworks and models that have been developed in the area of carbon accounting and sustainability accounting.
- Create actionable tools and frameworks: In future research the focus should be on creating usable tools and frameworks that companies and other organizations can deploy to measure, manage and report on their carbon emissions and sustainability outcomes.
- Encourage interdisciplinary collaboration: Carbon accounting and sustainability accounting are complex, multi-dimensional domains and demand interdisciplinary collaboration between researchers from diverse fields, including accounting, economics, environmental science, and engineering.
- Develop sustainable research models: Researchers should explore sustainable models for funding and conducting research that balance the need for rigorous, evidence-based studies with the necessity of rapid responses to global challenges.

References

1. Burritt, R. L., & Tingey-Holyoak, J. (2012, 2012/11/01/). Forging cleaner production: the importance of academic-practitioner links for successful sustainability embedded carbon accounting. *Journal of Cleaner Production*, 36, 39-47. <https://doi.org/https://doi.org/10.1016/j.jclepro.2012.02.001>
2. Carrión, E., Larrinaga, C., & Rigling Gallagher, D. (2024, 2024/08/08/). Carbon accounting for the translation of net-zero targets into business operations. *The British Accounting Review*, 101456. <https://doi.org/https://doi.org/10.1016/j.bar.2024.101456>
3. Comello, S. D., Reichelstein, J., & Reichelstein, S. (2023). Corporate carbon reporting: Improving transparency and accountability. *One Earth*, 6(7), 803-810.
4. Kaur, R., Patsavellas, J., Haddad, Y., & Saloniitis, K. (2022, 2022/01/01/). Carbon accounting management in complex manufacturing supply chains: A structured framework approach. *Procedia CIRP*, 107, 869-875. <https://doi.org/https://doi.org/10.1016/j.procir.2022.05.077>
5. Melkonyan, A., Hollmann, R., Gruchmann, T., & Daus, D. (2024, 2024/05/01/). Climate mitigation and adaptation strategies in the transport sector: An empirical investigation in Germany. *Transportation Research Interdisciplinary Perspectives*, 25, 101102. <https://doi.org/https://doi.org/10.1016/j.trip.2024.101102>
6. Qian, W., Hörisch, J., & Schaltegger, S. (2018, 2018/02/10/). Environmental management accounting and its effects on carbon management and disclosure quality. *Journal of Cleaner Production*, 174, 1608-1619. <https://doi.org/https://doi.org/10.1016/j.jclepro.2017.11.092>
7. Sharaf-Addin, H. H. (2024, 2024/12/01/). Towards net-zero carbon emissions: A systematic review of carbon sustainability reporting based on GHG protocol framework. *Environmental and Sustainability Indicators*, 24, 100516. <https://doi.org/https://doi.org/10.1016/j.indic.2024.100516>
8. Vanini, U., & Bochert, S. (2024, 2024/03/01/). Integration of sustainability issues into management accounting textbooks. *Journal of Accounting Education*, 66, 100886. <https://doi.org/https://doi.org/10.1016/j.jaccedu.2024.100886>