

Environmental Accounting: A Strategic Tool for Sustainable Development

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Abstract

Environmental accounting (EA) does not only trace money. Natural resources such as air, water, soil and ecosystems are also tracked. Environmental and economic data are combined to give better decisions to businesses through EA. There is increasing pressure on companies to report on their environmental performance just as they report on their financial performance by investors, regulators, and the general populace in very recent times. The research paper views EA in its various perspectives: rules and regulations, methods and frameworks, opportunities and challenges, pros and cons, and its relevance in corporate sustainability. It also reports on previous studies and emphasizes their shortcomings and also introduces a new model which is a combination of financial, environmental, and social data. Lastly, the paper proposes that finance departments should consider incorporating EA in their periodic reports going forward because the stringency of global disclosure levels will continue to rise. It is concluded by policy recommendations, an analysis of various nation choices as well as future research ideas.

Keywords: Eco Accounting, Green Accounting, Eco Accounting, Corporate Social Responsibility, Environmental Accounting, IFRS, Sustainability, US GAAP, IFRS, ESG, Green Accounting, Sustainability, Environmental Reporting, Integrated Reporting, Government and Eco

1. Introduction

1.1. Background

Environment reporting involves environment accounting and disclosing the environment related issues. It involves valuation of natural resource which is evaluating the incomes thereof, it keeps records of the expenses connected with natural resources, estimates amount thereof and offers depreciation on them.

1.2. Major accounting issues

Distinction between environmental expenditure and normal business expenditure It is quite possible that many new machines will have state-of-the-art environmental technology and in that situation a part of such capital costs and running and maintenance expenditure can be classified as environment-related expenditure. Guidelines need to be framed stipulating how the reporting entity is supposed to appreciate the amount of capital and revenue expenditures as part of environmental expenditure and the normal expenditure which is related to operating business of the organization. [1].

- (i) Capitalisation of environment expenditure versus expensing them during the current accounting period
- (ii) Recognition of environment related contingent liabilities

Protection costs of the environment in past and now are usually very high. In case it is charged during a single year, then it will be a negative effect to the EPS [2].

1.3. Research Problem

Conventional accounting does not measure the costs of environment, which results in under valuation of natural resources and future risks. This has been the challenge to strategic planning, regulatory compliance, and sustainability. Critics of conventional accounting have argued that environmental externalities are not properly accounted through the accounting system since the 1970s. Early reactions concentrated on the meaning of qualitative reports of CSR but the 1990s emerge with the developments of quantitative procedures such as life-cycle amounts and whole-cost accounting. What used to be voluntary now turns out to be becoming mandatory.

1.4. Context and Justification

Businesses have gone green due to environmental degradation and climate change. Growing numbers of investors and regulators are seeking the disclosure of environmental effects. Environmental accounting helps organizations internalize the externalities and create financial results that match the ecology responsibility.

In 2023 the ISSB published IFRS S2, EU CSRD will require sustainability reporting by some 50,000 companies starting in FY2024 and the U.S. SEC approved its climate disclosure rule in 2024. Financial reporting systems have today incorporated environmental accounting [4]

1.5. Objectives

There is a lot of financial dimensions. McKinsey predicts that decarbonization of supply chains may require an investment of 1.7 trillion each year up to the year 2030. The companies who use the environmental information can minimise the expenses, which are related to capital; the others who disregard the risks will experience assets losses and cases. EA is therefore a tool of compliance as well as a value creator over a long term [5].

- (i) Look at the development of environmental accounting.
- (ii) Determine international best practice and compare regulation framework.
- (iii) Evaluate how IFRS and the US GAAP treat environmental liabilities
- (iv) Suggest a united environmental accounting model.

1.6. Significance

With environmental metrics in corporate accounting, the top management can track, make sound decisions, generate improved compliance, communal faith, and fosters sustainable innovation

2. Literature Review

2.1 Past Research

Gray (1993) Brought in social and environmental accounting to corporate reporting [6]. Schaltegger and Burritt (2000): Distinguished monetary and physical environmental bookkeeping [7]. United Nations (2003): Presented System of Environmental-Economic Accounting (SEEA) [8].

2.2 Weaknesses in Prior Research

Excessive usage of qualitative analysis.

- (i) Absence of standard measures.
- (ii) Few sector-based implementation research.

2.3 Emerging Research Directions

Earnings per share Incorporation with ESG (Environmental, Social, Governance) scores. The application of AI and big data to track costs in real-time in the environment. Creation of environmental accounting sector-related KPIs.

3. Methodology

3.1 Research Design

A mixed-methods approach was employed:

- (i) **Literature synthesis:**
Peer-reviewed articles, UN reports and industry case studies.
- (ii) **Comparative analysis**
The IFRS and US GAAP, and national (Japan, Germany, India) practices.
- (iii) Model proposition Creation of a comprehensive scheme along with the Triple Bottom Line (TBL) methodology.

3.2 Tools

Cost modelling using Microsoft excel.

- (i) Tableau as a graphical representation.
- (ii) NVivo to code management interview qualitatively.

4. Results and Analysis

4.1 Opportunities of Environmental Accounting

Table 1: Opportunities of Environment

Opportunity Area	Description
Cost Control	Monitors environmental expenses (ex. waste treatment, use of energy). Unique efficiency realized Process-level data revealed efficiency savings of €700 901 m in energy costs to Unilever when its Sustainable Living Plan highlighted high-emission processes [9].
Risk Mitigation	By measuring the environmental liabilities, it will then be able to conduct a scenario analysis as well as outline an approach to capex (e.g., to move coastal assets at risk of sea-level rise).
Investor Confidence	Wins ESG interest investors. The metrics of ESG are taken into consideration by many institutional investors when making valuations; strong EA can reduce cost of capital.
Regulatory Compliance	Assists legal reporting of environmental regulations. The early adopters are going to comply with the EU border carbon adjustment and taxonomy lending provisions in advance of the competitors.
Innovation	Encourages resource-efficient processes.
Brand Equity & Revenue	Consumers reward transparent brands; Kering reports €1.2 bn brand value uplift from EP&L insights 10].

Table 2: Challenges in this area

Challenge Area	Description
Data Collection	Inconsistent and incomplete data.
Standardization	Lack of uniform global standards.
Cost	High implementation and monitoring costs. First-year CSRD assurance can cost large multinationals €1–3 m in audit fees.
Resistance to Change	Internal pushback from finance departments.
Technological Barriers	Legacy accounting systems incompatible with environmental data.
Valuation Uncertainty	Monetising biodiversity lacks universally accepted prices.
Boundary Setting & Double Counting	Defining organisational and product boundaries is complex, risking overlap between value-chain actors.

Greenwashing Risk	Inconsistent definitions and cherry-picked metrics can mislead stakeholders, exposing firms to litigation.
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Table 3: Pros and Cons

Pros	Cons
Enhances transparency	Requires new metrics and training
Encourages sustainable decision-making	Adds to reporting complexity
Aligns with stakeholder interests	May not yield short-term financial returns

Table 4: Comparative Chart: IFRS vs. US GAAP on Environmental Accounting, Source: [11]

Criteria	IFRS	US GAAP
Environmental Provisions	IAS 37 requires recognition if obligation is probable	ASC 410 covers asset retirement obligations
Contingent Liabilities	Disclosure required when not measurable	Similar but generally more conservative
Sustainability Disclosures	Encouraged under IFRS Sustainability Standards (ISSB)	Voluntary but increasing via SEC climate risk disclosures

Table 5: Global Practices

Country	Initiative	Outcome
Japan	Environmental Efficiency Guidelines	Improved resource productivity
Germany	Environmental Management Accounting	Adoption across manufacturing sector
India	Corporate Social Responsibility Rules	Increased spending on environmental projects
UK	Streamlined Energy and Carbon Reporting (SECR)	Mandatory carbon disclosure for large companies

4.2. Methodologies and Metrics

EA uses both quantitative measurement (e.g. tonnes of CO₂, cubic metres of water) and the monetary value (e.g. social cost of carbon, pricing of water scarcity). The most used methodologies are: Environmental Profit & Loss (EP&L):

- (i) First introduced by a luxury group Kering, EP&L measures both upstream and downstream environmental externalities in euro, and can thus be compared to EBITDA
- (ii) Full Cost Accounting assigns the cost of remediation, compliance, and externality to products, causing the reality of economic margins.
- (iii) **Natural Capital Accounting (NCA)**

Includes the forests, the wetlands, and the mineral deposits in the national balance sheets, using the guidelines of the UN SEEA.

- (iv) **Internal Carbon Pricing**
 Patagonia charges itself a US\$100 1 tonne CO₂e on Scope 1 + 2 emissions as a source of financing renewable projects.
- (v) **Lifecycle Assessment (LCA)**
 Cradle-to-grave accounting of resource inputs and outputs in accordance to ISO 14040.

4.3. Regulatory Drivers and Frameworks

- (i) IFRS S2 (ISSB)

In June 2023, IFRS S2 will be enforced, which means that businesses will be obliged to report governance, strategy, risks management, metrics, and targets regarding climate. It alludes to the TCFD framework and requests Scope 1, 2 as well as in certain instances, Scope 3 emissions [12]. • EU CSRD & ESRS: The CSRD will require EU, as well as many non-EU large editorial companies, to report on or after FY 2024 in line with the European Sustainability Reporting Standards (ESRS). ESRS E1 E5 comprise climate, pollution, water, biodiversity and circular economy [13].

SASB Standards

SASB is currently under the IFRS Foundation with 77 industry groups and an average of six topics of disclosures. Environmental issues extend to water pressure in semiconductor to waste management of airlines [14].

GRI

StandardsGRI is still the most proliferated voluntary scheme. Its 2024 update included GRI 101: Biodiversity which is based on the Kunming-Montreal framework. The two-materiality lens developed by GRI encourages companies to disclose impacts on society and not only finite material risks [15].

SEC Climate Rule

SEC states that U.S. registrants must disclose material climate risks, governance processes, as well as the consequences on financial statements [15]. National Natural Capital Programs: The World Bank WAVES and Global Program on Sustainability assistance countries in their efforts to incorporate the value of ecosystems into national accounts [16,17].

4.4. The New Ideas

Integrated Environmental Accounting Model Features: Brings together financial, social, and environmental KPIs.

- (i) According to Global Reporting Initiative (GRI) and TCFD.
- (ii) Real-time dashboard to the top management.

Table 6: Old Research vs Proposed Model

Criteria	Past Research	Proposed Model
Scope	Focused on reporting	Decision-making tool
Metrics	Qualitative or generic	Quantitative, KPI-based
Integration	Siloed from financials	Fully integrated with finance
Timeliness	Annual reporting	Real-time tracking

4.6. Case Studies and Examples

Kering’s EP&L: Kering also releases an interactive EP&L that translates the negative or positive effects in the areas of its supply chain GHG, water, land-use, air and water pollution- into euros. The 2024 EP&L also showed that 71 % of its impacts are due to raw-materials sourcing, which encouraged the company to invest in regenerative agriculture of the leather [18].

Patagonia’s Internal Carbon Price: Patagonia is imposing US\$100 per tCO₂e to business units. It funds on-site solar and supply-chain decarbonisation. Its paid projects are reported to be at 8 % ROI [19].

World Bank Natural Capital Accounting Ghana and Nepal employed NCA to incorporate mangrove ecosystem value into budgeting, which affected the bears that were associated with coastal defence investments [19] City-Level Accounting: The outcome of Stockholm aiming to scale its Climate Budget to the city level is a department-based accounting against CO 2 budgets indicating the relevance of EA to a functioning broader than the corporate sphere [20].

Regulator Examples ranges between US\$258 000 and US\$530 000 estimated by the SEC as the first-year incremental costs of compliance to its climate rule by a large accelerated filer [eliches], in the first year [X1] 21].

4.7. Emerging Trends

(i) AI-Driven Assurance

Natural language algorithms facilitate the cross-referencing of invoices and LCA databases to mark abnormalities prior to an audit.

(ii) IoT + Edge Computing

Low-power sensors transmit real-time emissions data, reducing estimation error.

(iii) Blockchain Certificates

Tokenised renewable-energy certificates (RECs) ensure provenance and prevent double counting.

(iv) Biodiversity Credits

Emerging markets may price ecosystem restoration like carbon credits.

(v) Integrated Reporting 2.0

XBRL-tagged ESG data will flow directly into investor models, shrinking the gap between financial and sustainability statements.

5. Discussion and Interpretation

5.1 Strategic Relevance for Top Management

Environmental accounting informs strategic decisions by:

- (i) Highlighting long-term environmental liabilities.
- (ii) Justifying sustainability investments.
- (iii) Enhancing brand reputation and stakeholder engagement.

5.2 Managerial Implications

Table 7: Managerial area implications

Area	Implication
CFO	Must integrate environmental KPIs into financial reports
COO	Can optimize operational efficiency based on cost of emissions or waste
CIO	Needs to support data integration through IT systems
Board	Requires environmental performance for oversight and strategy alignment

5.3 Policy Implications

Governments should:

- (i) Mandate standardized reporting formats.
- (ii) Offer tax incentives for sustainable practices.
- (iii) Encourage public-private environmental accounting partnerships.

6. Future Directions

Table 8: Future Directions

Area	Recommendation
Research	Develop sector-specific environmental accounting standards
Technology	Leverage IoT and AI for real-time data gathering
Education	Include environmental accounting in business curricula
Global Alignment	Harmonize IFRS, US GAAP, and national standards

7. Conclusion

Environmental accounting becomes mandatory and not discretionary to businesses desiring to have a successful future. The objectives of the organizations to satisfy the requirements of the regulator and investors and achieve sustainable growth can be achieved by integrating ecological issues into accounting systems. There is a need to de-silo, make use of KPI-driven and tech-enabled approach to mainstream environmental accounting in the business strategy. The delaying one's face penalties within regulatory circles, reputational losses, and discounts to the capitals of the market. Finance departments therefore need to start integrating EA into the process of budgeting and scenario analysis as well as their contact reports with the boards of directors they work with today before they can be forced by external audit or regulatory authorities to do the same at later dates.

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