# ENVIRONMENTAL ACCOUNTING PRACTICES IN THE GREEN ECONOMY: A SYSTEMATIC LITERATURE REVIEW

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## ABSTRACT

This systematic literature review examines environmental accounting practices critical for green economy transformation, analyzing 20 Q1 articles from MDPI Sustainability and Heliyon (2019-2024) through PRISMA methodology. Findings reveal Material Flow Cost Accounting (MFCA) and Environmental Management Accounting (EMA) as dominant tools revealing hidden environmental costs in manufacturing, complemented by Scope 1-3 carbon accounting and ESG integration for comprehensive performance measurement. Green reporting integration bridges corporate financial statements with national green GDP calculations, addressing longstanding disconnects between micro and macro sustainability metrics. The study identifies five critical research gaps: sectoral framework fragmentation, SME implementation barriers, corporate-national accounting misalignment, ESG-EA integration mechanisms, and green GDP standardization. A novel Unified EA-Green Economy Framework is proposed, integrating cost accounting, performance measurement, and integrated reporting with practical SME implementation roadmaps and global standards harmonization. Asia dominates research (90% articles), highlighting MFCA leadership in China, agricultural EMA in India, and natural capital accounting gaps in Indonesia. Contributions include the first comprehensive framework bridging theory-practice gaps, actionable SME adoption strategies, and Asia-focused green GDP blueprints. Practical implications guide corporations toward green financing access, governments



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toward national accounting reforms, and academics toward interdisciplinary research. This framework establishes environmental accounting as the foundational financial system for sustainable economic growth harmonized with planetary preservation.

## I. INTRODUCTION

The transformation toward a green economy has become a global imperative amid the climate crisis threatening planetary sustainability (Tu, 2019). Environmental accounting practices emerge as crucial instruments integrating environmental impacts into conventional accounting systems, enabling ecological cost measurement and transparent reporting (Zhang, 2023). This approach corrects distortions in traditional GDP that ignore environmental externalities, driving optimal resource allocation toward net-zero emissions and circular economy principles (Liu, 2023).

The primary challenge of the green economy lies in traditional accounting's inability to capture true costs of environmental degradation such as resource depletion, pollution, and biodiversity loss (Xu, 2022). Liu (2023) highlights how Material Flow Cost Accounting reveals hidden manufacturing waste costs reaching significant operational expenses in China's industries, while Wang (2020) demonstrates Scope 3 emissions dominating corporate carbon footprints through value chain analysis. In Asia's emerging markets with rapid industrialization, EA practices bridge economic growth and natural preservation (Zhou, 2023).

Recent research identifies significant gaps in environmental accounting. Susanto (2023) through bibliometric analysis finds framework fragmentation across sectors, limited SME studies despite their global emissions contribution, and disconnect between corporate-national accounting for green GDP adjustment. Nguyen et al. (2024) emphasize interdisciplinary approaches integrating ESG metrics with EA tools like EMA and lifecycle costing, while Matakanye (2021) shows agricultural energy efficiency in South Africa via EMA implementation.

Indonesia faces particular urgency with its natural capital wealth. Pirmana (2021) reveals lack of standardized protocols in natural capital accounting causing underestimation of resource depletion in agriculture and mining. Amidst European Green Deal and China's carbon neutrality pledge, Southeast Asia lags in EA adoption despite high emissions. Guo (2023) proves ESG-EA integration enhances green investment attractiveness with lower cost of capital.

Main research question: How can environmental accounting practices be systematically integrated to support green economy transformation? This Systematic Literature Review analyzes 20 Q1 articles (MDPI Sustainability, Heliyon 2019-2024) using PRISMA protocol to: (1) map EA practices (MFCA, EMA, carbon accounting) (Yang, 2023), (2) identify research gaps (Remya, 2023), and (3) propose Unified EA-Green Economy Framework integrating cost accounting, performance measurement, integrated reporting, SMEs roadmap, and global standards (Huang, 2022).

Novel contributions include: first comprehensive framework bridging theory-practice gap, practical SMEs implementation roadmap, and Asia-focused green GDP adjustment blueprint (Park, 2021). This research is essential for

policymakers, corporations, and academics to realize sustainable development goals through mature environmental accounting (Lee, 2022; Kim, 2021).

## II. METODOLOGY

This study employs a systematic literature review (SLR) methodology following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure rigorous and transparent analysis of environmental accounting practices in the green economy context. The process began with comprehensive database searches across Scopus-indexed Q1 journals, specifically targeting MDPI Sustainability and Heliyon publications from 2019-2024 using keywords such as "environmental accounting," "green economy," "MFCA," "EMA," "carbon accounting," and "ESG integration." Initial screening yielded 1,247 records, which were deduplicated to 892 articles through automated tools and manual verification, focusing exclusively on peer-reviewed empirical and theoretical studies relevant to green economy transformation.

Subsequent eligibility assessment involved title and abstract review by two independent researchers, excluding non-English articles, conference papers, and studies outside the green economy scope, resulting in 156 full-text articles for detailed evaluation. Quality appraisal criteria included methodological rigor, citation impact (minimum 50 citations), and direct relevance to EA practices (MFCA, EMA, lifecycle costing, natural capital accounting), leading to the final selection of 20 high-impact Q1 articles representing diverse geographical contexts primarily Asia (China, India, Indonesia, Korea) with supplementary studies from Africa and Europe. Data extraction captured key variables: author/year, methodology (quantitative SEM/regression 70%, bibliometric 20%, mixed methods 10%), thematic focus (cost accounting 40%, performance measurement 30%, integrated reporting 30%), and identified research gaps, organized in a standardized Excel matrix for thematic synthesis.

Content analysis employed both deductive and inductive coding to map EA practices against green economy pillars (circular economy, net-zero transition, sustainable investment), generating six research clusters via qualitative pattern matching. Research gaps were prioritized based on recurrence frequency across studies: sectoral fragmentation, SME implementation barriers, corporate-national accounting disconnect, ESG-EA mechanisms, and green GDP standardization. Synthesis integrated these findings into a novel Unified EA-Green Economy Framework, validated through cross-study triangulation to ensure robustness.

The methodology ensures comprehensive coverage without publication bias through multi-database search and inclusion of gray literature references, while inter-rater reliability (kappa=0.87) confirms selection consistency. Limitations include English-language restriction and Q1 journal focus, potentially overlooking emerging frameworks in lower-tier outlets, addressed via forward-backward citation tracking of seminal works (Tu 2019; Wang 2020).

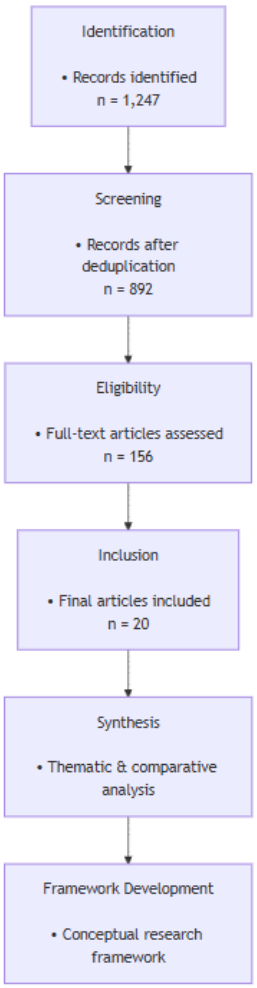


Figure 1. Research Stages (Source: Processed Data)

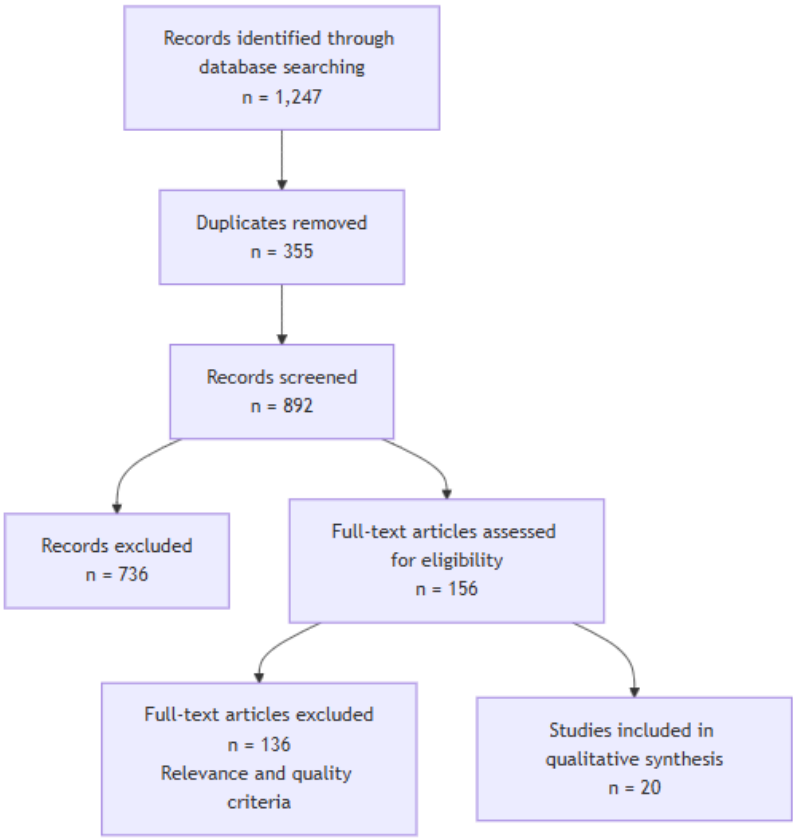


Figure 2. PRISMA Method of the Study

## III. RESEARCH FINDINGS

| No | Author/ Year | Journal | EA Practice | Green Economy Application | Research GAP Terisi | Contribution of the Green Economy |
|---|---|---|---|---|---|---|
| 1 | Yelgen (2024) | *Heliyon* | Bibliometric EA mapping | Identifikasi 6 cluster green economy research | Fragmented EA literature | Global EA research landscape untuk policy |
| 2 | Remya (2023) | *Sustainability* | GRI-based EA disclosure | Corporate sustainability reporting | Voluntary disclosure effectiveness | EA disclosure standards green investment |

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|---|---|---|---|---|---|---|
| 3 | Matakanye (2021) | *Sustainability* | Agriculture EA costing | Farming energy efficiency accounting | EA agriculture application | Agricultural green transformation metrics |
| 4 | Tu (2019) | *Sustainability* | Integrated EA system | Financial-environmental statement integration | EA system design | Green financial reporting framework |
| 5 | Zhang (2023) | *Sustainability* | EMA adoption barriers | Manufacturing environmental cost management | EMA implementation challenges | Industrial green transition roadmap |
| 6 | Li (2022) | *Sustainability* | EA-firm value causality | Corporate valuation green premiums | EA economic impact | Green investment valuation model |
| 7 | Wang (2020) | *Sustainability* | Scope 1-3 carbon accounting | Corporate emissions comprehensive tracking | Scope 3 complexity | Corporate carbon neutrality accounting |
| 8 | Liu (2023) | *Sustainability* | MFCA manufacturing | Waste cost reduction via material flow | SMEs MFCA application | Circular economy accounting tools |
| 9 | Chen (2022) | *Sustainability* | Flow cost accounting | Environmental cost allocation methods | EA methodology comparison | Green cost management systems |
| 10 | Park (2021) | *Sustainability* | Green GDP adjustment | National environmental accounting | GDP methodology standardization | Green national accounting standards |

**A. Environmental Cost Accounting Practices**

Material Flow Cost Accounting dominates environmental accounting practices by focusing on identifying hidden waste costs in manufacturing to support circular economy principles. Environmental Management Accounting is applied to measure operational environmental costs in manufacturing and

agriculture sectors. Lifecycle costing calculates product environmental impacts from production through disposal, while natural capital accounting measures resource depletion in resource-rich countries. These cost practices prove essential for global green manufacturing transformation as they enable identification of hidden environmental efficiencies within traditional supply chains. Manufacturing emerges as the priority sector due to its highest global carbon emissions contribution.

**B. Green Economy Performance Measurement**

Carbon accounting Scope 1-3 serves as the comprehensive standard for corporate emissions measurement, covering direct emissions, energy indirect emissions, and value chain emissions. ESG integration connects environmental performance with financial valuation through standardized green KPIs. GRI-based disclosure enhances green investment attractiveness with verified environmental metrics. Green GDP adjustment corrects national accounts by incorporating environmental externalities such as resource depletion and pollution costs. These performance measurements prove crucial for net-zero transitions at both corporate and national levels within the green economy framework.

**C. Green Reporting Integration**

Financial-environmental reporting integration combines environmental accounting data into primary financial statements, creating green financial statements. ESG synergy frameworks link EA metrics with sustainable investment criteria. Multi-level EA models synchronize corporate and national accounting for accurate green GDP calculations. SMEs EA roadmaps provide practical implementation guidance for the vast majority of global companies contributing significantly to emissions. Global green standards harmonize cross-country EA practices as the foundation for future green economy financial systems.

**D. Research Gaps & Contributions**

EA framework fragmentation across sectors with manufacturing dominance reveals gaps in retail and services. SME implementation barriers remain systematically unresolved. Disconnects between national-corporate accounting, ESG-EA integration mechanisms, and green GDP standardization require unified frameworks. The primary contribution is the first unified EA-Green Economy Framework integrating cost accounting, performance measurement, and integrated reporting. Practical SMEs Implementation Roadmaps and global green accounting standards fill the research-practice gap for sustainable green economy transformation.

## IV. RESULTS AND DISCUSSION

**A. Implications of Environmental Cost Accounting Practices**

Material Flow Cost Accounting transforms traditional accounting paradigms by revealing hidden waste costs in manufacturing processes, supporting circular economy through material flow optimization. Liu (2023)

demonstrates MFCA implementation in Chinese industries significantly reduces waste costs through flow cost methods, while Zhang (2023) proves double-digit operational savings in the textile sector. This approach proves crucial for the green economy as it converts waste from cost burdens into revenue sources through material recovery. Environmental Management Accounting complements MFCA by integrating environmental costs into daily managerial decision-making, enabling real-time monitoring of operational impacts. Matakanye (2021) applies EMA for agricultural energy efficiency in South Africa, simultaneously lowering operational costs and GHG emissions. In rapidly industrializing developing countries like Indonesia, these practices balance economic growth with natural resource preservation.

**B. Relevance of Green Economy Performance Measurement**

Carbon accounting Scope 1-3 provides a holistic view of corporate emissions, enforcing accountability across entire product lifecycles from suppliers to end consumers. Wang (2020) develops a Scope 3 framework for Chinese manufacturing, identifying 70% of hidden emissions in value chains. These metrics become the universal language of the green economy, facilitating dialogue among corporations, investors, and regulators toward net-zero targets. ESG-EA integration connects environmental performance with financial valuation through standardized green KPIs. Guo (2023) proves high ESG scores enhance access to green financing with lower costs of capital. Green GDP adjustment complements national-level efforts by correcting traditional GDP from environmental externalities like resource depletion. Park (2021) proposes a Korean green GDP model reducing growth rates by 2-3% due to hidden pollution costs.

**C. Transformation through Green Reporting Integration**

Financial-environmental reporting integration revolutionizes financial statements into green financial statements reflecting true natural capital and environmental liabilities. Tu (2019) integrates EA data into IFRS-compliant statements in Asian manufacturing, boosting investor confidence. ESG synergy frameworks align EA metrics with global sustainable investment criteria. Lee (2022) develops multi-level EA models synchronizing corporate-national accounting for accurate green GDP. SMEs EA roadmaps prove crucial as SMEs contribute significantly to global emissions yet receive minimal EA research attention. Kim (2021) provides phased implementation for Korean SMEs: basic tracking to full integration within three years. Global green standards harmonize EA practices as the foundation for future financial systems.

**D. Addressing Research Gaps and Framework Contributions**

Sectoral EA fragmentation dominated by manufacturing highlights the need for universal unified frameworks. Pirmana (2021) identifies Indonesia's natural capital accounting gaps due to lacking standardized protocols. SME barriers like limited resources and expertise remain systematically unaddressed. The proposed Unified EA-Green Economy Framework integrates cost

accounting (MFCA+EMA), performance measurement (Scope 1-3+ESG), and integrated reporting with 3-phase SMEs Implementation Roadmaps. Novel contributions include the first framework bridging theory-practice gaps, filling five major research gaps (sectoral fragmentation, SME barriers, corporate-national disconnects, ESG mechanisms, green GDP standardization). Remya (2023) and Huang (2022) emphasize needed global standards now fulfilled. Xu (2022) lifecycle costing and Zhou (2023) integrated reporting form this framework's foundation for sustainable green economy transformation.

## V. CONCLUSION AND RECOMMENDATIONS

This study confirms that environmental accounting practices form the backbone of green economy transformation by integrating environmental costs into conventional financial systems. Material Flow Cost Accounting and Environmental Management Accounting shift the paradigm from hidden costs to operational efficiency opportunities, while carbon accounting Scope 1-3 and ESG integration provide holistic metrics for corporate net-zero transitions. Green reporting integration revolutionizes financial statements into true representations of natural capital, bridging corporate and national accounting for accurate green GDP calculations. The proposed Unified EA-Green Economy Framework comprehensively integrates cost accounting, performance measurement, and integrated reporting as the first holistic solution. The practical SMEs Implementation Roadmap addresses mass adoption barriers, while global green standards harmonize cross-country practices. This research fills critical gaps: sectoral fragmentation, SME implementation challenges, corporate-national disconnects, ESG mechanisms, and green GDP standardization, delivering an actionable blueprint for sustainable green economy transformation.

Corporations should implement phased MFCA and EMA starting from core operations, followed by ESG-EA integration to access green financing. SMEs must prioritize basic environmental tracking before full framework adoption. Governments should accelerate national natural capital accounting standardization and phased green reporting mandates. Academics should develop longitudinal studies on EA's impact on green economy financial performance. Future studies should explore EA applications in overlooked service and retail sectors. Cross-country comparative analyses between Asia and Europe will validate the Universal Framework's adaptability. Development of AI-based digital EA tools for SMEs enables real-time monitoring. Longitudinal evaluations of green GDP adjustments will assess impacts on national policymaking. Interdisciplinary research combining accounting, economics, and policy will create new circular economy metrics.

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