

The Evolving Landscape of Environmental Management Accounting: A Systematic Review of Contemporary Research (2020-2025)

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ABSTRACT

This article provides a systematic literature review (SLR) of the Environmental Management Accounting (EMA) field, synthesizing research published between 2020 and 2025. The primary objective is to map the contemporary landscape of EMA, tracing its evolution from a traditional costing tool to an integrated, strategic information system for corporate sustainability. This review employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 methodology, analyzing articles from Scopus, Web of Science, and Google Scholar. The findings reveal several key trends. First, the conceptual boundaries of EMA are expanding beyond its foundational definition (tracking physical and monetary flows) to encompass complex, data-intensive areas such as biodiversity accounting and the circular economy. Second, the theoretical understanding of EMA adoption has matured, moving from single-theory models to integrated frameworks combining institutional, strategic, and contingency perspectives. Third, while the positive link between EMA implementation and organizational performance (environmental, financial, and competitive) is well-established, recent meta-analyses demonstrate this relationship is contingent, moderated by firm size and national-level EMA maturity. This finding helps explain persistent implementation barriers, particularly for Small and Medium-sized Enterprises (SMEs). Finally, the review identifies a profound co-evolution: emerging sustainability frontiers (e.g., the Taskforce on Nature-related Financial Disclosures - TNFD) are creating demand for complex environmental data, while digitalization (e.g., Big Data Analytics, Artificial Intelligence, and Building Information Modeling) provides the necessary tools to supply and analyze it. The article concludes by outlining critical research gaps, focusing on SME implementation models, the practical application of digital EMA tools, and the development of operational accounting frameworks for biodiversity and circularity.

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I. INTRODUCTION

1.1 The Strategic Imperative for Environmental Accounting in an Era of Sustainability

In an era defined by escalating environmental crises, from climate change to catastrophic biodiversity loss, organizations face unprecedented pressure to transition toward sustainable models of operation (Ndemuweda, 2025). This transition necessitates a fundamental shift in corporate information systems. Traditional management accounting, with its historical focus on financial metrics and short-term profitability, has proven inadequate for capturing, measuring, and managing the profound environmental dependencies and impacts of modern business (Ndemuweda, 2025). In response, Environmental Management Accounting (EMA) has emerged as a critical corporate information system (Munir & Yassin, 2020).

Initially conceived as a reactive tool for compliance with legal environmental requirements, the role of EMA has undergone a significant strategic transformation (Munir & Yassin, 2020). It is evolving from a defensive, cost-minimization function into a proactive, strategic enabler of sustainable value creation (Hasan et al., 2024). This shift is driven by a convergence of external forces. Regulators, investors, consumers, and other stakeholders are demanding radical transparency and accountability for corporate environmental performance, compelling firms to develop robust internal accounting mechanisms to support these disclosures (Munir & Yassin, 2020; Ndemuweda, 2025). Consequently, EMA is increasingly positioned at the nexus of risk management, operational efficiency, and strategic planning, providing the data necessary to navigate sustainability challenges and achieve long-term objectives, including the Sustainable Development Goals (SDGs) (Pratama, 2024).

1.2 Defining Environmental Management Accounting (EMA): Conceptual Boundaries and Dual Information Flows

To understand its role, a precise definition is essential. EMA is formally defined as the identification, collection, analysis, and use of information primarily for *internal* managerial decision-making (International Federation of Accountants [IFAC], 2005; Ndemuweda, 2025). It is a subset of the broader field of environmental accounting, which also includes external environmental reporting.

The conceptual core of EMA, as endorsed by the International Federation of Accountants (IFAC), is its dual-flow information system. This structure distinguishes it from conventional accounting by simultaneously tracking:

1. **Physical Environmental Information (PEMA):** This involves quantifying the use, flow, and final disposition of physical resources, including energy, water, and materials, as well as the generation of outputs such as waste and emissions (Ndemuweda, 2025; IFAC, 2005).
2. **Monetary Environmental Information (MEMA):** This involves the identification, estimation, allocation, and analysis of environment-related costs, investments, earnings, and savings (Ndemuweda, 2025; IFAC, 2005).

While this foundational definition remains stable, the scope and nature of the information it governs are expanding rapidly. Contemporary research indicates that the *types* of information being integrated into EMA systems are becoming more complex. The field is moving beyond tracking conventional pollution (e.g., "tons of CO₂") to include highly complex, data-intensive metrics related to ecosystem dependencies ("biodiversity accounting") (Ndemuweda, 2025) and real-time operational data from digital systems ("digitally supported EMA") (Abdelhalim et al., 2023). This suggests the informational boundaries of EMA are expanding, transforming it from a tool for eco-efficiency into a comprehensive information system for strategic sustainability management.

1.3 Review Objectives and Guiding Research Questions

This systematic review aims to synthesize and critically analyze the state-of-the-art of EMA research published in the contemporary period of 2020-2025. By examining the recent literature, this article addresses the following guiding research questions (RQs):

- **RQ1.** What are the dominant theoretical frameworks underpinning contemporary EMA research?
- **RQ2.** What are the primary tools and practices (e.g., Material Flow Cost Accounting, Life Cycle Costing, Sustainability Balanced Scorecard) discussed in the recent literature, and how are they applied?

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- **RQ3.** What are the key drivers, barriers, and organizational performance outcomes associated with EMA implementation?
- **RQ4.** What are the emerging frontiers and research gaps, specifically concerning digitalization (e.g., AI, Big Data, BIM), the Circular Economy (CE), and biodiversity accounting?

II. Literature Review: Theoretical Foundations of EMA

The adoption, design, and impact of EMA are complex organizational phenomena. Recent research (2020-2025) demonstrates that no single theory can fully explain these dynamics. Instead, the literature shows a significant trend toward *theoretical integration*, where researchers combine macro-societal, firm-strategic, and internal-operational perspectives to build more robust and comprehensive explanatory models (Hasan et al., 2024; Qian et al., 2021).

2.1 Macro-Level Pressures: The Role of Institutional and Legitimacy Theories

At the macro-level, Institutional Theory and Legitimacy Theory explain the powerful external forces that compel firms to engage with EMA.

- **Institutional Theory:** This perspective posits that organizational structures and practices, including EMA, are often adopted not for rational efficiency but to conform to the norms, rules, and beliefs of the wider institutional environment (Qian et al., 2021). This drive for conformity, or "isomorphism," stems from three types of pressure:
 1. **Coercive Pressure:** Direct force from powerful external actors, most notably government regulations and legal requirements, as well as pressure from dominant stakeholders (Munir & Yassin, 2020; Qian et al., 2021).
 2. **Mimetic Pressure:** The imitation of practices from other firms, particularly successful competitors, to reduce uncertainty.
 3. **Normative Pressure:** The influence of professional standards, education, and professional bodies that define "appropriate" organizational conduct (Qian et al., 2021).
- **Legitimacy Theory:** A closely related perspective, Legitimacy Theory focuses on the "social contract" between a firm and society (Qian et al., 2021). It posits that organizations must operate within societal norms and expectations to maintain their legitimacy, which is essential for continued access to resources (Ndemuweda, 2025). EMA provides the crucial internal data that feeds into external environmental disclosures—disclosures that are used as a strategic tool to manage public perception, demonstrate compliance, and secure or repair legitimacy (Qian et al., 2021; Nguyen & Tran, 2025).

2.2 Firm-Level Strategy: Stakeholder Theory and the Natural Resource-Based View (NRBV)

At the firm-level, Stakeholder Theory and the Natural Resource-Based View (NRBV) provide the strategic rationale for *why* and *how* firms respond to macro-pressures.

- **Stakeholder Theory:** This theory provides a more granular view of the external environment, moving beyond abstract "institutions" to identify specific stakeholder groups (e.g., shareholders, customers, employees, communities, regulators) (Abdelhalim et al., 2023; Munir & Yassin, 2020). EMA is framed as a key information system that enables managers to identify the demands of these salient stakeholders, manage trade-offs, and develop specific responses to their environmental concerns (Qian et al., 2021).
- **Natural Resource-Based View (NRBV):** The NRBV provides the definitive "business case" for EMA (Hasan et al., 2024). It extends the traditional Resource-Based View (RBV) by arguing that a firm's relationship with the natural environment can be a source of rare, inimitable, and non-substitutable resources and capabilities (Nguyen & Tran, 2025). From this perspective, EMA is not merely a compliance tool but a strategic *information capability*. It provides the data that allows a firm to build

unique competencies in areas like pollution prevention, green innovation, and resource efficiency, which ultimately lead to a *sustainable competitive advantage* (Hasan et al., 2024; Nguyen & Tran, 2025).

2.3 Internal Design: Contingency Theory and the Fit of EMA Systems

Finally, Contingency Theory addresses the internal design and implementation of EMA systems. This theory argues that there is "no one best way" to structure an organization or its subsystems (Hasan et al., 2024). The effectiveness of an EMA system is *contingent* upon its "fit" with the specific internal and external contextual factors of the organization (Hasan et al., 2024).

Recent literature applies this lens to understand the significant variation in EMA adoption and success. The optimal design and impact of an EMA system are moderated by factors such as:

- **External Context:** High environmental uncertainty in the market may drive a greater need for sophisticated EMA data (Qian et al., 2021).
- **Organizational Context:** Firm size is a critical contingency; large firms possess the resources and slack to implement more comprehensive EMA systems than small firms (Hasan et al., 2024).
- **Strategic Context:** The firm's chosen environmental strategy (e.g., reactive vs. proactive) and existing technological capabilities will influence the type of EMA system required (Abdelhalim et al., 2023; Qian et al., 2021).

Table 1. Theoretical Frameworks in EMA Research (2020-2025)

Theoretical Lens	Core Argument	Level of Analysis
Institutional Theory	Firms adopt EMA practices to conform to external rules, norms, and pressures to gain legitimacy.	Macro-Societal
Legitimacy Theory	EMA provides internal data to support external disclosures used to manage the firm's "social contract."	Macro-Societal
Stakeholder Theory	EMA is an information system to identify and manage the specific environmental demands of salient stakeholders.	Firm-Strategic
Natural Resource-Based View (NRBV)	EMA is an information capability that enables firms to build environmental competencies (e.g., eco-efficiency) that lead to sustainable competitive advantage.	Firm-Strategic
Contingency Theory	There is no single "best" EMA system; its design and effectiveness depend on a "fit" with the firm's specific context (e.g., size, strategy, uncertainty).	Internal-Operational

III. METHODS

This research employs a Systematic Literature Review (SLR) methodology, which has become an established and rigorous research method within accounting and finance (Page et al., 2021). To ensure transparency, replicability, and a comprehensive synthesis, the review process is structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The PRISMA 2020 checklist guided the reporting of this study's methods, results, and discussion, ensuring a high-quality review.

A comprehensive search was conducted in leading multidisciplinary academic databases, selected for their advanced search functionalities and extensive coverage of management accounting, finance, and environmental science literature. The selected databases were Scopus, Web of Science (WoS), and Google Scholar

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The search was conducted using a Boolean strategy to identify relevant articles. Search terms included combinations of keywords related to the core topic (e.g., "Environmental Management Accounting," "sustainability accounting," "EMA") and thematic terms relevant to the research questions (e.g., "drivers," "barriers," "performance," "digitalization," "big data," "AI," "circular economy," "biodiversity," "MFCA," "LCC").

3.3 Inclusion and Exclusion Criteria

To maintain focus and relevance in line with the study's objectives, strict inclusion and exclusion criteria were applied.

Inclusion Criteria:

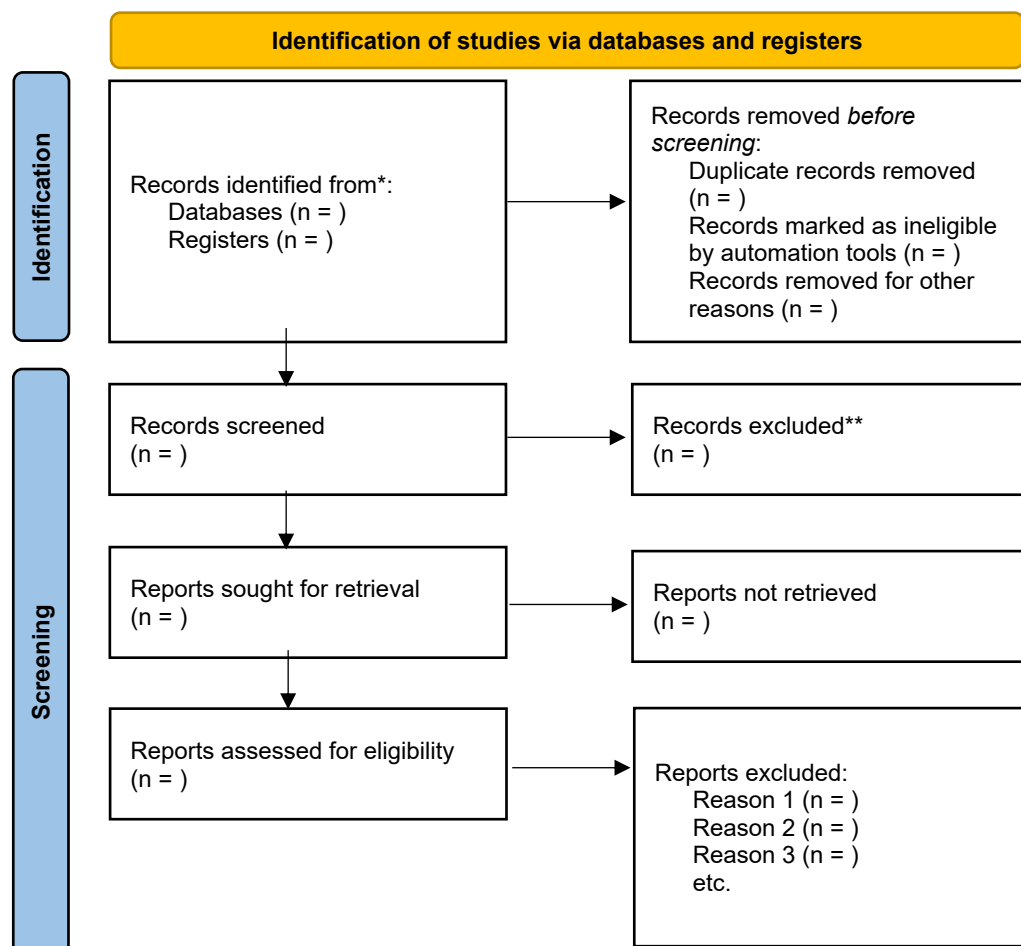
1. **Publication Period:** Articles published between January 1, 2020, and March 31, 2025.
2. **Language:** Publications in the English language.
3. **Document Type:** Peer-reviewed empirical articles, literature reviews, and high-impact conceptual papers published in academic journals.
4. **Relevance:** The article's primary focus must be on Environmental Management Accounting or its specific tools, theories, or practices.

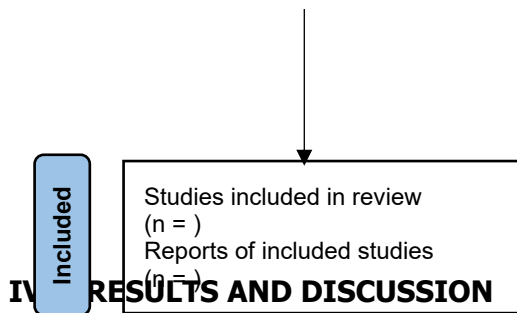
Exclusion Criteria in this research such as Articles published before 2020, non-English publications, Non-peer-reviewed content, such as editorials, conference summaries, book reviews, or opinions, and Articles where EMA was only a peripheral or passing mention.

3.4 Data Extraction and Thematic Synthesis Process

The article selection followed the PRISMA process. First, titles and abstracts were screened for relevance, and duplicates were removed. Second, the full texts of the shortlisted articles were assessed for eligibility against the inclusion criteria. A standardized data extraction form was developed to capture key information from each included article, including: Author(s) and Year, Journal, Methodology, Theoretical Framework, Key Findings (e.g., tools, drivers, barriers, performance outcomes), and identified future research directions. Following data extraction, a thematic synthesis approach was employed. This involved systematically identifying, coding, and categorizing recurring themes and patterns across the literature. These themes were then synthesized to build the analytical narrative presented in the "Results and Discussion" section.

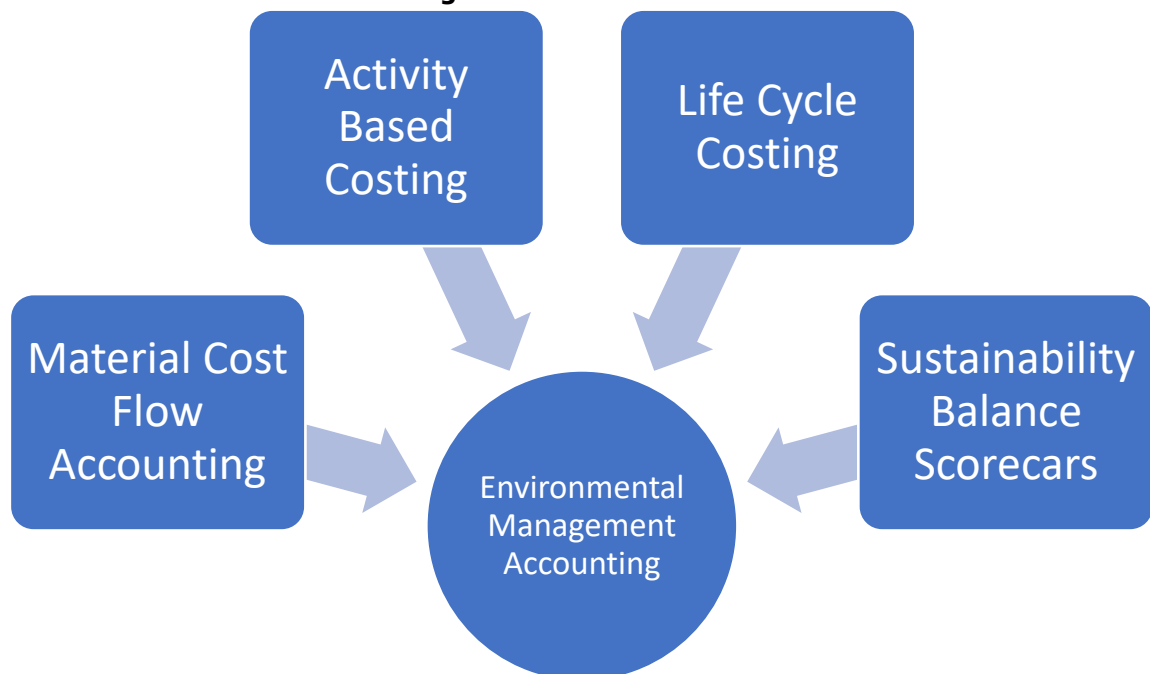
Figure 1. PRISMA DIAGRAMS





The thematic synthesis of the 72 included articles (2020-2025) reveals a dynamic and rapidly maturing field. The following sections discuss the findings, organized by core practices, implementation dynamics, and emerging frontiers. The "toolbox" of EMA consists of several established instruments designed to operationalize the dual physical and monetary information flows.

Figure 2. EMA Toolbox



MFCA was identified as the "most recorded tool" in recent literature reviews (Munir & Yassin, 2020). Its prominence is supported by its formal standardization as ISO 14051, which lends it significant legitimacy (Munir & Yassin, 2020). The primary function of MFCA is to operationalize the PEMA and MEMA concepts by tracing and quantifying the flows of materials (including water and energy) through a production process in *both* physical units (e.g., kilograms) and monetary costs (Munir & Yassin, 2020). Its strength lies in making the cost of waste and inefficiency transparent, thereby identifying "win-win" scenarios for cost reduction and cleaner production. However, recent research explicitly *rejects* the view that MFCA alone is a silver bullet; sustainable production requires a *combination* of EMA tools, and MFCA is most effective when integrated with other systems (Munir & Yassin, 2020).

In traditional accounting, environmental costs (e.g., waste treatment, pollution control, compliance) are often obscured within general overhead accounts. Environmental Activity-Based Costing (ABC) addresses this by allocating those costs to the specific *activities* and *products* that generate them (Ndemuweda, 2025). Recent research highlights its utility in identifying production stages with the highest environmental impact and associated costs. By providing more accurate and

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granular cost information, ABC allows managers to optimize processes, reduce emissions, and make more eco-efficient and sustainable decisions regarding product pricing and mix (Ndemuweda, 2025).

Life Cycle Costing (LCC) expands the temporal scope of analysis far beyond the factory gate. It aims to identify and quantify all costs—including environmental and social costs—associated with a product *across its entire lifecycle*, from research and development and raw material extraction to production, use, and end-of-life disposal or recycling. LCC is frequently used in conjunction with Life Cycle Assessment (LCA), which assesses environmental impacts. A 2025 bibliometric analysis of LCC research found that the tool is undergoing a significant transition: it is evolving from a niche financial tool into a *strategic framework for sustainable planning and policymaking*, particularly in sustainable construction and infrastructure projects.

The SBSC is a key strategic performance management tool (Ndemuweda, 2025). It addresses a core challenge of sustainability: integration. The SBSC integrates environmental and social objectives directly into the traditional four perspectives of the Balanced Scorecard (Financial, Customer, Internal Process, and Learning & Growth). This tool links high-level corporate sustainability strategy to tangible operational performance metrics, enhancing comprehensive performance evaluation and embedding environmental stewardship into routine managerial decision-making (Ndemuweda, 2025).

Table 2: Comparison of Core EMA Tools (2020-2025 Literature)

EMA Tool	Primary Function	Scope of Analysis	Key Contribution to Decision-Making
Material Flow Cost Accounting (MFCA)	Traces physical material/waste flows and assigns monetary costs to both products and waste.	Process / Production-Level	Identifies "win-win" opportunities for cost reduction and cleaner production by making waste transparent.
Environmental Activity-Based Costing (ABC)	Allocates hidden environmental overhead costs to the specific activities and products that create them.	Activity / Product-Level	Provides accurate product costing for eco-efficient pricing and process optimization decisions.
Life Cycle Costing (LCC)	Assesses all economic, environmental, and social costs of a product over its entire life.	Full Lifecycle (Cradle-to-Grave)	Enables strategic, long-term decisions on sustainable product design, investment, and policymaking.
Sustainability Balanced Scorecard (SBSC)	Integrates environmental and social metrics into the firm's strategic performance management system.	Strategic/Organization al-Level	Connects high-level sustainability strategy with day-to-day operations and performance measurement.

Implementation Dynamics: Drivers, Barriers, and the Performance Nexus

The literature extensively explores the "why" (drivers and barriers) and "so what" (performance outcomes) of EMA adoption. The primary motivations for implementing EMA are consistently found to be external.

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- **Regulatory and Stakeholder Pressures:** The most dominant drivers are adherence to government regulations and intense pressure from external stakeholders (e.g., investors, shareholders, community groups) demanding greater transparency and accountability.
- **Internal Motivations:** Internally, the pursuit of cost reduction through improved resource efficiency (e.g., reducing energy, water, and material costs) is a major driver. This is often linked to enhancing corporate image and reputation, which is seen as a source of competitive advantage.

Despite these clear drivers, EMA adoption remains uneven. Significant barriers persist, particularly for Small and Medium-sized Enterprises (SMEs).

- **Internal Barriers:** These are often the most difficult to overcome. They include a lack of knowledge, skills, and expertise to structure and use EMA procedures ; skepticism from top management about the value of environmental tools ; and a general resistance to organizational change. Furthermore, poor internal documentation and the perception that EMA is too costly and time-consuming to implement are critical hurdles.
- **External Barriers:** These include a lack of clear governmental policies or support frameworks and inadequate financial and technical resources, which especially hinders adoption by SMEs.

The literature from 2020-2025 provides strong evidence for the "business case" for EMA, confirming a positive relationship with performance across multiple dimensions.

- **Environmental Performance:** This is the most direct and strongly supported outcome. EMA implementation enables organizations to reduce waste, improve resource efficiency, and enhance pollution management (Hasan et al., 2024).
- **Financial and Organizational Performance:** By identifying and managing environmental costs (e.g., waste, energy, compliance), EMA contributes directly to long-term profit improvement and sustainable development (Hasan et al., 2024; Sari et al., 2020).
- **Competitive Advantage:** As outlined by the NRBV, EMA acts as a strategic information capability. By improving environmental performance and enhancing corporate reputation, it allows firms to build unique competencies that foster a sustainable competitive advantage (Hasan et al., 2024; Nguyen & Tran, 2025).

This positive EMA-performance link, however, is not universal. The evidence reveals a crucial contingency. A 2024 meta-analysis confirms the positive impact but finds that its magnitude is significantly *moderated* by national EMA maturity and firm size (Hasan et al., 2024). This is a critical finding. It indicates that large firms and firms operating in high-maturity countries (i.e., those with strong regulations, support infrastructure, and professional standards) realize far more significant performance benefits from EMA. This "Maturity-Size-Performance" model helps explain the persistent implementation gap for SMEs and in many developing nations (Hasan et al., 2024; Qian et al., 2021). For these firms, the high implementation barriers (cost, knowledge, resource scarcity) are not yet perceived to be outweighed by the performance benefits, suggesting that tailored policies and support systems are required.

Emerging Frontiers in Environmental Accounting

The scope of the "E" in EMA is expanding, pushing the field into new, complex, and urgent territories. The focus of environmental accounting is rapidly broadening from "carbon and waste" to include the much more complex domains of "nature and biodiversity" (Ndemuweda, 2025). This shift is being catalyzed by global agreements like the Kunming-Montreal Global Biodiversity Framework. The most significant development in this space is the Taskforce on Nature-related Financial Disclosures (TNFD). Modeled on the successful Taskforce on Climate-related Financial Disclosures (TCFD), the TNFD provides a framework for organizations to externally report on their nature-related dependencies, impacts, risks, and opportunities (TNFD, 2023). The release of the TNFD framework in 2023 has created an immediate and massive internal information demand. Organizations cannot disclose what they do not measure. This places management accountants at the center of a new challenge: they must rapidly design and implement new EMA systems capable of identifying, measuring, and managing complex, location-specific data on ecosystem health and biodiversity (TNFD, 2023; Ndemuweda, 2025).

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The literature shows a strengthening convergence between EMA and the principles of the Circular Economy (CE) (Di Vaio et al., 2023). This integration reframes the fundamental goal of EMA. In a linear "take-make-dispose" model, EMA's goal is to minimize negative impacts (like pollution and waste). In a circular model, its goal is to provide information to enable a positive system of resource optimization, material looping, and waste elimination (Di Vaio et al., 2023). EMA tools are being adapted for this new paradigm; for example, MFCA is being explicitly extended to track material circularity and design out waste from the start (Munir & Yassin, 2020).

The second major trend transforming the field is digitalization. The new, complex data demands from frontiers like biodiversity and CE are being met by the concurrent rise of Industry 4.0 technologies. These trends are not separate; they are *mutually dependent and co-evolving*. The frontiers create the *demand* for complex data, and digital tools provide the *supply* of data-processing power, making the previously "unaccountable" accountable.

Digitalization is a dominant theme in recent management accounting research (Pratama, 2024). This includes "digitally supported EMA" (Abdelhalim et al., 2023) and the use of ICT and specialized accounting software to improve the efficiency, quality, and timeliness of environmental reporting (Broccardo et al., 2025).

- **Big Data Analytics (BDA):** BDA is seen as a transformative technology for sustainability. It allows firms to analyze massive, complex, and unstructured datasets (e.g., sensor data, satellite imagery, social media) to identify environmental patterns and risks. Recent studies provide empirical evidence that BDA implementation leads to a significant improvement in corporate environmental performance (Abdelhalim et al., 2023).
- **Artificial Intelligence (AI) and Blockchain:** These are identified as key emerging technologies (Abdelhalim et al., 2023; Pratama, 2024). AI is expected to enhance predictive analytics for environmental risk, while blockchain offers immutable traceability for complex green supply chains (Abdelhalim et al., 2023).

4.4.2 Specialized Applications: Building Information Modeling (BIM) in Sustainable Construction

In the construction sector, Building Information Modeling (BIM) has emerged as the key digital integration tool (Lopez & Martínez, 2021). Research shows a strong trend toward integrating BIM with sustainability and accounting frameworks. BIM creates a single, intelligent 3D model that serves as a shared data source for the entire project lifecycle. This allows for the direct integration of EMA tools: LCC data can be embedded in the model to manage whole-life costs, materials accounting can be automated, and LCA can be run to assess environmental impacts, all within one digital environment (Lopez & Martínez, 2021).

The synthesis of literature from 2020-2025 demonstrates that EMA is evolving from a set of discrete, internal-costing tools into a *strategic, digitized, and integrated sustainability information system*. The "E" in EMA is expanding to include biodiversity and circularity, while the "MA" is being fundamentally transformed by digital technology. This co-evolution highlights a shift in the management accountant's role from a historical "cost-tracker" to a future-oriented "sustainability data architect."

Based on this synthesis, several critical research gaps persist:

- **The SME Gap:** The "Maturity-Size-Performance" model (Hasan et al., 2024) confirms that SMEs are being left behind. The most persistent gap is the need for research that develops and tests scalable, low-cost, high-impact EMA implementation models specifically designed for the resource constraints of SMEs.
- **The Digital-Practice Gap:** While much is written about AI and blockchain, empirical research is scarce. There is a critical need for case studies and action research on how firms are actually integrating these advanced technologies into their EMA systems (Pratama, 2024).
- **The New Frontiers Gap:** The TNFD framework (TNFD, 2023) and CE principles (Di Vaio et al., 2023) are conceptually revolutionary but lack operational accounting guidance. Urgent research is needed to develop practical, auditable accounting models for biodiversity and circularity.
- **The Contextual Gap:** The field needs more longitudinal studies to track the long-term impact of EMA on financial performance. It also requires more comparative studies to understand

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implementation dynamics in developing countries (Hasan et al., 2024; Qian et al., 2021), which is essential for validating and detailing the "Maturity-Size-Performance" model.

V. CONCLUSION

5.1 Principal Contributions of the Review

This systematic review of the 2020-2025 literature provides a comprehensive map of the contemporary Environmental Management Accounting field. Its principal contribution is the synthesis of recent findings, which demonstrates that EMA has transcended its origins as a niche costing tool. It is now evolving into a strategic, digitized information system that is central to corporate sustainability. This review has articulated the key theoretical frameworks, core tools, and implementation dynamics that define the field. Crucially, it has highlighted two defining trends: first, the emergence of the "Maturity-Size-Performance" contingency model, which explains the relationship between EMA adoption and performance; and second, the *co-evolution* of new sustainability frontiers (like biodiversity and the circular economy) with the digital tools (like Big Data, AI, and BIM) required to manage them.

5.2 Implications for Management Accounting Practice and Policy Formulation

The findings of this review have significant implications for practice and policy.

- **For Management Accountants:** The accountant's role is irrevocably changing. This review highlights an urgent need for professional upskilling beyond traditional finance. Accountants must become experts in managing non-financial data, implementing digital systems (BDA, AI, BIM), and understanding strategic sustainability frameworks (CE, TNFD). They must be prepared to act as the data architects of the sustainable enterprise.
- **For Organizations:** Adopting EMA is no longer a discretionary choice for reputation management. It is a core strategic necessity. The findings show EMA is essential for long-term risk management (to meet TNFD demands), operational efficiency (to enable CE), and securing a sustainable competitive advantage (per NRBV).
- **For Policymakers:** A "one-size-fits-all" policy to promote EMA is destined to fail. The "Maturity-Size-Performance" model shows that policy must be targeted. Governments and industry bodies must provide specific financial and technical support to help SMEs overcome their significant implementation barriers. Furthermore, national-level investment in data infrastructure, standards, and education is required to raise "national EMA maturity" and unlock the full performance benefits of EMA for all firms

5.3 Limitations and a Comprehensive Agenda for Future Research

This review is subject to the standard limitations of an SLR, including its defined timeframe (2020-2025), language (English-only), and the specific databases searched. The findings represent a thematic synthesis of the selected articles.

Building on the gaps identified in section 4.5, this review proposes a clear agenda for future research to advance the field:

1. **Develop and test** scalable, low-cost, and high-impact EMA implementation models for **SMEs**.
2. Move beyond conceptual discussions of **digitalization** to conduct empirical case studies on the practical integration of **AI and blockchain** in EMA.
3. Develop **operational and auditable accounting models** for the new frontiers of **biodiversity (to support TNFD)** and the **Circular Economy**.
4. Conduct more **longitudinal studies** and **comparative analyses in developing countries** to further validate and explore the "Maturity-Size-Performance" contingency model.

Addressing these research priorities is essential for ensuring that Environmental Management Accounting can fulfill its potential as a critical information system for navigating the complex sustainability challenges of the 21st century.

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