Accounting for Carbon Emissions and Climate-Related Risks: A Qualitative Review of Standards, Corporate Practices, and Reporting Challenges

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Abstract
This study examines the accounting and sustainability-reporting system for carbon emissions and climate-related risks, corporate measurement and disclosure practices, and the main reporting gaps. A structured qualitative review including academic studies, theoretical and methodological sources, and authoritative standards or guidance documents. Evidence was organised around the three research questions and analysed thematically. The findings show a layered system: The Green House Gas (GHG) Protocol guides emissions measurement, International Financial Reporting Standard (IFRS) S2 gives an investor-focused climate-disclosure baseline, GRI and ESRS cover wider impact and materiality issues, while IFRS Accounting Standards deal with financial-statement effects. Practice is stronger for Scope 1 and Scope 2 than Scope 3, and climate assumptions are not always reflected in impairment, useful lives, provisions, fair values, expected credit losses, or related disclosures. Boundary choices, carbon allowances and credits, boilerplate reporting, and uneven assurance also reduce comparability. The study concludes that the main problem is weak connection between emissions data, management assumptions, financial recognition, disclosure, and assurance. It recommends stronger data controls, climate-to-financial-statement reviews, clearer carbon policies, entity-specific reporting, and suitable assurance.

Keywords: *Carbon accounting; Climate-related risk; Greenhouse Gas Emissions; IFRS S2; Scope 3; Sustainability Reporting*

1.1 Introduction

Climate change is an accounting concern because physical hazards and the move to a lower-carbon economy can affect cash flows, asset values, useful lives, provisions, financing, and risk. Accounting research now considers greenhouse gas measurement, carbon performance, climate-related financial risk, assurance, and market effects. However, these areas have often developed as partly separate research streams (He et al., 2022; Mashhadi Rajabi et al., 2026). Corporate carbon accounting is the system used to measure greenhouse gas emissions and connect them with business and financial decisions. It covers reporting boundaries, Scope 1, Scope 2 and

Scope 3 emissions, emission factors, activity data, carbon measures, pricing, and external reporting. It has physical and monetary sides because an emissions inventory alone does not decide how carbon costs, allowances, impairment, obligations, or stranded assets should be treated in financial statements (He et al., 2022; Reichelstein, 2024).

The reporting system now includes IFRS S2, the GHG Protocol, GRI standards, ESRS, and climate-related use of existing IFRS Accounting Standards. These frameworks serve different purposes. IFRS S2 focuses on risks and opportunities that may affect an entity's prospects; GRI focuses on organisational impacts; ESRS uses double materiality; and IFRS Accounting Standards deal with recognised amounts, estimates, judgements, and disclosures (European Commission, 2023, 2026; GRI, 2025; IFRS Foundation, 2023a, 2023b, 2025b). More disclosure has not removed problems of comparability and connection. Scope 3 still depends heavily on value-chain data and assumptions, reports can be generic, and material climate information is not always linked to financial reporting assumptions (Hettler & Graf-Vlachy, 2024; Lin et al., 2024; Treepongkaruna et al., 2024). Investors and analysts respond to carbon risk and material climate information, making these weaknesses important for decision making (Ben-Amar et al., 2024; Matsumura et al., 2024).

1.2 Statement of the Problem

Ideally, accounting for carbon emissions and climate-related risks should produce information that is relevant, comparable, verifiable, and connected to general-purpose financial reporting. Emissions inventories should use transparent boundaries, consistent Scope 1, Scope 2, and Scope 3 methods, and reliable activity data. Where physical or transition risks materially affect cash-flow expectations or obligations, consistent assumptions should be reflected in impairment tests, useful lives, provisions, fair values, expected credit losses, budgets, transition plans, and related disclosures. Assurance should reinforce confidence in the methods and evidence used (IFRS Foundation, 2023a, 2023b; WBCSD & WRI, 2004, 2011).

In practice, this is not always achieved. Scope 3 often depends on supplier data, secondary emission factors, allocation methods, and assumptions. Reports may be long but still generic, climate risks may not be clearly linked to accounting estimates, and carbon allowances and credits are treated in different ways. Assurance also varies in coverage, level, criteria, and expertise (Clermont et al., 2024; Hettler & Graf-Vlachy, 2024; Lin et al., 2024; Luo et al., 2023).

The research gap is not simply a lack of standards. Earlier and recent reviews show continuing problems with carbon accounting, climate disclosure, materiality, comparability, and implementation (He et al., 2022; Mashhadi Rajabi et al., 2026). Less attention has been given to how the same climate facts move from emissions data and management assumptions into financial statements, sustainability reports, and assurance.

This study addresses that gap by treating carbon and climate reporting as one connected accounting process. It brings together evidence on emissions measurement, financial recognition, external reporting, and assurance to show where the links break down and what controls can improve them. The study therefore connects physical carbon information with financial effects while recognising the different purposes of the major reporting frameworks.

The aim of the study is to evaluate how contemporary accounting and sustainability-reporting arrangements measure, recognise, disclose, and assure carbon emissions and climate-related risks, with particular attention to the connectivity between emissions data and financial reporting.

In view of the above, the study provided answers to the following research questions:

1. What accounting standards and reporting frameworks are used in accounting for carbon

emissions and climate-related risks?
2. How do corporations measure, recognise, and disclose carbon emissions and climate-related financial risks?
3. What major challenges affect carbon accounting and climate-related risk reporting, and what improvements are supported by the literature?

2. Literature Review

2.1 Conceptual Review

2.1.1 Carbon Emissions and Carbon Accounting

Carbon emissions are greenhouse gas releases stated in carbon-dioxide-equivalent amounts, while carbon accounting is the system used to identify, measure, manage, and report those emissions and related financial effects. The GHG Protocol groups them into Scope 1 direct emissions, Scope 2 emissions from purchased energy, and Scope 3 other value-chain emissions (WBCSD & WRI, 2004, 2011). This classification is widely used in corporate reporting.

Carbon accounting has physical and monetary sides. Physical accounting records quantities, sources, boundaries, and changes, while monetary accounting records carbon taxes, allowances, internal prices, obligations, and investment effects. Comparability can be weakened by consolidation choices, restatements, emission factors, intensity measures, and poor value-chain data (Stachelscheid & Dutzi, 2025; Wegener et al., 2019).

2.1.2 Climate-Related Risks and Materiality

Climate-related financial risk is the possibility that physical climate effects or the transition to a lower-carbon economy will affect an entity's financial position, performance, cash flows, access to finance, or cost of capital; materiality determines whether such information could reasonably influence the decisions of the intended users. Physical risks include acute events such as floods, storms, and wildfires and chronic changes such as heat, water stress, and sea-level rise, while transition risks arise from policy, legal, technological, market, and reputational change (IFRS Foundation, 2023a; TCFD, 2017). Empirical evidence links climate exposure and disclosure to firm risk and analyst usefulness, reinforcing the financial relevance of material climate information (Ben-Amar et al., 2024; Matsumura et al., 2024).

Materiality varies with reporting purpose. IFRS S2 focuses on climate-related risks and opportunities that could reasonably affect an entity's prospects, whereas GRI focuses on significant impacts on the economy, environment, and people, and ESRS combines impact and financial materiality through double materiality. These approaches can be interoperable without being identical. Credible reporting therefore requires entities to state the reporting objective, boundary, materiality basis, and reasons for any differences between sustainability and financial reporting (European Commission, 2023, 2026; GRI, 2025; IFRS Foundation, 2023a).

2.1.3 Accounting Standards and Reporting Frameworks

Accounting standards and reporting frameworks are authoritative or widely accepted principles and requirements that govern how economic and sustainability information is identified, measured, presented, and disclosed. The architecture for carbon and climate matters is layered: IFRS Accounting Standards govern recognised financial-statement effects; IFRS S2 provides an investor-focused climate-disclosure baseline; the GHG Protocol structures emissions measurement; and GRI and ESRS extend reporting toward organisational impacts and double materiality. The key accounting requirement is not uniformity of purpose but traceability

between the layers (European Commission, 2023; IFRS Foundation, 2023a, 2023b; WBCSD & WRI, 2004, 2011).

Climate Effects within Financial Statements

Climate effects within financial statements are material consequences of physical or transition risks that alter the recognition, measurement, presentation, or disclosure of assets, liabilities, income, expenses, estimates, or judgements under applicable accounting standards. Existing IFRS Accounting Standards do not create a separate climate ledger. Instead, climate information can affect useful lives and residual values under IAS 16 and IAS 38, impairment under IAS 36, provisions and contingencies under IAS 37, expected credit losses under IFRS 9, and market-participant assumptions under IFRS 13. The IASB's 2025 illustrative examples on uncertainties reinforce the need for entity-specific materiality, estimation-uncertainty, and disaggregation judgements where climate-related facts make generic disclosure insufficient (IFRS Foundation, 2023b, 2025b). Carbon allowances and credits illustrate the difficulty of applying general accounting standards to emerging climate transactions. Units may be received or purchased for regulatory compliance, generated through projects, held for trading, used voluntarily, or retired against targets. Those different purposes and contractual features can produce diversity in classification and measurement and may create mismatches between the asset and the related compliance obligation. Research consequently identifies a continuing standard-setting and comparability gap rather than a single settled accounting model (Clermont et al., 2024; Reichelstein, 2024).

Climate and Sustainability Disclosure Frameworks

Climate and sustainability disclosure frameworks are structured requirements for communicating governance, strategy, risk management, metrics, targets, impacts, and related information to external users. IFRS S2 requires investor-focused climate information, including material Scope 1, Scope 2, and Scope 3 emissions and current and anticipated financial effects. The GHG Protocol supplies the principal measurement vocabulary through organisational boundaries and the three scopes, including 15 Scope 3 categories. GRI provides an impact-oriented perspective, while ESRS E1 embeds climate reporting within double materiality (European Commission, 2023; GRI, 2016, 2025; IFRS Foundation, 2023a; WBCSD & WRI, 2004, 2011).

The framework environment remains dynamic. The ISSB's December 2025 amendments to IFRS S2 provide targeted greenhouse-gas reporting reliefs and clarifications and are effective for annual periods beginning on or after 1 January 2027, with earlier application permitted. GRI 102: Climate Change 2025 becomes effective for reports published on or after 1 January 2027. In the European Union, the Commission adopted revised ESRS on 3 July 2026 as part of the simplification programme; the revised standards are intended to reduce reporting burden while retaining decision-useful sustainability information, with legal effectiveness tied to completion of the EU adoption process (European Commission, 2026; GRI, 2025; IFRS Foundation, 2025a). These developments support interoperability but also require papers and corporate reports to distinguish standards currently in force from forthcoming amendments.

Table 1: ***Comparison of Principal Carbon and Climate-Reporting Frameworks***

Framework	Primary orientation	Accounting/reporting role	Key limitation or current-status issue
IFRS S2	Investor-focused climate-related financial disclosure	Governance, strategy, risk management, financial effects, emissions and targets; connected to general-purpose financial reporting.	Application depends on materiality, estimates and jurisdictional adoption; 2025 GHG amendments apply from 2027 unless adopted early.
GHG Protocol	Corporate physical GHG inventory	Organisational boundaries; Scope 1, Scope 2 and Scope 3 measurement; value-chain categories.	Permitted boundary and estimation choices, secondary data and restatements can reduce comparability.
GRI 305 / GRI 102	Impact-oriented sustainability reporting	Emissions, reductions, transition and adaptation, targets and related impacts.	Materiality differs from investor-focused standards; GRI 102 becomes effective from 1 January 2027.
ESRS E1	EU double-materiality reporting	Transition plans, policies, targets, energy, emissions, carbon credits and financial effects.	Detailed requirements and EU scope create implementation burden; revised ESRS were adopted by the Commission in July 2026.
IFRS Accounting Standards	Financial-statement recognition and measurement	Impairment, useful lives, provisions, expected credit losses, fair value, judgements and estimates.	No single climate-accounting standard; effects are dispersed across standards and entity-specific judgements.

Source*:* Synthesised from European Commission (2023, 2026), GRI (2016, 2025), IFRS Foundation (2023a, 2023b, 2025a, 2025b), and WBCSD and WRI (2004, 2011).

2.2 Theoretical Framework

2.2.1 Institutional Theory

DiMaggio and Powell (1983) developed the institutional theory framework used here. It explains how organisations respond to coercive pressure from regulation, normative pressure from professional standards, and mimetic pressure from copying others under uncertainty. In climate reporting, it helps explain why firms adopt similar disclosure structures and assurance practices even when measurement is still developing.

2.2.2 Legitimacy Theory

John Dowling and Jeffrey Pfeffer (1975) developed Legitimacy Theory. Legitimacy theory explains disclosure as a means through which organisations seek congruence between their activities and socially accepted expectations. Suchman (1995) later conceptualises legitimacy as a generalised perception that organisational actions are appropriate within a socially constructed system of norms and values. The theory is relevant because climate reporting can represent substantive accountability or symbolic conformity; boilerplate language, selective emphasis, and greenwashing are more likely where disclosure incentives exceed the strength of measurement and verification systems (Treepongkaruna et al., 2024).

2.2.3 Stakeholder Theory

Edward Freeman R. (1984) developed Stakeholder Theory. Stakeholder theory explains corporate reporting as a response to the information needs and influence of parties that affect or are affected by the organisation. Investors and lenders may emphasise enterprise value, resilience, and cash-flow effects, while regulators, communities, customers, and employees may place greater weight on absolute emissions, environmental impacts, and transition consequences. This perspective helps explain why IFRS S2, GRI, and ESRS coexist and why interoperability should preserve rather than erase legitimate differences in reporting purpose (Mashhadi Rajabi et al., 2026).

2.3 Empirical Review

Depoers et al. (2016) examined whether greenhouse gas information reported by French listed firms was consistent across corporate reports and the Carbon Disclosure Project. They used comparative content analysis to compare emission figures and the explanations supporting those figures. The study found that greenhouse gas amounts were significantly lower in corporate reports than in the Carbon Disclosure Project. It also found that firms gave more explanation when the figures in the two reporting channels differed.

Downar et al. (2021) examined the effect of the 2013 United Kingdom carbon disclosure mandate on emissions and operating performance. They used a difference-in-differences method, comparing affected UK listed firms with a control group of European firms. The study found that firms covered by the rule reduced emissions by about 8 percent. It also found no significant change in gross margins, showing that the reduction in emissions did not clearly harm operating performance. Tomar (2023) studied whether mandatory greenhouse gas disclosure can reduce emissions through benchmarking. Using facility-level data from the United States Greenhouse Gas Reporting Program and econometric analysis, the study examined changes after emissions became public. The results showed that facilities reduced emissions by about 7.9 percent after disclosure. The study also found that comparison with peer facilities encouraged reductions, while measurement without public disclosure did not produce the same effect.

Luo et al. (2023) examined whether external carbon assurance improves the quality of carbon disclosure. They analysed Carbon Disclosure Project data from 2010 to 2020, covering 9,902 firm-year observations from 1,700 companies in 38 countries. Regression and cross-sectional analyses were used. The findings showed that assured firms had better carbon disclosure than unassured firms. Disclosure quality also increased when a larger share of reported emissions was assured and when the assurance level was higher. Ben-Amar et al. (2024) examined whether climate risk disclosure helps financial analysts. They analysed 2,184 firm-year observations from United States non-financial firms between 2010 and 2016 and tested the link between disclosure, forecast accuracy, and forecast disagreement. The results showed that disclosure improved forecast precision and reduced disagreement mainly where climate risk was financially material. Material physical-risk disclosure reduced forecast error, while transition-risk disclosure showed no clear effect. Matsumura et al. (2024) examined the relationship between climate risk disclosure and firm risk. They hand-collected climate disclosure data from 10-K reports for 3,919 S&P 500 firm-year observations from 2008 to 2016 and used the SASB Materiality Map and implied cost of equity. The results showed that firms disclosing climate risk had a lower cost of equity than non-disclosing firms, especially in industries where climate risk was expected to be financially material.

2.4 Gap in Literature

These studies show that climate disclosure can influence emissions, disclosure quality, analysts, and market risk. However, most of them study only one part of the reporting process. They do not fully explain how climate information moves from emissions measurement to management assumptions, financial statement recognition, sustainability disclosure, and assurance. Most evidence also comes from large firms in developed markets. This leaves a gap for a review that connects these parts as one accounting process. This study addresses that gap by examining carbon measurement, financial reporting, disclosure, and assurance together.

3. Methodology

The study used a structured qualitative literature review and documentary analysis because the evidence includes empirical studies, conceptual papers, reviews, accounting research, and authoritative standards that require interpretation rather than statistical combination (Snyder, 2019). Academic sources were included when they directly addressed a research question and came from peer-reviewed or established scholarly outlets. Authoritative documents came from the IFRS Foundation, European Commission, GRI, and the GHG Protocol.

The sources utilised comprised of 22 academic, theoretical, and methodological works and 11 authoritative standards or guidance documents. The sources were organised against the three research questions. The study used Thematic Analysis to address the research questions. This procedure provides an auditable evidence trail while keeping the synthesis focused on the paper's accounting-connectivity gap.

4. Thematic Analysis and Discussion

4.1 Accounting Standards and Reporting Frameworks Used in Accounting for Carbon Emissions and Climate-Related Risks

The evidence shows a layered reporting system rather than one climate-accounting standard. The GHG Protocol provides the main measurement base for Scope 1, Scope 2 and Scope 3 emissions. IFRS S2 adds investor-focused disclosure on governance, strategy, risk, financial effects, emissions, and targets. GRI covers organisational impacts, ESRS applies double materiality, and IFRS Accounting Standards deal with material effects on impairment, useful lives, provisions, fair values, expected credit losses, and related disclosures (European Commission, 2023, 2026; IFRS Foundation, 2023a, 2023b, 2025b; WBCSD & WRI, 2004, 2011).

The accounting significance of this finding is that coexistence of frameworks is not itself the principal weakness; weak connectivity between them is. Each framework solves a different reporting problem, and credible reporting requires an entity to trace a common emissions inventory and climate assumptions across sustainability reporting and, where financially material, into accounting estimates and judgements. The 2025 IFRS S2 amendments, the 2027 effective date of GRI 102, and the 2026 revision of ESRS show that standardisation remains implementation-sensitive as data systems and regulatory expectations develop (European Commission, 2026; GRI, 2025; IFRS Foundation, 2025a). Institutional theory explains the diffusion of these structures through regulatory, professional, and peer pressures, but the literature also warns that standard adoption can outpace substantive integration (He et al., 2022). Accordingly, the answer to Research Question One is that credible carbon and climate-risk reporting depends on coordinated application of the GHG Protocol, IFRS S2, relevant IFRS Accounting Standards, and, where applicable, GRI and ESRS, with explicit explanation of reporting purpose, materiality, boundary, measurement basis, and any cross-report differences.

4.2 Corporate Measurement, Recognition, and Disclosure of Carbon Emissions and Climate-Related Financial Risks

This part examines how corporations measure, recognise, and disclose carbon emissions and climate-related financial risks. Measurement normally begins with organisational and operational boundary decisions. Equity-share, financial-control, and operational-control approaches can generate different footprints where joint ventures, leases, acquisitions, disposals, or outsourced operations are material. Scope 1 is generally closest to direct operational data, Scope 2 depends on purchased-energy information and applicable measurement choices, and Scope 3 is the most estimation-intensive because it relies on suppliers, logistics providers, customer behaviour, product-use assumptions, end-of-life treatment, industry averages, spend-based factors, and other models. This makes transparency about exclusions, emission factors, estimation hierarchies, uncertainty, and restatement policies essential to comparability (Hettler & Graf-Vlachy, 2024; Wegener et al., 2019). Absolute emissions and intensity measures provide different information, and the choice of denominator can materially change apparent performance (Stachelscheid & Dutzi, 2025). Recognition occurs when climate-related information changes the recognition criteria or measurement inputs of the relevant asset or liability, not simply because an emissions figure exists. Physical hazards, carbon prices, technological substitution, demand shifts, regulation, and binding commitments can affect impairment tests, remaining useful lives, provisions, fair values, and expected credit losses. The literature nevertheless finds weaker connectivity between sustainability narratives and conventional accounting estimates than between emissions inventories and external disclosure (Mashhadi Rajabi et al., 2026; Reichelstein, 2024). Carbon allowances and credits add further diversity because the economic substance of units held for compliance, trading, project generation, voluntary use, or retirement may differ, contributing to varied accounting policies (Clermont et al., 2024). The IASB's 2025 examples strengthen the expectation that climate-related uncertainty should be reflected through entity-specific accounting judgements where material rather than through generic narrative alone (IFRS Foundation, 2025b). External climate disclosure has expanded, but decision usefulness depends on precision, comparability, and financial relevance. Depoers et al. (2016) documented inconsistencies between disclosure channels, while Lin et al. (2024) identify growth in boilerplate reporting. By contrast, more financially material and precise disclosures can improve analyst usefulness, and mandatory disclosure or benchmarking can influence emissions behaviour where information is observable and comparable (Ben-Amar et al., 2024; Downar et al., 2021; Tomar, 2023). Assurance can improve carbon-disclosure quality, although its effect depends on the scope, criteria, level, and competence of the provider (Luo et al., 2023; Pham et al., 2026). The answer to Research Question Two is therefore that companies increasingly measure and disclose carbon information, but Scope 3 reliability, carbon-instrument accounting, and the translation of climate assumptions into financial-statement amounts remain uneven. Corporate climate accounting is best understood as a chain of boundary selection, data collection, estimation, financial judgement, disclosure, and verification, with uncertainty potentially entering at each stage.

4.3 Challenges Affecting Carbon Accounting and Climate-Related Risk Reporting, and Improvements

This section concerns the major challenges and the improvements supported by the literature. Six interrelated weaknesses recur across the evidence: boundary and consolidation choices; Scope 3 data limitations; weak connectivity between sustainability reporting and financial statements;

unsettled accounting for carbon allowances and credits; boilerplate or selective disclosure; and uneven assurance and climate expertise. Boundary decisions can alter reported totals without equivalent changes in underlying impact, while Scope 3 estimates may be dominated by secondary data and assumptions. Transition plans may also be published without corresponding changes in budgets, forecast cash flows, impairment assumptions, asset lives, provisions, or valuation models. At the disclosure stage, lengthy reports can still omit entity-specific locations, time horizons, financial effects, or methodological explanations; at the assurance stage, users may overestimate reliability where only selected metrics receive limited assurance (Clermont et al., 2024; Hettler & Graf-Vlachy, 2024; Lin et al., 2024; Luo et al., 2023; Treepongkaruna et al., 2024). These weaknesses reinforce one another because weak source data impair targets, uncertain targets weaken transition plans, and disconnected plans weaken both sustainability narratives and accounting estimates. The literature supports an integrated response rather than additional disclosure volume. Technical improvements include documented organisational and operational boundaries; a hierarchy that progressively replaces secondary Scope 3 estimates with supplier-specific data for material categories; formal consistency reviews linking scenarios and transition milestones to budgets and accounting estimates; transparent policies for allowances and credits based on economic purpose; entity-specific disclosure of uncertainty and methodological change; and assurance supported by climate, accounting, data, and sector expertise. Institutional improvements include clearer regulatory expectations, professional education, and enforcement focused on substance and traceability rather than prescribed headings. Legitimacy theory explains why formal structures can encourage ceremonial reporting, while stakeholder scrutiny and assurance increase pressure for evidence that emissions, targets, and financial effects are traceable to underlying systems (Suchman, 1995; Treepongkaruna et al., 2024). The answer to Research Question Three is therefore that the principal gap is integration and implementation: credible improvement requires source data, managerial decisions, financial recognition, external reporting, and assurance to operate as one controlled accounting architecture. Comparability should be improved through transparency about structural differences, exclusions, methodological revisions, and uncertainty rather than by forcing unlike business models into superficially uniform figures.

5.0 Conclusion and Recommendations

5.1 Conclusion

The review concludes that carbon and climate-risk accounting have a developed but not fully connected reporting system. The GHG Protocol guides emissions measurement, IFRS S2 gives an investor-focused climate baseline, GRI and ESRS cover wider impact and materiality needs, and IFRS Accounting Standards deal with financial-statement effects. Practice is stronger where emissions come from direct operational data and weaker where Scope 3 estimates, carbon instruments, future climate assumptions, and judgement are important. Climate narratives are also not always linked to impairment, useful lives, provisions, fair values, expected credit losses, or other accounting assumptions. The study's contribution is to locate the central research and practice gap in the accounting connectivity between physical emissions measurement, managerial assumptions, financial recognition, sustainability disclosure, and assurance. The problem is therefore not solved by increasing disclosure volume alone. Credible climate accounting requires a traceable system in which boundaries and estimation methods are controlled, material climate assumptions are consistently reflected in financial reporting, changes are explained, and assurance is proportionate to the significance and uncertainty of the

information. When these elements operate together, the different reporting frameworks can remain purpose-specific while still producing information that is more comparable, verifiable, and decision-useful.

5.2. Recommendations

Based on the findings, the following recommendations are made:

1. Corporations should strengthen carbon-data governance by formally documenting organisational and operational boundaries, maintaining approved emission-factor and estimation hierarchies, and progressively prioritising supplier-specific information for material Scope 3 categories. This directly addresses the comparability weakness created by boundary choices and secondary data.
2. Companies should institute a formal climate-to-financial-statements connectivity review. Climate scenarios, transition milestones, carbon-price assumptions, capital budgets, forecast cash flows, impairment tests, useful lives, provisions, fair values, and expected credit-loss models should be reconciled, with material inconsistencies explained. This addresses the central gap between sustainability narratives and accounting recognition and measurement.
3. Standard setters and regulators should prioritise entity-specificity, traceability, and clearer accounting policy disclosure for carbon allowances and credits. Reporting should distinguish compliance allowances, voluntary credits, project-generated units, trading positions, and units retired against targets according to their economic substance, while enforcement should focus on boundary changes, target baselines, methodological revisions, and consistency with audited financial statements.
4. Reporting entities and assurance providers should expand climate-related professional competence and progressively increase assurance coverage over material emissions and climate metrics. Assurance reports should identify the metrics, entities, scopes, criteria, and level of assurance covered so that users can distinguish independently supported information from unaudited or limited-assurance disclosures.

5.3 Limitations of the Study

This study has some limitations. First, it is a structured qualitative review and does not include every publication on carbon accounting and climate risk. The sources were selected because they were relevant, current, and authoritative, so other useful studies may not have been included. Second, the paper depends on published evidence and standards rather than new data collected from companies. It therefore cannot show how every firm applies the requirements in daily practice. Third, climate reporting rules are changing, so some requirements discussed here may be revised as IFRS S2, GRI, ESRS, and local rules develop. Finally, much of the available evidence comes from large companies and developed markets. Smaller firms and organisations in developing countries may face different data, cost, skills, and assurance problems. These limits do not remove the value of the review, but they should be considered when applying its findings.

5.4 Contributions to Knowledge

This study contributes to knowledge by bringing carbon and climate reporting into one accounting view. Many studies discuss emissions measurement, sustainability disclosure, financial reporting, or assurance as separate issues. This paper shows that these areas are closely connected. It explains that carbon information should move from source data and emissions

measurement to management decisions, financial statement estimates, external disclosure, and assurance. This accounting connectivity view explains why a company may publish detailed climate information and still have weak financial reporting when the same assumptions are not reflected in impairment, provisions, useful lives, fair values, or credit risk estimates. The study also brings together the purposes of the GHG Protocol, IFRS S2, GRI, ESRS, and existing IFRS Accounting Standards without treating them as the same. It shows that good reporting depends on clear boundaries, reliable data, consistent assumptions, and verification. The study therefore gives a simple way to understand where carbon reporting can break down and where stronger controls are needed.

5.5 Areas for Further Studies

Further studies can build on this review. Researchers can use interviews, surveys, and case studies with accountants, auditors, sustainability officers, investors, and regulators to see how climate information is used in accounting decisions. Studies can compare companies across industries because oil and gas, banking, manufacturing, agriculture, transport, and technology firms face different emissions and climate risks. More research is needed on Scope 3 emissions, especially the reliability of supplier data, emission factors, estimates, and methods used when direct data are unavailable. Future studies can examine how companies account for carbon allowances and credits and whether different policies affect profit, assets, liabilities, or comparability. Another area is climate assurance. Researchers can study whether stronger assurance improves emissions data and whether users understand levels of assurance. As IFRS S2 and other climate reporting rules become used, future research should test whether disclosure becomes more connected to financial statements. Long term studies may examine whether better climate accounting improves investment decisions, planning, reporting quality, and actual reductions in emissions.

6 References

Ben-Amar, W., Herrera, D. C., & Martinez, I. (2024). Do climate risk disclosures matter to financial analysts? *Journal of Business Finance & Accounting, 51*(7-8), 2153-2180.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101.

Clermont, E., Caron, M.-A., Tessier, S., & Fortin, A. (2024). Accounting for carbon allowances: A conventionalist reading. *Accounting Auditing Control, 30*(4), 135-189.

Depoers, F., Jeanjean, T., & Jérôme, T. (2016). Voluntary disclosure of greenhouse gas emissions: Contrasting the Carbon Disclosure Project and corporate reports. *Journal of Business Ethics, 134*, 445-461.

DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147-160.

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. Pacific Sociological Review, 18(1), 122-136.

Downar, B., Ernstberger, J., Reichelstein, S., Schwenen, S., & Zaklan, A. (2021). The impact of carbon disclosure mandates on emissions and financial operating performance. *Review of Accounting Studies, 26*(3), 1137-1175.

European Commission. (2023). *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU as regards sustainability reporting standards*. Official Journal of the European Union. https://eur-lex.europa.eu/eli/reg_del/2023/2772/oj

European Commission. (2026, July 3). *Commission adopts revised sustainability reporting standards*. https://finance.ec.europa.eu/news/commission-adopts-revised-sustainability-reporting-standards-2026-07-03_en

Freeman, R. E. (1984). Strategic management: A stakeholder approach. Pitman.

Global Reporting Initiative. (2016). *GRI 305: Emissions 2016*. https://www.globalreporting.org/standards/media/1012/gri-305-emissions-2016.pdf

Global Reporting Initiative. (2025). *GRI 102: Climate Change 2025*. https://www.globalreporting.org/pdf.ashx?id=29514

He, R., Luo, L., Shamsuddin, A., & Tang, Q. (2022). Corporate carbon accounting: A literature review of carbon accounting research from the Kyoto Protocol to the Paris Agreement. *Accounting & Finance, 62*(1), 261-298.

Hettler, M., & Graf-Vlachy, L. (2024). Corporate Scope 3 carbon emission reporting as an enabler of supply chain decarbonization: A systematic review and comprehensive research agenda. *Business Strategy and the Environment, 33*(2), 263-282.

IFRS Foundation. (2023a). *IFRS S2 Climate-related Disclosures*. https://www.ifrs.org/issued-standards/ifrs-sustainability-standards-navigator/ifrs-s2-climate-related-disclosures/

IFRS Foundation. (2023b). *Effects of climate-related matters on financial statements*. https://www.ifrs.org/content/dam/ifrs/supporting-implementation/documents/effects-of-climate-related-matters-on-financial-statements.pdf

IFRS Foundation. (2025a). *Amendments to Greenhouse Gas Emissions Disclosures: Amendments to IFRS S2*. https://www.ifrs.org/projects/completed-projects/2025/amendments-to-disclosure-of-greenhouse-gas-emissions-s2/

IFRS Foundation. (2025b). *Disclosures about uncertainties in the financial statements*. https://www.ifrs.org/projects/completed-projects/2025/climate-related-risks-in-the-

financial-statements/

Lin, Y., Shen, R., Wang, J., & Yu, Y. J. (2024). Global evolution of environmental and social disclosure in annual reports. *Journal of Accounting Research, 62*(5), 1941-1988.

Luo, L., Tang, Q., Fan, H., & Ayers, J. (2023). Corporate carbon assurance and the quality of carbon disclosure. *Accounting & Finance, 63*(1), 657-690. https://doi.org/10.1111/acfi.13060

Mashhadi Rajabi, M., Shen, Y., Linnenluecke, M., Sidhu, B., Nguyen, H., & Smith, T. (2026). Climate-related financial disclosures: A meta-theoretical synthesis for accounting research and practice. *Meditari Accountancy Research, 34*(1), 328-361.

Matsumura, E. M., Prakash, R., & Vera-Muñoz, S. C. (2024). Climate-risk materiality and firm risk. *Review of Accounting Studies, 29*(1), 33-74.

Pham, L., Hay, D., Miihkinen, A., Myllymäki, E.-R., Niemi, L., & Sihvonen, J. (2026). Climate risk disclosures and auditor expertise. *The British Accounting Review, 58*, 101439.

Reichelstein, S. (2024). Corporate carbon accounting: Balance sheets and flow statements. *Review of Accounting Studies, 29*(3), 2125-2156.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333-339.

Stachelscheid, S., & Dutzi, A. (2025). Corporate carbon performance metrics in academia: Overcoming carbon accounting issues. *Management Review Quarterly*. Advance online publication. https://doi.org/10.1007/s11301-025-00564-y

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. *Academy of Management Review, 20*(3), 571-610.

Task Force on Climate-related Financial Disclosures. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf

Tomar, S. (2023). Greenhouse gas disclosure and emissions benchmarking. *Journal of Accounting Research, 61*(2), 451-492.

Treepongkaruna, S., Au Yong, H. H., Thomsen, S., & Kyaw, K. (2024). Greenwashing, carbon emission, and ESG. *Business Strategy and the Environment, 33*(8), 8526-8539.

Wegener, M., Labelle, R., & Jerman, L. (2019). Unpacking carbon accounting numbers: A study of the commensurability and comparability of corporate greenhouse gas emission disclosures. *Journal of Cleaner Production, 211*, 652-664.

World Business Council for Sustainable Development, & World Resources Institute. (2004). *The Greenhouse Gas Protocol: A corporate accounting and reporting standard (Rev. ed.)*. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

World Business Council for Sustainable Development, & World Resources Institute. (2011). *Corporate value chain (Scope 3) accounting and reporting standard*. https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf