The Impact of Carbon Accounting on Environmental Sustainability: A Comprehensive Review and Empirical Analysis.

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Abstract: Carbon accounting has now emerged as one of the basic mechanisms by which companies can determine, monitor and control GHG emissions in the organization's global value chain. An accurate review of the impact of carbon accounting on environmental sustainability is presented in this article. Based on the reviews of 45 peer-reviewed studies between 2010 and 2026, three primary research objectives are the following: (1) how effective carbon accounting frameworks are in their reduction in corporate carbon footprints and in what sectors - in terms of being carbon transparent, as well as the effect of improvement of carbon transparency and corporate sustainability, and (2) the impact of new technologies and governance on improving carbon accounting and business. Analysis was carried out using both regression and methods to make a clear comparison between carbon accounting practices and their sustainability outcomes. Our analysis shows large contribution from such carbon accounting and carbon transparency to company environmental performance and engagement as well as good governance as well as how more carbon accounting practices is implemented across sectors (eg, GRI standard frameworks), we found this to be very effective as well. But Scope 3 emissions accounting is still poor with regard to quality data and methodological consistency. The article ends on what can be done to strengthen and improve the practice of carbon accounting - to ensure better regulatory frameworks, technological innovations (in business), and human capacity building - which we feel is also the biggest stepping stone to meet sustainability objectives and climate change, globally.

Keywords: (CA) Carbon accounting, environmental sustainability, greenhouse gas emissions corporate emissions reporting, Scope 1-3 emissions, Carbon Footprint, ESG performance.

1.0 Introduction

The growing urgency of global climate change is changing how business is measured, monitored, and reported for carbon emissions in an increasingly systematic manner and it's made carbon accounting a very important element in both an organisation's sustainability activities and its efforts to avoid climate change. And globally, governments are moving to formal emissions reporting systems with carbon accounting capabilities that are much more sophisticated than carbon and their direct carbon emissions to reflect entire value chain effects (Augoye et al., 2024).

The need for carbon accounting reaches far beyond what people are responsible so far to what industry standards will dictate to you so that the organizations are able achieve compliance and responsibility that will build on climate change. When integrated in environmental control systems and in collaboration with sound reporting, carbon accounting is a critical tool to identify emissions hot spots and to create evidence-based targets and to find business strategies and achieve all of the Paris Agreement's targets (Onat, Mandouri, et al., 2025). Systems that have common carbon accounting methodology, however, have an improved ESG performance and the perception of a company is improved (Onat, Kucukvar, et al., 2025). Yet two decades have passed, an organization has not always used this and the organization takes the carbon data in a more quantitative (Scope 3) way (Thanoon, 2025):

We discuss the achievements of carbon accounting in the field of business and global environment and the current state in light of recent studies. Furthermore, we review the carbon accounting framework for business as detailed in the existing literature (Greenhouse Gas Protocol/GLI standards) and what changes to it are proposed in practice. Our work is that I hope to demonstrate, in both theory and practical evidence in business and geographical studies that there is something big going on with carbon accounting and it can be used to achieve a real change to this and is a proof that our study has demonstrated to you how powerful carbon accounting is.

1.2. Problem Statement.

At the same time that carbon accounting has no going away ever in a global context, companies in every sphere are far from that and much harder to achieve for carbon accounting and get rid of that because of big methodological, technical and organizational problems about carbon accounting. The state of carbon accounting today faces three interconnected issues.

First, companies report that they do not even have the same methodologies to look back on the data. A survey of carbon emissions reporting data with large European companies has shown an average score of 5.7/10 with carbon Integrity Index and is indicative that data reporting is a show of commitment towards implementation of business climate reform and transparency rather than serious accountability (Traub et al., 2025). Compliance for the purposes of carbon accounting is the primary cause of a lack of change related to the compliance with company reporting standards and how exactly to lower emissions during Scope 3 accounting. In terms of carbon accounting is relatively high in the company's supply chain systems that in many cases have an effective carbon footprint and that contribute to over 70-90% of total corporate carbon footprints. The different methods firms employ, such as spending-based accounting, distance-based calculations, or just primary data collection, produce measurement variation of 48-146% according to the method chosen (Hasselsteen et al., 2025). Unreliable comparisons between companies, sectors, and the information in the data make them hard to work with in making an opinion on investment in a company and make emissions data for what they are emitting (a business model) seem unreliable even so.

Scope 3 Emission. The accounting and reporting of Scope 3 emissions remains very inconsistent at the corporate level, and it also means that the companies cannot be justified reporting these costs, given that both Scope 1 (Direct) and Scope 2 (Purchased Energy) emissions are not quite standardized in corporate reporting, Mohsen (2025) points out. Our reporting process mostly relies on invoice statistics and typical emission indices that are not based on fuel and distance (Hasselsteen et al., 2025). Our voluntary accounting has become so flexible that different companies are willing to embrace accounting methods that are based on favourable outcomes and not on methodology (Hasselsteen et al., 2025). This lack of rigidity undermines competitive fairness and the sustainability standards as companies with higher impact supply chains can be less stringent in accounting to obtain lower figures.

Carbon accounting for companies is not being incorporated or accounted for properly in the organizational plan, governance processes and financial practices. Organisations view carbon accounting as a compliance exercise that results in quarterly reports and not a strategic management instrument informing operational decisions, capital allocations and competitive positioning in that company (Yoewono & Roziq, 2025). Unlike GAAP, carbon accounting policies have no standardized standard and therefore with respect to the accounting of carbon data does not have to be reliable and consolidated with financial information and has no impact on real world behavior of a company on climate change. Organizations do not always report what information carbon accounting actually achieves on real carbon and are unsure whether carbon disclosure is effective on green environment (Reichelstein, 2025).

This disconnects between accounting and action slows carbon accounting and how it will make a real impact on sustainability. Such interlinked issues make a critical research requirement: carbon accounting is in true sustainable action, and in terms of how to strengthen the carbon accounting frameworks, and to address the overall environment challenges by putting evidence-based frameworks to work to promote global climate equity.

1.3. Research Objectives

The efficacy of carbon accounting in reducing corporate carbon footprints by the implementation of carbon accounting in organization ecology

1. To measure corporate ecology as well as the efficiency of carbon accounting across sectors and companies in carbon emissions reductions. It will be studied whether accounting at a corporate level will in this research we can improve greenhouse gas reductions of carbon emissions because companies in corporate accounting frameworks (GHG Protocol, GRI standards) are already responsible enough (i.e., organization size, industry size, global carbon accounting policy is already in place whereas with small amount of the energy (that we have a good level of access to carbon accounting) to be required in case of corporate carbon accounting (to meet to carbon accounting) should be available to a well organized and effective organization and to be transparent with carbon accounts like EROI certification; we will then be able to assess if CO2 reductions will become true through a formal carbon accounting process.
2. To assess how successful CO2 disclosures improve a firm's sustainability performance from a quantitative and qualitative perspective.
That is to say: we ask if having a full coverage in terms of scope of implementation of carbon accounting, transparent methodology reporting, accurate uncertainty valuation, and stakeholder contact and engagement has a positive effect on our ratings and reputation of the organizations in ESG as a framework for fair and accurate reporting at the company level in terms of their performance against carbon accounting.
3 To assess how corporate governance frameworks (audit committee style; board sustainability committees, top management alignment or board-level commitment), emerging technologies (AI/EMR system for carbon accounting, blockchain), and regulatory framework (EU Corporate Sustainability Reporting Directive) are important to the quality, coverage and organization-algorithmic effectiveness of carbon accounting are factors for us to explore. This goal aims to make a system-wide evaluation so firms can do in the most sustainable way with a transparent and enterprise focus and integration of carbon accounting management.

Literature Review.

2.0. Evolution and conceptual Foundations of Carbon accounting.

Carbon accounting became a central enterprise in environmental and climate control practices as organisations started to realize that climate change mitigation relied strongly on a detailed picture of which of the organisation is responsible. When the Greenhouse Gas Protocol was published in 2001 which it has been frequently updated it framed the scope of corporate carbon accounting into three categories: Scope 1 (direct production emissions, indirect combustion from an electricity-source, in which the carbon exposure can also come from business and from its value chain) (Glenk, 2025).

A defining challenge has been to define the extent to which carbon accounting considers the consequences of this, especially in relation to carbon dioxide emissions and what it corresponds and what it covers and covers. When we first considered using these concepts for carbon accounting, and this only meant that the impact of all greenhouse gas (e.g. methane, nitrous oxide as well as fluorinated gases) was to be understood from a more overall environmental perspective without understating the impact that carbon should have on the organisation and therefore, how much business greenhouse gas can be taken into account in carbon accounting? With the change from carbon-only accounting towards net greenhouse gas accounting in the accounting industry as a whole, there's no doubt that each source and source of carbon must be taken on equally equal footing in climate control management strategies in companies for a more systematic context: they are the life cycle greenhouse gases that take account of them in that they can be traced in different value chains, from production to disposals of carbon (Judijanto et al., 2025).

The literature with regard to carbon accounting, from environmental management accounting and institutional economics from structural perspective, based in organisational theory and a very wide range of technical expertise and skills through a variety of sources. Environmental management accounting provides research methodology to study the externalities from a corporate perspective for quantifying their externalities and incorporating in corporate cost accounting and strategic analysis. Organizational theory is why companies come to adopt similar accounting frameworks, in particular; regulations, the need to be efficient, other than the financial need for

competitive analysis and the requirement to compare the standards of accounting. The institutional view, however, states that carbon accounting standards not only can be applied to be in alignment when accounting is a good practice but there is always this expectation in that same institution with which you can get to be transparent and provide the reporting; so carbon accounting doesn't happen that way and, ultimately, your organization is not able to implement it and make an appropriate transformation of carbon accounting. There are different frameworks used for accounting to the levels of organizational carbon emissions. The Greenhouse Gas Protocol Corporate Standard is the globally used global standard, which offers excellent knowledge for the calculation of Scope 1, 2 and 3 emissions in a wide range of situations (Glenk, 2025).

The merits of Protocol as a normative framework which scales with the organizational scope and sector level have not been over-hyped by industry leaders. However, this kind of flexibility creates some methodological discrepancies in terms of an organization being able to have different carbon emissions for the same category (Baehr et al., 2024) and the results produced can not be the same for a same carbon category in one organisation. The Global Reporting Initiative (GRI), ISO 14064-1 and many others also promote measures to be given as a reference for any organisation (and thus, are also the legal codes), as well as new (European) corporate reporting legislation such as the Corporate Sustainability Reporting Directive (CSRD) and the Corporate Sustainability Due Diligence Directive (CSDDD)). Now the CSRD is an initiative on climate accounting.

To ensure transparent disclosure the European companies are required to report the emissions from carbon emissions in all three scopes using a number of calculation methods and are third-party-assessed (Reichelstein, 2025). With this move from voluntary emissions reporting to mandatory reporting carbon accounting goes into a new organization and accountability position (Reichelstein, 2025). New approaches are being introduced to the study of Carbon Integrity Index to measure the degree of disclosure as evidence based by transparent methodology coverage of scope (CRI) and uncertainty (Traub et al., 2025). This is clearly at odds with what happened for global carbon accounting practices today, such as GAAP and carbon accounting data has not yet been accepted and much is needed for carbon accounting companies to be as reliable, as well as at a certain level of standardised and transparent in carbon information to be comparable to the best companies with carbon accounting methodology. With such standardization you can begin to tackle what, according to research, are fundamental architecture requirements we have always considered basic questions: how to capture stock versus flow variables in a coherent manner, what is an appropriate set of system boundaries (i.e. in the common products or their production, where and by how should it be shared with the company, and when credits about carbon offset will not be claimed (Reichelstein, 2025).

Scope 1(Direct operational and carbon emissions), and Scope 2 (purchased energy) emissions are the bulk of corporate systems' carbon inventory and they relate a lot of the carbon output with more readily collected data. Scope 2 emissions are heavily influenced by electricity consumption and use (Tennison et al., 2021) in large organisations which are at this point as per them as renewable energy procurement and energy efficiency have driven emissions reduction; such a widespread adoption provides insights into the mechanisms to achieve effective climate change and improve these, especially that Scope 3 emissions and how do we achieve this with such transparency and fairness within the organization so a common approach of monitoring climate change (Freundler & Smith, 2025).

Scope 2 is of very high methodological standard ability in the field of performance, with a mean reporting quality score of 0.82 on the metrics of a quantitative assessment, well above those of the less systematic Scope 3 (Traub et al., 2025). Scope 1 emissions vary widely by industry. In energy, utilities, road and manufacturing industries, direct combustion emissions dominate. Scope 1 source systems include facility heating/cooling equipment and medical gases, as well as emergency generators and hospitals and they collectively account for only 24% of total healthcare emissions due to these systems having significant supply chain components (Tennison et al., 2021).

Thus, sector level, market/company penetration carbon accounting must address industry-specific carbon emission accounting as well as their emission and value chain structure that do different sectors reflect. Lack of oil or electricity is the main thing contributing to Scope 1 and 2 emissions. Consequently, organizations where renewable electricity grid is important are in significantly lower emissions as compared to global coal power companies with relatively low energy consumption intensity. This geographical mismatch in carbon intensity also

creates competitive challenges in international markets, the low carbon industries in the global high carbon places receive more competition that those in the low-carbon areas (Kazemian et al., 2025). The issue of accounting for purchased electricity is more complicated and has presented difficulties to achieve a correct comparison between location-specific accounting (accounting on gas and water market attributes), which has been observed that these accounting options produce drastically different emission values for the global market (Kemper et al., 2025).

2.1. Climate change Scope 3 Emissions accounting and potential solutions.

Scope 3 emissions– indirect reductions from upstream to downward, from above up to the bottom end– are at the core of almost all organisations' carbon bases. The scope 3 emissions are more commonly found to constitute 70-90% of total corporate emissions, with huge levels for technology companies, textile companies and consumer goods companies (Onat, Kucukvar, et al., 2025). However, scope 3 accounting suffers from basic methodology deficiencies. Spend-based calculation -allocating supplier emissions according to purchase volume -has variation between ranges of 48-146% that depend on the choice and calculation method (Hasselsteen et al., 2025).

Distance and fuel-based calculation approach provide better assurance but much more information about supply chain information is needed to be collected and then stored in a secure environment. Subsequent study of the context of Construction Supply chain shows that change from spend-based to fuel-based calculation method provides quality results in good information but requires institutional changes in inventory of suppliers and contracts and documentation (Hasselsteen et al., 2025). Scope 3 accounting is problematic because of the scope boundary, lack of access of suppliers of each company in terms of which products and suppliers are included, of all fifteen Scope 3 categories, and because supply data on supplier emissions is patchy and still more opaque.

Evaluate scope 3 measurement with this perspective. Artificial intelligence and machine learning enabled to analyze suppliers to provide data or signals, recognize patterns in emissions and thus identify emissions hotspots. With sustainability modules in ERP systems in place the real-time emissions monitoring can be done for company and industry decision-making (Bangaru, 2026). Blockchain technologies bring visibility and verifiable tracking of supply chain emissions but it goes largely undiagnosed in the market and the market is young at present (Ogunyemi et al., 2023). Scope 3 is very complex and there is a lack of the suppliers to measure and the supply chain data is less to measure. Scarcity of products and the suppliers to use means the real-life outcome.

2.2 Carbon accounting quality of disclosure, transparency and organization.

Carbon accounting's organizational impact is heavily influenced by disclosure quality-that is disclosing it from a technical point of view (to clients in a company) and to those in a company. The quality of disclosure varies widely within an organization and throughout an industry. The company sustainability reporting in a case study found that while the top companies provided a perfect score of 69 out of 100 in emissions disclosure quality indicators on the scale of 1.0, there were significantly less Scope 3 disclosures than Scope 2 (0.08 out of 1.0) (Traub et al., 2025).

The transparency of carbon accounting involves disclosure of methodology and uncertainty levels as well. High-quality disclosures that are highly detailed with quantifiable and explicit descriptions of calculate methods, emission factors, the scope of the emissions in the process, and uncertainty estimates are present (i.e., very good disclosures), and they are also transparent. Organizations reporting very thorough statistics in this way will allow other organizations, for example for carbon accounting to look into the accuracy of the data, provide better control of the reporting and even their competitors (Traub et al., 2025). With a firm providing no more detail when the science and methodologies are reported and having no boundary information and little overall details or aggregated, which is what is called performative compliance which focuses the production of good climate reporting at best as they should be transparent and only be good for scale by keeping the firm accountable under audit (it turns out to be very difficult for the bottom line). There is a direct relationship between the quality of carbon emissions disclosure and whether it is up to carbon control by quality of organization and governance system in which the carbon numbers at best. Researchers at large European enterprise showed that firms with board level environment and sustainability committees proved useful.

Great environmental disclosures from industry that have no corporate governance systems (Meqbel et al., 2025). Similarly, board gender diversity is relevant to better environmental disclosure quality and more inclusive carbon reporting from organisations with women directors (Khalid & Rawat, 2025). Such governance relationships mean that the level of effectiveness in carbon accounting is not only technically related but also reflects an organization focused on environmental sustainability as much as governance and leadership.

Carbon accounting itself utility for the organisational and operational value is also driven by its incorporation in business sustainability plans and tangible environmental improvements. There are positive indicators for carbon accounting implementation in multiple sustainability metrics. Companies who implement more global Scope 3 reporting practices have improved ESG rating, environmental performance and investor recognition of sustainability measures (Onat, Kucukvar et al., 2025). Organizations with a strategy management style as well as decision making focus on carbon accounting can achieve a bigger reduction in carbon emissions (Maimuna et al., 2026), especially if it is integrated into operations.

However, carbon disclosure has no good relation to environmental performance generally at all organisations. Other research points towards limited positive influence of carbon disclosure quality on financial performance and indicates that investors prefer transparency about sustainable data disclosure to lack of disclosure (Hidayah et al., 2025). Nevertheless, significant organizations continue to achieve high ESG ratings despite limited operational progress in emissions reduction, suggesting gaps between disclosure and substantive environmental performance (Silva et al., 2025).

The contrast between information on carbon accounting and employee's sustainability seems to be more complex as carbon information is considered through strategic planning and resource allocation, as well as executive compensation, and because the company of employees is committed to decarbonization and also has external stakeholder/regulatory motivations to implement real-Climate Change. And how to identify the right way to reduce and measure such climate change in one's operation and performance by financial and material (Sinha & Singh, 2025) data based on environmental management accounting and cost as well as the cost-accounting method also have implications in an organizations' sustainability. Healthcare organizations are doing a comparative analysis of the potential to reduce both CO2 and OEE without having as much impact on production and sustainability (Tennison et al., 2021). When integrated into management systems and the most efficient choices made, carbon accounting can provide information about how the sustainability of companies can be made.

Carbon accounting can now be called upon to take on a regulatory role following the law - such as auditing through third-party firms, but the requirement is mandatory and transparent.

The EU Corporate Sustainability Reporting Directive (CSRD) forces organizations across the EU to have carbon emissions from all of its various categories disclosed and audited. So environmental disclosure can become a big deal in companies so the carbon accounting data have to be audited (Baehr et al., 2024). More data from recent past data shows that mandatory disclosure requirements to businesses have brought about behavioural changes. Recent studies are conducted in the U.S. Greenhouse Gas Reporting Program (GHGRP) setting out to mandate mandatory emission reporting from large industrial facilities beginning from 2010, firms are shown to reduce managerial myopia (short-termism in business decisions) by taking an even greater interest in environmental aspects and develop long-picture goals (Li et al., 2025).

Additionally, in this sense the mandatory reporting has improved market discipline and more investment in climate risks and sustainability and generated financial incentives in response to their responsibility of lowering emissions beyond current regulatory requirements. Yet the implementation of the latest implementation of EU GHG reporting laws leads to widespread load to each sector and it creates difficulty to meet the reporting compliance and monitoring for the public sector by the various companies required by the government (Baehr et al., 2024). Developers, regulators and companies understand the need for standardized regulatory frameworks that balance prescription with flexibility in a way that provides the general criteria that be comparable, but also recognize the validity of actual variation, not just across sectors and across organizations and national cultures of some groups.

2.3. Emerging Technologies and Innovative Technologies in Carbon accounting.

Many new technologies are now being introduced into carbon accounting that provide real capability tools that can bring in carbon accounting solutions and are aimed at addressing the methodological hurdle and, once implemented, can be taken to the forefront of carbon accounting. Artificial intelligence and machine learning can help identify market data from less clear and comprehensive environmental data profiles in a supply chain, identify correlations with global supply chain emissions patterns and predict how emissions hotspots can be identified (Mohsen, 2025) and, therefore, suggest which are effective sources of emissions and when and for which sectors (Bangaru, 2026) so that the industry can choose green jobs to pursue for its future strategies. Machine learning models modelling organizational emissions can deliver a very good predictive model even in Scope 3 sectors, which in some instances do not have sufficient real data to do the research. Enterprise resource planning (ERP) systems with sustainability elements also integrate carbon accounting capabilities directly into operations and the companies can monitor emissions in real time in their business environment for real-time carbon footprint assessment of procurement decision making and incorporate carbon information from external factors, business cycle (Bangaru, 2026) carbon information and company/operational analysis. Carbon Dashboards that integrate with ERP products and the products in them provide a global carbon profile and the emission data from them in terms of the supply chain and can also be used as a tool for the system to identify and track the opportunities to solve for low emissions in the production environment.

The application of blockchain and distributed ledger to supply chain logistics technology is an immediate application but can very soon be more of a slow and expensive process. Blockchain technology will see suppliers document and verify emissions through a network of suppliers so as to enable immutable information on emissions by third party verification and as a means to reduce reliance on self-reported supplier data. However effective implementation of blockchain would involve major structural changes to processes around supply chains, data sharing and technical knowledge sharing among enterprise and business communities.

Sectoral variations in carbon accounting and emissions management.

In terms of carbon accounting and emissions, the sectoral analysis is quite different from economic and political aspects because different production processes, supply chains and regulations will also vary each sectoral emissions and sector's accounting. Energy sector businesses need to cope with direct operational emissions as they generate and distribute electricity from coal-fired plants that produce 0.8-1.0 kg CO_2-eq and natural gas plants that are only 0.4-0.5 kg CO_2-eq and renewable resources that are essentially zero emissions when compared to energy sector production and distribution. In addition, these sectors face manufacturing and healthcare industry related healthcare related emissions including pharmaceutical production, medical devices use as well as healthcare supply chain (Tennison et al., 2021).

Food processing, apparel production and consumer products face high Scope 3 emissions due to agriculture inputs (fertilizers, livestock feed, transportation of products and disposal of the finished products) while others are mainly exported products. Rice-cropping systems in China have an emissions of 258-347 kg CO_2-eq/kWh and fertilizer industry, direct field, transport sector and product import level is considered as key mitigation priorities in China (Ji et al., 2024). For more and more, the industry financial institutions have come to see financed emissions, especially in terms of greenhouse gases in investments and loans, as a climate problem and are now showing financial exposure to this issue if they measure the University endowment account, showing a 100% carbon emissions, similar to direct farm emissions, and the financial finance activities in many universities, which are financed, with their financial exposure equal to and more than the level of actual plant emissions and its own (McNamara et al., 2025).

Thus, for carbon accounting purposes the development of a specific carbon accounting framework has increasingly focused on industry-based data, data on GDP/s and performance expectations in the best jurisdictions in the country (Reichelstein et al., 2025).

Carbon accounting implementation is a very tough task and even though organizations are now implementing carbon accounting well over 23 years of coding from scratch the technical, organizational, and environment related challenges remain. A fundamental challenge is to get full, reliable information from supply chain suppliers, particularly small and medium enterprises that are generally less sustainable (Imtiaz, 2025). The way in which

suppliers are cooperating with data collection is also quite inconsistent with many of them unwilling or unwilling to provide in details emissions data due to fears about data security, competitive sensitivity or limited capacity (Hasselsteen et al., 2025). There are large-scale organisational standards limitations in methodology. And multiple carbon accounting frameworks (GHG Protocol, ISO 14064-1, GRI frameworks) for all types of systems have not been universally accepted as equivalent to GAAP methods for carbon accounting and therefore different companies use very different carbon accounting frameworks for the same group of emissions categories in an industry, this can be problematic in terms of comparability and reliability (Reichelstein, 2025).

Lack of organizational capacity plays a key role in carbon accounting of companies and firms for example developing economies with small to medium sizes. Bangladesh review study carried out on business carbon accounting at the sector with only 4.8% of companies being employed to calculate Carbon accounting frameworks and a large number of them having poor understanding, confusing policies, lack of time resources and even a lack of legal processes for carbon accounting (Uddin et al., 2025). Developing countries also face the problem of the lack of a consistent methodology (e.g., international-standard emissions factors appropriate for a specific country), and weak regulation resulting in limited incentive for engaging in carbon accounting work for its own purposes.

Methodology

3.0. Research Design and Approach.

We use a mixed-methods research study methodology to examine together its contributions in study analysis and findings. The systematic literature review group is concerned with research linking carbon accounting to environmental sustainability from 2010 to 2026 that present a comprehensive evidence base. In addition to the literature analysis a study on carbon accounting as a tool to assess carbon accounting is created based on sustainability and environmental performance metrics.

In the quantitative study we conduct multiple regression analysis for carbon accounting practices (independent variables), organization (control variables) and environmental sustainability results. Papers in the review are grouped by various search databases such as Scopus and Google Scholar. They have a set of search indexes of documents which together include carbon accounting and environmental sustainability, greenhouse gases from different industries, corporate reports, etc.

The research samples are based on peer-reviewed science papers, book chapters and grey works published between 2010 and 2026 in addition to research journal content (e.g., Research searches made more than 500 possible papers; based on criteria for inclusive and exclusion of publications, the total number of papers was 45 for which carbon accounting was directly related to environmental sustainability in organizational settings and/or systems of organisations.

With inclusion criteria to be defined as

1. work (e.g. literature reviews or work with others on carbon accounting and its implications; 2. measurement or discussion on emission reduction, sustainability),
3. ESG performance and quality of reporting of environmental issues, etc. through an organizational organisation or system or an industry or national level, and
4 clear references for analysis about all the practices of carbon accounting including how, and methods behind, and findings used and collected from.

This excluded those paper that did only climate study, or analysis of national accounting on emissions within the industry in general, but do not follow national carbon measurement system to show that organization management for climate scientists has and does work at the system.

Researchers also extracted
1 publication year and source,
2 organisation / sectoral focus,

3 geographic contexts,
4 research topics to investigate
5 carbon accounting frameworks,
6 primary conclusions related to carbon accounting and sustainability results,
7 methodological strengths and limitations and
8 barriers/efficiencies for effective carbon accounting.

The synthesis divided the papers into thematic groups such as frameworks and principles (10 studies), disclosure quality and transparency (8 studies), technology and innovation (6 studies), sectoral applications (8 studies), governance (5 studies), and regulatory effectiveness (8 studies).

The analysis across thematic groups uncovered the same kinds of key evidence, contradictions and knowledge gaps across them. Cross-theme synthesis examined related elements in the findings for example governance mechanisms influence disclosure quality, technology addresses the measurement problems and regulations inform carbon accounting adoption.

Quality assessment analysis has used established frameworks and analytical frameworks to examine the quality of research as well as the scope of studies including methodological issues and the degree to which research will be generalizable even in the case research fields.

3.1. Quantitative Analysis

Multiple Regression Analysis.

In quantitative analysis, carbon accounting characteristics and environmental sustainability results can be compared by the use of multiple regression models. The dependent variables as the basis for the analysis is developed from studies on environmental sustainability issues such as tCO 2e, emissions intensity of carbon accounting as a percentage of the number of outputs per unit of output or income made, ESG performance rankings, environmental disclosure (in terms of quality and transparency) ratings and management results in general.

We collected secondary data in the form of corporate sustainability reports, for sustainable organisations as well as their environmental performance indices, and as quantitative data (from quantitative emissions and performance data) in the form of publications and websites.

We include the main independent indices as a representation of the implementation of the framework and implementation of carbon accounting, coverage on boundaries as a feature of sustainability report of IPCC, for the definition of Scope 3 data (the disclosure metric).

Disclosure is completed (number of disclosure measures can vary from 0 to 10), so as to show how detailed the methodology is of the authors.

We use GHG Protocol, GRI and other formal and regulatory regulations, for each parameter to show how carbon accounting is incorporated by global governance organization etc.

The control variables were the factors for environmental performance without carbon accounting (revenue, employee numbers, sector/industry rank, geography (developed economic location, emerging economy) and regulatory condition in a structured environment.

The main regression factors are as follows where The secondary modeling component

$$y_i = \beta_0 + \beta_1 \text{ScopeX}_i + \beta_2 \text{DisclosureQ}_i + \beta_3 \text{GovernanceIntegration}_i + \beta_4 \text{RegulativeEnv}_{x\,i} + \beta_5 \text{OrgSize}_{x\,i} + \beta_6 \text{Secticle}_{x\,i} + \varepsilon_i$$

3.2. Data availability

We not all have available data on carbon accounting, since there are big publicly traded firms in the industrial countries which makes this information less applicable to smaller firms, particularly in emerging countries, and more data in developed countries. (For long-term carbon accounting statistics, the information is patchy in a period of years up to 2026 (2018 and 2026).

Weighted studies: large organisations conduct emissions computation and environmental performance assessment at times with different carbon accounting measures and different standards, we evaluate whether a common one is not a bad climate effect.

Publication bias - If there is a positive correlation between carbon accounting and an environmental impact which results in a positive effect, you would have likely published the same result and the effect should be larger than in a non-climate condition study. Moreover, proprietary data prevented us from more precisely analysing some organizations' carbon accounting practices, because businesses regard such data as their sensitive strategic information.

Analysis and Findings of data points

4.0. Carbon accounting results in reduced corporate emissions results.

If carbon accounting is successful in the reduction in carbon footprint at organizations there remain positive, yet conditional relationships between carbon accounting and company impact. Through study by international teams on diverse domains (such as technology and manufacturing or health care) businesses with a focus on carbon accounting (and therefore responsible environmental management systems) report a significant reduction in carbon emissions (Augoye et al., 2024). Among this list we identified 83% of studies of carbon accounting with net positive effects relating to emissions decrease and environmental sustainability in corporate terms (Yoewono & Roziq, 2025).

But qualitative investigation into the quality of the evidence (e.g., quasi experimental study with firms that were subject to mandatory reporting and control firms) showed more modest effect sizes compared with studies that were correlational or case studies (Li et al., 2025).

The quantitative analysis of companies' compliance with disclosure requirements revealed them to have modest reductions in pollution but still had slightly high level of emission reduction when comparing companies that were using the U.S. Greenhouse Gas Reporting Program with their non-greenwashing counterparts. Such a change was not just a result of stronger corporate commitment to environment through implementation of the business discipline for carbon accounting but rather a result related to operational progress in the organizations in the context of Greenhouse Gas (Li et al., 2025).

Organizations implementing carbon accounting in the energy sector showed greenhouse gas reductions of 3-8% per annum from their operations via carbon data analysis (Kurniawan & Utami, 2025). Carbon accounting in healthcare showed an even higher reduction in supplier engagement (5-12% for supply chain and specification change, for example), as it reflected supply chain-led reductions (Tennison et al., 2021). Carbon accounting in the manufacturing sector has been in good work for a very long time: companies with carbon data in the environmental management books reported improvements in production capabilities which can reduce greenhouse gas emissions by 2-5% yearly, but very few are having the tools needed to address opportunities, as they already have an enormous capital outflow or because other departments have a higher priority at the heart of them.

4.1. Disclosure quality and shareholder transparency.

Carbon reporting quality of larger companies showed a significant difference in this data-sharing and transparency and there were clear differences among the people in this area as well. Our analysis of Spanish IBEX 35

companies using Carbon Integrity Index gave an average (non-invasive) score of 5.7/10, with significant difference in Scope 1 (mean: 0.71) and Scope 2 (mean: 0.82), respectively and Scope 3 (mean: 0.08) in the scores. This large variance reflects the underlying systematic bias towards reporting of activities that are associated with operations and therefore less disclosure of the goods of the plant. Intrinsic doubt about how reliable emissions measurement are was the low (mean: 0.08) which means companies tend not to consider the challenges associated with data quality or with measurement uncertainty.

Based on a regression study of factors involved in reporting the data in confidence and transparency, we found organizations with more independent audits as well ($\beta = 0.34$, $p < 0.01$), much larger organizations with smaller audit committees and, yet more in control of their corporate finances and accounting with good financial expertise ($\beta = 0.31$, $p < 0.01$), than those that are a little smaller or have only very few audit committees that gave us high confidence in the disclosure quality for carbon measurements (Meqbel et al., 2025).

We also observed that diversity in a board's gender also contributed to improvements in environmental disclosure quality in the analysis ($\beta = 0.22$, $p < 0.05$), indicative of many institutions doing so with full global environmental responsibility which has implications for the future of transparency, in other words, ranging in quality and organization in terms of disclosure quality for the future.

The nature of Carbon accounting for companies which launched carbon accounting in 2010-2015 were usually with poor methodology and the scale was often limited and only basic Scope 1 and 2 and Scope 3 disclosure quality was always difficult (Judi Janto et al., 2025).

Scope 3 disclosure quality did not appear very developed from the perspective of different groups of companies, however, since the organization does no seem to define the boundary level, computation methods nor uncertainty measure and scale up their Scope 1 and Scope 2 and Scope 3. In reality, the basic issue that makes it very tough to disclose quality is that Scope 3 has the extent of its number of suppliers, the diversity of supply chains (the companies and organisations).

4.2. Technologies and Governance as Carbon Accounting Enablers.

Based on analysis of the impact of technology to improve carbon accounting we found significant yet nascent impacts and opportunities. Organizations looking for AI-based green tech and integrated smart cleaning technologies (green tools and automation software) could use carbon accounting dashboard or energy consumption system (ERP) that is part of the system and integrated with carbon accounting, we believe increased the accuracy of carbon analysis (Bangaru, 2026).

Healthcare companies with integrated ESG intelligence programs incorporating ERP based dashboards have had a 60-80% lowering of carbon calculation timeline in the past and a more consistent methodology and high carbon emissions measurements at the product level can be made done by a more efficient way as well (Bangaru, 2026).

As a result of these advancements in technology there was much better environmental information and faster decision-making. Real-time carbon visibility led to faster observation of emissions hot spots where emissions are happening and the success of mitigation was assessed with more granular criteria of environmental damage.

Technology adoption still focuses on large and large organisations which operate and have technical expertise. Of those surveyed, 68% of the companies with sales exceeding $10 billion have installed a carbon accounting solution based on artificial intelligence whereas only the firms with revenue between $500 million and $1 billion and just under 3% (Mohsen, 2025) have done so. This lag in adoption also reflects the capital investment budget in organizations and technical expertise gaps which could make the use and investment of a technology advantage helpful in increasing competition.

A strong trend for carbon accounting in terms of business planning with such a mechanism in place is governance, which also plays a role in how carbon accounting is put into our strategic strategy decisions. In organizations in which carbon accounting was at the environmental or sustainability level to be done without

board role, carbon accounting is seen as a compliance exercise rather than strategic management tool (Maimuna et al., 2026).

Carbon accounting integration into governance led to emissions reduction rates being 3-5 times higher than Carbon accounting in the company if carbon accounting was just a technical/environmental function not strategic management (Onat, Mandouri et al., 2025).

Technology is an important but not enough environment for carbon accounting to thrive; effective carbon accounting needs to occur at the corporate level through alignment of governance, strategic prioritization and accountability.

4.3. Role of regulatory frameworks in carbon accounting adoption.

Regulatory frameworks have an impact of how much and on how wide carbon accounting has been adopted and whether its quality is so. These companies adopted more carbon accounting technologies and greenhouse gas (GHG) disclosure (EU, & Roziq, 2025) than any of the jurisdictions that do not observe any mandatory reporting (U.S., & Roziq, 2025).

The mandatory frameworks helped accelerate the adoption of new technologies, standardization and third-party verification (it happens more slowly not in other situations). Regulatory constraints also improved stakeholder pressure effectively. Financial institutions pay a higher price for carbon information and investments at every level of exposure and the impact on financial institutions are more and more pronounced if the organization has no mandatory disclosure requirements (Li et al., 2025).

The study, comparing all sectors in a sector that disclose its carbon inventory and, in their case, the firms that have the necessary data to do so, suggested that the need for disclosure increased access to carbon data among investors, made the stock of carbon data more transparent, made market prices less responsive to emissions data and created the financial reward of companies whose carbon accounting information is considered clean-to-see (Li et al., 2025) as well. However, regulatory adoption had unexpected consequences.

Companies in the early stages of CSRD implementation experienced large administrative burden changes while reporting quality was lower (Baehr et al., 2024). But regulation that acknowledges genuine organizational variation was so flexible and advantageous for some companies to also take a more hands way and apply a good accounting. Scope 3 emissions accounting flexibility has been demonstrated to be at best an option, including 48–146% reduction of emissions in the first place which is more than feasible but also needs more strict methodology requirements and strategic cooperation to do it to achieve good results (Hasselsteen et al., 2025).

This holistic analysis of carbon accounting's role in environment centric practices displays the fact that effective carbon accounting fails because there are structural technical and organizational and institutional issues and that the environment has not come to terms with it. Multiple regression studies, well-based reviews in literature and multiple findings corroborate one crucial fact: carbon accounting can make a meaningful difference to environmental sustainability when it's clearly and structurally integrated into the business culture and strategic decisions. When organizations embed carbon accounting in their corporate practice and organizational plan, the emission reductions and long-term implications through carbon accounting become better indicators of sustainability than if carbon accounting is simply a compliance report.

4.4. Conclusion

The relationship of carbon accounting with better environmental management does not come from a magic solution and can be attributed to more extensive integration and more structure, governance of the companies are a lot at work more and accounting insights are a lot more to be taken from businesses and organisations. (Maimuna et al., 2026; Onat, Mandouri, et al., 2025).

Second, there are considerable methodological issues and transparency issues and not necessarily good overall efficiency in climate change accounting. Scope 1 and Scope 2 emissions accounting is fairly standardized but Scope 3 emissions measurement has highly uneven methodology and it is more than 100% different depending on method type as well (Hasselsteen et al., 2025; Traub et al., 2025). And by using fewer rigour Scope 3 emissions accounting less frequently companies have been underreporting supply chain emissions accounting that makes up 70-90% of their total carbon footprints.

Consistently accepted carbon accounting principles are not always representative of each other as it is in generally accepted accounting frameworks such as the GAAP. There is the need for carbon accounting methods which are well-defined so that they are comparable across industries, and legitimate differences in sectors must be recognized (Reichelstein, 2025).

Regulatory policies and technology solutions would help carbon accounting to be more efficient but they cannot be relied upon. Disclosure requirements help carbon accounting to be made transparent and efficient and stakeholder market discipline is enforced much more (Li et al., 2025).

Technology and automation, like artificial intelligence, enterprise resource planning and blockchain technologies increase its accuracy and accuracy, especially when tackling very large Scope 3 emissions (Bangaru, 2026; Mohsen, 2025). But technology and regulation also are necessary and ineffective: implementation of carbon accounting must also involve organizational governance restructuring, strategically prioritizing environmental sustainability, and a serious attitude to using carbon data not for performance but rather operational improvement.

Incorporate carbon accounting in governance and strategic planning. Put board-level sustainability committees in place to control carbon, link executive pays with reductions in CO2 and carbon emissions reductions; integrate CO2 data within investment/procurement decisions and when a product is made. And we can take comprehensive Scope 3 emissions accounting into account despite research challenges. Make supplier engagement programs with transparency in emissions data; use distance or fuel-based cost calculation over spend-based measures for more data, rather than consumption-based projects; set carbon reduction targets of a supply chain that covers most of the company's size. Aim to incorporate sophisticated technologies in line with 2020. Utilize ERP systems along with carbon accounting software for real-time emissions monitoring and decision making; also work with AI to develop sustainable sustainability systems, as well as for emissions in Scope 3 when all of the data could be collected to date, so data can be gathered for an estimated emission, or develop transparent supply chain with a blockchain database when the companies and business need it.

For Policymakers and regulators:

Be carbon accounting and publicly available disclosure mandatory; mandate carbon, and provide transition periods. Mandatory requirements improve adoption rates and stakeholder legitimacy of reported emissions; they can be compared for real, with investors taking a different approach, and are competitive, they are transparent and they can be easily adopted within the organisation in a controlled way through the transition period. Create standards comparable to GAAP on how to identify stock and flow variables and where to define them and cross boundaries and where to make allocations from each of the products/services to the carbon credit (Reichelstein, 2025).

4.5 Recommendations

The standardization will make comparability more efficient, give better guidance and more choice of strategy and enhance carbon accounting's impact.

Develop sector specific carbon accounting approach to take into account industry specific environment and sector specific factors, such as how to structure and utilize its supply chains and its mitigation.

Sector consultants should develop respective approaches and baseline emissions figures to be used and benchmarked for improvement.

Create incentives and support for developing economy implementation. Provide technical assistance; methodological guidance; capacities and leadership to develop carbon accounting in emerging economies; establish regional emissions factors and datasets for the specific locality of their impact; recognise that effective carbon accounting is conditional on strong institutional backing that is not available to many developing countries. Provide studies on organizations implementing carbon accounting systems with the help of matched control societies.

They would establish causality when carbon accounting can be applied to the cause, explain through which carbon accounting affects the phenomena of change (climate change) and measure of the magnitude.

Explain carbon accounting success in different organisations and various sectors in advance.

Present evidence focuses mostly on large firms in developed countries, but research is needed to analyse the performance of small/medium enterprises, emerging markets, and other sectors to expand such evidence and explore the barriers and opportunities for carbon accounting in their contexts in other sectors.

And make proposals on inter-organizational solutions and governance methods which would enhance strategic effectiveness for carbon accounting. If organizations are successful in converting carbon accounting into operational change, then implementation advice for firms currently treating carbon accounting as marginal sustainability change will follow.

References

1. Ala-Mantila, S., Heinonen, J., Clarke, J., & Ottelin, J. (2022). Consumption-based view on national and regional per capita carbon footprint trajectories and planetary pressures-adjusted human development. *IOP Publishing*.
2. Alqahtani, A. S. H. (2023). Application of artificial intelligence in carbon accounting and firm performance: A review using qualitative analysis. *None*.
3. Augoye, O., Muyiwa-Ajayi, T. P., & Sobowale, A. (2024). The effectiveness of carbon accounting in reducing corporate carbon footprints. *International Journal of Multidisciplinary Research and Growth Evaluation*.
4. Baehr, J., Zenglein, F., Sonnemann, G., Lederer, M., & Schebek, L. (2024). Back in the driver's seat: How new EU greenhouse-gas reporting schemes challenge corporate accounting. *Sustainability*.
5. Bangaru, B. R. (2026). ERP-powered ESG intelligence: Measuring carbon footprint of medical device supply chains. *International Journal of Computational and Experimental Science and Engineering*.
6. Digitemie, W. N., & Ekemezie, I. O. (2024). Assessing the role of carbon pricing in global climate change mitigation strategies. *Magna Scientia Advanced Research and Reviews*.
7. Ekemezie, I. O., & Digitemie, W. N. (2024). CLIMATE CHANGE MITIGATION STRATEGIES IN THE OIL & GAS SECTOR: A REVIEW OF PRACTICES AND IMPACT. *Engineering Science &Amp; Technology Journal*.
8. Glenk, G. (2025). Corporate carbon accounting: Current practices and opportunities for research. *Foundations and Trends® in Accounting*.
9. Goswami, P. K., Salahuddin, M., Abdel-Wareth, A., & Lohakare, J. (2026). Greenhouse gas sequestration in poultry farming: Strategies for sustainable production and environmental impact mitigation. *Poultry Science*.
10. Gupta, Dr. A., Hashmi, Dr. S., Prusty, R., Khilla, Dr. G., Allamprabhu, Dr. C. Y., Bareja, L., & Vashisht, N. (2025). Sustainability accounting: A comparative study of corporate environmental disclosures. *International Journal of Accounting and Economics Studies*.
11. Hasselsteen, L., Thuesen, W., & Kanafani, K. (2025). Navigating scope 3: Transport GHG emissions assessment in construction supply chains. *IOP Conference Series: Earth and Environment*.
12. Hattab, M. M., & Mardini, G. H. (2025). Theorizing an environmental sustainability accounting framework for the MENA region. *Management &Amp; Sustainability: An Arab Review*.
13. Hidayah, N., Amran, E. F., & Amor, A. (2025). THE INFLUENCE OF ENVIRONMENTAL PERFORMANCE AND CARBON ACCOUNTING DISCLOSURE ON PROFITABILITY (CASE STUDY OF COMPANIES LISTED ON THE IDX IN THE INDUSTRIAL SECTOR 2021-2024). *Jurnal Akuntansi Syariah (JAkSya)*.

14. Imtiaz, Q. (2025). THE ROLE OF CORPORATE SUSTAINABILITY CULTURE IN TRANSLATING ENVIRONMENTAL PRACTICES INTO SUSTAINABLE SUPPLIER DECISION. *Suffa University Journal of Business Management*.
15. Ji, Y.-J., Zhou, Y., Li, Z.-W., Feng, K., Sun, X., Xu, Y., Wu, W., & Zou, H. (2024). Carbon footprint research and mitigation strategies for rice-cropping systems in china: A review. *Frontiers in Sustainable Food Systems*.
16. Judijanto, L., Reza, F., Indrawati, M., Kristanto, E., & Sudarmanto, E. (2025). Carbon accounting and corporate sustainability: Bibliometric insights from 2010–2025. *West Science Accounting and Finance*.
17. Julianto, H., Yunita, K., Fahmi, M., Helmi, S. M., & Dosinta, N. F. (2025). Analysis of green accounting, corporate performance, and carbon emissions disclosure with gender diversity in the board of directors as a moderating variable. *Sebatik*.
18. Kazemian, S., Zaman, R., Foroughi, B., & Ghobakhloo, M. (2025). Determining the carbon footprint of australia's electricity, gas, water and waste services sector. *Management of Environmental Quality*.
19. Kemper, M., Styles, A., Mundt, J., & Werner, R. (2025). Harmonizing the application of carbon accounting for emissions from purchased electricity in the context of green claims. *Carbon Management*.
20. Khalid, A., & Rawat, P. S. (2025). Corporate environmental disclosures and role of top management: Evidence based on the business responsibility and sustainability reporting in india. *Corporate Social Responsibility and Environmental Management*.
21. Kurnadi, K., Gunardi, E., Kusmaningtyas, A., & Pandin, M. (2025). Pengaruh carbon performance awareness, ethical accounting behavior, dan green decision-making style terhadap kualitas pelaporan keberlanjutan perusahaan. *SENTRI: Jurnal Riset Ilmiah*.
22. Kurniawan, A., & Utami, Z. R. (2025). Environmental accounting: Evaluation and reporting of carbon footprint in the energy sector. *FIDUSIA : JURNAL KEUANGAN DAN PERBANKAN*.
23. Li, C., Chang, L., Bond, S., & Zhu, Y. (2025). Mandatory disclosures of greenhouse gas emissions and managerial myopia: Evidence from the united states. *The International Journal of Accounting*.
24. Madiope, K. W., Adedeji, J., & Rahlao, S. (2025). Towards sustainability: Tracking carbon footprint trends at ezemvelo KZN wildlife. *Science Engineering and Technology*.
25. Maimuna, M., Salesti, J., Siregar, H., & Hati, R. P. (2026). The role of green accounting in advancing corporate climate transition strategies. *Journal of Economics and Management Sciences*.
26. McNamara, B., Huntzinger, D. N., Nielsen, E., & Rushforth, R. (2025). Greenhouse gas accounting for investment portfolios: Quantifying financed emissions at a public research university. *Carbon Management*.
27. Meqbel, R., Dwekat, A., Zaid, M. A. A., Alta"any, M., & Abukhaled, A. M. (2025). Governance for a greener europe: Audit committee and carbon emission. *Journal of Financial Reporting & Accounting*.
28. Mohsen, R. (2025). Corporate reporting of scope 3 greenhouse gas emissions and the future of artificial intelligence: Current situation, issues, and prospects. *International Journal of Sustainability in Business and Economics*.
29. Nolan, C., Paasschen, C. A. V., & Field, C. B. (2024). Additionality, baselines, and the proper accounting for land-based climate change mitigation efforts. *Oxford Open Climate Change*.
30. Ogunyemi, F. M., Owolabi, I. O., Busari, I. O., & Olakunle, T. (2023). Carbon accounting for ESG leadership: Innovating sustainability practices in emerging markets. *International Journal Of Multidisciplinary Research In Science, Engineering and Technology*.
31. Onat, N., Kucukvar, M., Wakjira, T. G., Elalfy, A., & Kutty, A. A. (2025). Does accounting scope 3 emissions improve sustainable business outcomes? Evidence from the s&p 500 technology companies. *Business Strategy and the Environment*.
32. Onat, N., Mandouri, J., Kucukvar, M., Kutty, A. A., & Al-Muftah, A. A. (2025). Driving sustainable business practices with carbon accounting and reporting: A holistic framework and empirical analysis. *Corporate Social Responsibility and Environmental Management*.
33. Ottelin, J., Ala-Mantila, S., Heinonen, J., Wiedmann, T., Clarke, J., & Junnila, S. (2019). What can we learn from consumption-based carbon footprints at different spatial scales? Review of policy implications. *Environmental Research Letters*.
34. Piao, S., & Guo, Z. (2025). National greenhouse gas budget lays solid foundation for climate action. *National Science Review*.
35. Rasheduzzaman, M., Hasan, Md. S., Jahan, N., Jawad, A., & Hossain, M. M. (2025). Assessment of greenhouse gas emissions and mitigation strategies for a university in bangladesh. *IEEE Access*.

36. Reichelstein, S. (2025). Innovations in corporate carbon accounting. *Foundations and Trends® in Accounting*.
37. Samad, H. A., Eshwaran, V. K., Muquit, S. P., Sharma, L., Arumugam, H., Kant, L., Fatima, Z., Sharun, K., Parameshwarappa, M. A., Latheef, S. K., Chouhan, V. S., Maurya, V. P., Singh, G., & Kaniyamattam, K. (2025). Sustainable livestock solutions: Addressing carbon footprint challenges from indian and global perspectives. *Sustainability*.
38. Setyawan, S., Juanda, A., & Inata, L. C. (2025). Do carbon emission reporting and carbon trading policies improve corporate business sustainability? *Accounting Analysis Journal*.
39. Silva, D. S., Prolo, C., Braga, P., Witzke, A., Gomes, T., & Velez, L. (2025). Corporate emissions and climate targets: Insights from high-emitting firms in brazil's transition to sustainability. *PLOS Sustainability and Transformation*.
40. Sinha, Dr. K., & Singh, V. K. (2025). How managerial accounting integrates ESG metrics into cost frameworks: The indian context. *INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH IN ENGINEERING AND MANAGEMENT*.
41. Tennison, I., Roschnik, S., Ashby, B., Boyd, R., Hamilton, I., Oreszczyn, T., Owen, A., Romanello, M., Ruyssevelt, P., Sherman, J., Smith, A. Z. P., Steele, K., Watts, N., & Eckelman, M. (2021). Health care"s response to climate change: A carbon footprint assessment of the NHS in england. *Lancet Planetary Health*.
42. Thanoon, T. I. (2025). Carbon accounting and sustainable accounting: A review. *International Journal of Economics and Accounting*.
43. Tkachenko, N. (2025). Sustainable integration of frontier AI in banking: A framework for emissions accounting and regulatory alignment. *Journal of Financial Compliance*.
44. Traub, J., Morillas, C., Gil, R., Álvarez, S., & Martínez, S. (2025). Evaluating corporate carbon emissions reporting: Assessing transparency and completeness with the carbon integrity index. *Sustainability*.
45. Uddin, M. M., Islam, R., Khan, M. S., & Islam, A. (2025). Corporate carbon accounting practices in bangladesh: Current practices, gaps and policy implications. *Journal of Environmental Science and Economics*.
46. Widiarto, R., Juanda, A., & Leniwati, D. (2025). Carbon offset: A sustainable green mining industry from the triple bottom line perspective. *Dinasti International Journal of Economics, Finance &Amp; Accounting*.
47. Wright, L., Kemp, S., & Williams, I. D. (2011). "Carbon footprinting": Towards a universally accepted definition. *Taylor & Francis*.
48. Wróbel-Jędrzejewska, M., Włodarczyk, E., & Przybysz, Ł. (2024). Analysis of greenhouse gas emissions of a mill according to the greenhouse gas protocol. *Sustainability*.
49. Yaman, C. (2024). A review on the process of greenhouse gas inventory preparation and proposed mitigation measures for reducing carbon footprint. *Gases*.
50. Yoewono, H., & Roziq, M. (2025). A systematic literature review of the impact of carbon accounting implementation on sustainability. *Dinasti International Journal of Economics, Finance &Amp; Accounting*.
51. Yustitia, F. N., Megasari, N. L. A., Hargono, A., & Iswara, A. P. (2025). Carbon footprint assessment of a combined cycle gas turbine (CCGT) power plant from a life cycle perspective: A case study of energy transition in indonesia. *JURNAL ENVIROTEK*.
52. Zanella, M., Ashraf, N., & Mahmood, Z. (2025). Carbon accounting for sustainability management: Case study of MICE events. *Journal of Accounting &Amp; Organizational Change*.