

# How environmental management accounting drives performance: a meta-analysis considering national EMA maturity

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## Abstract

**Purpose** – This study investigates the impact of environmental management accounting (EMA) on organizational performance, with a focus on how national EMA maturity, performance type and firm size influence this relationship. The aim is to explore how EMA can support sustainability goals while enhancing performance across diverse contexts.

**Design/methodology/approach** – A comprehensive meta-analysis was conducted, incorporating 36 studies with a combined total of 13,010 observations. Data from the Future of Growth Report (2024) by the World Economic Forum were used to create an innovative EMA index that classifies countries based on their level of EMA adoption. It explores how the EMA–performance relationship varies across national, organizational and performance-specific factors.

**Findings** – The meta-analysis confirms EMA's positive impact on performance, moderated by national EMA maturity, performance type and firm size. High-maturity contexts and large firms see more significant benefits, with environmental performance showing the strongest link. These insights underscore EMA's role in driving performance while highlighting the need for context-specific strategies, especially in less developed EMA environments or for small and medium-sized enterprises (SMEs).

**Practical implications** – Organizations in high EMA maturity countries or larger firms should adopt EMA to boost environmental performance, while policymakers should improve EMA frameworks in less developed regions and support SMEs with resources. Additionally, companies should prioritize EMA to enhance sustainability, given its strong impact on environmental outcomes.

**Originality/value** – This study enriches EMA literature by analyzing how national context, firm size and performance type affect the EMA–performance link, offering practical insights for aligning sustainability and performance goals for researchers, practitioners and policymakers.

**Keywords** Environmental management accounting, EMA, Environmental performance, Financial performance, Country's EMA level, Meta-analysis

**Paper type** Research paper

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*Conflict of interest:* The authors declare that they have no conflicts of interest related to this study.

*Research involving human participants and/or animals:* This study did not involve any human participants or animals. The data used in this research were derived from secondary sources, including published studies and publicly available datasets.

*Informed consent:* Since the study did not involve human participants, informed consent was not applicable.



## 1. Introduction

As environmental sustainability increasingly becomes a central consideration in corporate strategy, businesses worldwide are adopting frameworks that integrate environmental accountability into decision-making processes (Cho and Patten, 2013; Liem and Hien, 2024; Singhanian and Chadha, 2023). Environmental management accounting (EMA) has emerged as a critical tool in this shift, enabling firms to identify, measure and manage environmental costs while simultaneously improving their financial and operational performance (Asiaei *et al.*, 2022; Gerged *et al.*, 2024; Gunarathne and Lee, 2015; Zeng *et al.*, 2024). EMA offers a dual advantage by promoting environmental stewardship and enhancing organizational efficiency, aligning with the principles of sustainable governance. However, despite its potential, the impact of EMA on organizational performance is not yet fully understood, especially when accounting for contextual factors (Correa *et al.*, 2023). This gap underscores the need for further research on how accounting innovations like EMA contribute to sustainable development and organizational effectiveness.

One of the significant gaps in the existing literature lies in understanding the moderating role of national EMA maturity levels. Cross-national variations in EMA practices are shaped by institutional frameworks, regulatory environments and cultural attitudes toward sustainability (Christ and Burritt, 2013). These variations suggest that the broader institutional and societal context can significantly influence the relationship between EMA and firm performance (Qian *et al.*, 2011). Yet, prior research has largely focused on firm-level adoption, neglecting the role of macro-level differences. To address this limitation, this study introduces a novel measure of national EMA maturity derived from the Future of Growth Report (2024) by the World Economic Forum. The EMA Index, a weighted composite of sustainability, resilience, inclusiveness and innovativeness, categorizes countries by evaluating the extent and sophistication of their EMA practices, such as the adoption of eco-focused accounting tools, adaptability to challenges, sector-wide implementation and use of innovative technologies. This detailed framework enables a thorough analysis of cross-national variations, shedding light on how these differences influence the relationship between EMA and firm performance. It specifically allows researchers to explore whether a supportive national context, characterized by robust EMA practices, strong regulatory support and institutional maturity, amplifies the positive impact of EMA on organizational outcomes.

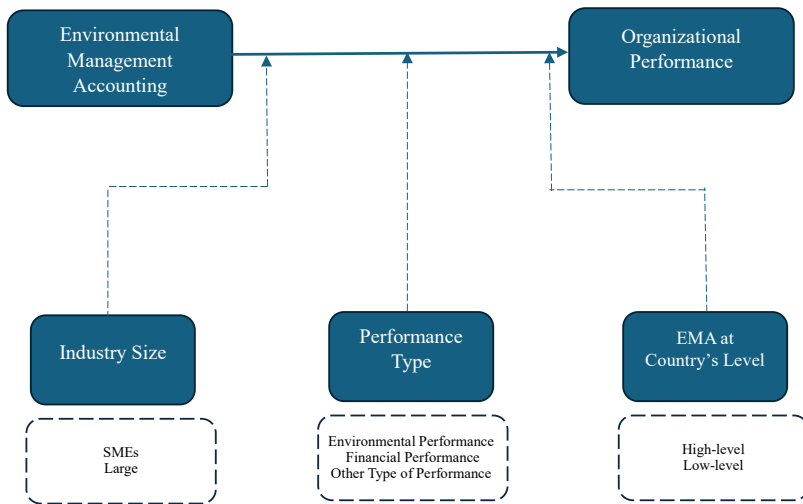
Another gap is the inconsistent focus on performance outcome types across studies examining EMA. While some research comprehensively addresses multiple dimensions, such as financial, environmental and social performance, or explores combinations of these (Mat Yusoh *et al.*, 2023; Sidik *et al.*, 2019; Zeng *et al.*, 2024), some empirical studies still predominantly emphasize financial performance (Gerged *et al.*, 2024), often underexplored other critical areas like environmental outcomes, operational efficiency and stakeholder-related performance. This inconsistent focus highlights the need for a more balanced and integrative approach to understanding EMA's broader impact on organizational performance (Silva *et al.*, 2019). These non-financial indicators are highly relevant in the sustainability context, where firms must balance economic, environmental and social objectives (Huang and Watson, 2015). It remains unclear whether EMA adoption benefits all aspects of performance equally or if its impact is more pronounced for certain types of outcomes (Burritt *et al.*, 2023). By categorizing performance into distinct dimensions (e.g. financial versus environmental performance), this study examines how the type of performance outcome might moderate the effect of EMA on organizational success.

Firm-specific characteristics, particularly firm size, may also influence EMA's effectiveness, yet have received relatively little attention in prior research. Larger firms typically possess greater resources and infrastructure to implement sophisticated EMA systems, whereas smaller firms face resource constraints but may benefit from greater agility and flexibility (Burritt *et al.*, 2002; Johnson and Schaltegger, 2016). The interaction between firm size and EMA outcomes remains poorly understood, and existing studies provide mixed insights into whether small and large firms realize comparable performance gains from EMA.

By examining firm size as a moderating variable, this study seeks to fill this gap and offer nuanced insights into EMA's applicability across different organizational scales. To explore these multi-level influences, this study draws on complementary theoretical perspectives, i.e. contingency theory, institutional theory and the natural resource-based view (NRBV), which collectively suggest that EMA's impact on performance is context-dependent, shaped by both external institutional pressures and internal resource capabilities.

To address the foregoing gaps, this study conducts a comprehensive meta-analysis to quantitatively synthesize the evidence on EMA's impact on organizational performance. Meta-analysis enables us to aggregate findings across disparate studies and statistically examine the overall effect of EMA as well as the influence of contextual moderators. Drawing on 36 independent studies and 13,010 firm observations, this study offers one of the most comprehensive analyses of the relationship between EMA and performance to date. This approach allows us to test whether national EMA maturity, performance type and firm size systematically alter the effectiveness of EMA. In doing so, this paper extends prior literature reviews that have been primarily qualitative or conceptual. For example, [Schaltegger et al. \(2013\)](#) use the bibliometric literature review to investigate the body of literature on EMA; [Johnstone \(2020\)](#) provides a systematic review of the drivers, implementation processes and performance outcomes of environmental management systems in SMEs, emphasizing management accounting and control. Studies like [Javed et al. \(2022\)](#), [Alwan and Maelah \(2024\)](#), and [van der Poll \(2022\)](#) explain the barriers to the adoption of EMA. [Schaltegger et al. \(2022\)](#) consider that sustainability management accounting connects to organizational contexts and contributes to sustainability transformations beyond the organization through systematic reviews. Recently, [Swalih et al. \(2024\)](#) investigated why and how EMA is used for strategic decision-making based on a systematic literature review. While these reviews offer valuable insights into EMA practices and challenges, none have quantitatively assessed the overall EMA–performance link across studies or accounted for the moderating effects of national context and firm characteristics. By filling this void with a meta-analytic synthesis, the present study contributes a more robust, evidence-based understanding of how and under what conditions EMA drives performance.

This study offers several key contributions to EMA literature. First, it advances the literature by explicitly addressing how contextual factors, particularly country-level EMA maturity and firm size, shape the effectiveness of EMA, thereby illuminating contingencies that can amplify or diminish its impact. Second, it bridges the gap between macro-level institutional environments and micro-level organizational practices, offering a holistic perspective on EMA implementation that connects national policy and culture with internal management accounting processes. Third, it provides actionable insights for practitioners and policymakers by identifying conditions under which adopting EMA is most likely to yield performance benefits, informing strategies for both large and small firms in different national contexts. Finally, by synthesizing empirical results from dozens of studies, this meta-analysis delivers a more generalizable and reliable assessment of EMA's impact than any single study alone. Findings indicate that EMA adoption has a significant positive effect on overall organizational performance. Notably, this positive effect is stronger in countries with high EMA maturity (i.e. where environmental accounting practices are well established nationally), highlighting the importance of the supportive external context. Likewise, larger firms experience greater performance improvements from EMA than smaller firms, consistent with the idea that resource availability enhances EMA's impact. In terms of performance types, EMA has the most substantial impact on environmental outcomes, such as reductions in waste, emissions and resource usage. It also contributes meaningfully, though to a slightly lesser degree, to financial and operational performance. These findings underscore that EMA is particularly effective in driving environmental improvements, which in turn can translate into broader organizational success, especially when deployed in conducive environments and adequately resourced companies. [Figure 1](#) outlines the proposed conceptual framework.



**Figure 1.** Conceptual framework

The rest of the paper is organized as follows. [Section 2](#) presents the theoretical underpinnings and the research hypotheses. [Sections 3 and 4](#) present the research methodology and results, respectively. [Section 5](#) explains and discusses the study's main findings. Lastly, the paper highlights the importance of the findings, outlines the study's limitations and offers recommendations for future research.

## 2. Literature review and hypotheses development

The relationship between EMA and performance has attracted significant attention in recent years. However, the mechanisms through which EMA influences performance vary. Scholars have relied on several theoretical frameworks to understand this relationship. Among the most frequently utilized theories are the Contingency Theory ([Donaldson, 2001](#)), the Institutional Theory ([Dimaggio and Powell, 1983](#)) and the NRBV ([Hart, 1995](#)). These frameworks provide complementary perspectives on how EMA impacts performance outcomes.

Contingency theory posits that organizational effectiveness is not a one-size-fits-all phenomenon but depends on the alignment between organizational practices and contextual factors ([Donaldson, 2001](#)). In the context of EMA, this theory suggests that the impact of EMA on performance may vary based on external and internal conditions, such as the country's level of EMA adoption. High levels of national EMA maturity indicate well-established regulatory, cultural and market pressures that encourage organizations to align their accounting systems with sustainability goals. This alignment is expected to enhance performance outcomes, particularly in environmentally conscious markets, as organizations can better capture, measure and act on sustainability metrics ([Fuzi et al., 2020](#); [Gunarathne and Lee, 2021](#); [Nkundabanyanga et al., 2021](#); [Phan et al., 2017](#)).

Institutional theory highlights the role of institutional pressures (coercive, normative and mimetic) in shaping organizational behavior ([Dimaggio and Powell, 1983](#)). Countries with high EMA adoption levels likely exhibit strong institutional pressures, compelling organizations to conform to sustainability practices to achieve legitimacy. For instance, regulatory mandates, professional norms and competitive benchmarking may drive firms to implement EMA systems comprehensively, thereby strengthening the relationship between EMA and organizational performance ([Appiah et al., 2020](#); [Chaudhry and Amir, 2020](#); [Deb et al., 2023](#); [Huynh and Nguyen, 2024](#); [Kadir et al., 2024](#); [Susanto and Meiryani, 2019](#); [Zandi and Lee, 2019](#)).

The NRBV (Hart, 1995) explains that the importance of organizational capabilities lies in managing environmental resources as a source of competitive advantage. EMA serves as a critical capability for identifying, managing and optimizing the use of environmental resources, thus driving superior environmental performance. The findings align with the NRBV by showing that EMA's strongest impact is on environmental performance, as organizations leveraging EMA can reduce waste, improve resource efficiency, and enhance sustainability (Appannan *et al.*, 2023; Asiaei *et al.*, 2022; Hanif *et al.*, 2023; Hoai *et al.*, 2023; Latan *et al.*, 2018; Sari *et al.*, 2020; Sidik *et al.*, 2019; Solovida and Latan, 2021). In high EMA adoption contexts, organizations are likely to realize greater competitive advantages due to more robust resource management frameworks and stakeholder support.

### 2.1 EMA and performance

EMA is a comprehensive approach that integrates environmental and financial data into organizational decision-making processes (International Federation of Accountants, 2005). EMA allows organizations to identify, measure and manage environmental costs, offering tools to reduce waste, optimize resource use and align strategic objectives with sustainability goals (Christ and Burritt, 2013). Theoretical foundations such as the NRBV (Hart, 1995) suggest that EMA functions as a valuable internal capability that enables firms to develop eco-efficient processes and gain a competitive advantage. Simultaneously, institutional theory posits that EMA enhances corporate transparency and accountability by aligning organizational practices with established societal norms and expectations, thereby helping firms manage institutional pressures, maintain legitimacy and improve their social and market positioning (Scott, 2008).

Empirical evidence from diverse international settings reveals that integrating EMA can transform strategic environmental initiatives into measurable competitive advantages. For instance, analyses conducted in Malaysia and Australia illustrate how combining EMA with initiatives such as pollution prevention and clean technology not only elevates environmental performance but also streamlines operational practices (Appannan *et al.*, 2023; Phan *et al.*, 2017). Insights emerging from Iran and Sri Lanka further indicate that embedding EMA within frameworks that harness green intellectual capital and robust environmental strategies creates a pathway for enhanced overall performance (Asiaei *et al.*, 2022; Gunarathne and Lee, 2021). In addition, evidence from Pakistan and Japan suggests that when EMA is reinforced by proactive top management support, transformative leadership and effective stakeholder integration, both environmental and financial outcomes are significantly improved (Bresciani *et al.*, 2023; Gerged *et al.*, 2024; Hanif *et al.*, 2023; Zeng *et al.*, 2024). Collectively, these contributions underscore EMA as a vital strategic tool that not only advances sustainability objectives but also fortifies a firm's competitive edge in today's dynamic business landscape.

While the empirical literature largely supports a positive EMA–performance relationship, some inconsistencies persist. Studies differ in how they operationalize EMA and performance, leading to variation in outcomes. Many emphasize environmental performance but underrepresent financial or operational metrics (Ali *et al.*, 2023; Amir *et al.*, 2020; San *et al.*, 2018; Saputra *et al.*, 2023; Solovida and Latan, 2017; Susanto and Meiryani, 2019; Uyar, 2020; Zandi *et al.*, 2019). Additionally, the effects of EMA on financial outcomes may be delayed or realized indirectly via cost control and innovation, leading to uneven findings across short-term and long-term horizons (Papagiannakis *et al.*, 2019). Contextual factors, including institutional support, regulatory environments and firm size, further moderate EMA's effectiveness (Chaudhry and Amir, 2020; Hasan *et al.*, 2024; Qian *et al.*, 2011). These disparities underscore the need for a systematic quantitative review. By synthesizing evidence, this study's meta-analysis aims to provide a more reliable and generalizable understanding of EMA's impact on firm performance. This enables clearer conclusions about the strength and consistency of the EMA–performance link across diverse contexts and performance types.

*H1.* EMA is positively related to organizational performance.

## 2.2 Moderator effect of EMA level

By integrating environmental considerations into traditional accounting practices, EMA enables organizations to identify cost-saving opportunities, optimize resource utilization and enhance their environmental footprint. Several studies emphasize its role in promoting financial savings through waste reduction and energy efficiency, as well as improving operational efficiency by fostering innovation in processes and products (Agustia *et al.*, 2019; Assakhaa Wisesa, 2024; Christ, 2014; Christensen and Himme, 2017; Gerged *et al.*, 2024; Mat Yusoh *et al.*, 2023; Wachira and Wang'Ombe, 2019). Research also suggests that EMA contributes to enhanced environmental performance, facilitating compliance with environmental regulations and stakeholder expectations (Gunarathne and Lee, 2021). While these benefits are widely recognized, the degree to which they are realized may vary across national settings, depending on the country's institutional readiness for sustainability-oriented accounting. Thus, it is not only the adoption of EMA that matters but also the context in which it is embedded.

National EMA maturity refers to the degree to which a country has developed institutional, regulatory and cultural frameworks that support the adoption and effectiveness of EMA practices (Christ and Burritt, 2013). This includes factors such as government enforcement, professional education systems, environmental legislation and organizational incentives. Countries with higher EMA maturity typically exhibit robust regulatory enforcement, advanced accounting standards and widespread awareness of sustainability issues. In contrast, countries with lower EMA maturity may face challenges such as weak regulatory frameworks, limited expertise and insufficient organizational incentives to adopt EMA (Javed *et al.*, 2022; Johnstone, 2020; Qian *et al.*, 2011). From an institutional theory perspective, organizational practices are not developed in a vacuum but are shaped by the societal and regulatory structures within which firms operate (Scott, 2008). In this view, national context serves as a critical contingency influencing whether EMA translates into performance gains.

Empirical studies illustrate this point. For instance, Le *et al.* (2019) found that strong government enforcement significantly encouraged EMA adoption and enhanced environmental efficiency in Vietnamese firms. Phan *et al.* (2017) similarly noted that the comprehensiveness of environmental management systems, often shaped by national context, positively influenced EMA usage and firm performance. Conversely, in countries with weak enforcement or limited institutional pressure, EMA's integration may be superficial or ineffective (Setthasakko, 2010; van der Poll, 2022). Despite these insights, most EMA studies have not explicitly examined how national-level variation moderates the EMA–performance relationship. This represents a significant gap in the literature. To address this, we draw on the Future of Growth Report (2024) by the World Economic Forum to develop a new index of national EMA maturity. This index enables us to assess how differences in environmental accounting infrastructure across countries influence the strength of the EMA–performance link. EMA's effectiveness depends on institutional context; thus, analyzing these differences is necessary to predict outcomes.

Given this context, the following hypothesis is proposed:

H2. EMA at the country level moderates the relationship between EMA and organizational Performance.

## 2.3 Moderator effect of performance type

The relationship between EMA and organizational performance, however, is multifaceted, spanning financial, environmental and operational dimensions (de Villiers and Sharma, 2020). While existing literature emphasizes the environmental benefits of EMA, its implications for financial and other performance types, such as operational efficiency and innovation, remain less explored (Gerged *et al.*, 2024; Gunarathne and Lee, 2021). This limited focus restricts our understanding of the full spectrum of EMA's outcomes and calls for a more nuanced investigation into how EMA interacts with different types of performance.

Performance type plays a crucial role in determining the extent to which EMA delivers measurable benefits. Drawing on the NRBV, the value of strategic tools such as EMA depends on their alignment with specific organizational objectives and capabilities (Asiaei *et al.*, 2022; Hart, 1995). For instance, organizations prioritizing environmental performance may realize more immediate benefits from EMA than those emphasizing financial outcomes, where the payoffs might be long-term or indirect (Bennett *et al.*, 2003; Schaltegger, 2018; Schaltegger *et al.*, 2013). This temporal and structural distinction suggests that EMA's benefits may not be uniformly distributed across all performance types. Moreover, diverse stakeholder groups, acting as institutional forces, impose varying expectations that shape how organizations deploy EMA to secure legitimacy. Investors may focus on return on investment and risk management; regulators may prioritize legal compliance and environmental reporting; and customers may value sustainability innovation (Silva *et al.*, 2019). EMA, therefore, must adapt to these distinct expectations to deliver measurable performance outcomes (Gunarathne and Lee, 2021). For example, a firm aiming to satisfy regulatory compliance may use EMA differently than one aiming to enhance product eco-innovation or profitability. This heterogeneity in priorities further supports the need to examine how performance type influences EMA's effectiveness.

Findings also point to variations in EMA's outcomes. Mat Yusoh *et al.* (2023) found that EMA significantly improves environmental, economic and social outcomes, whereas studies like Gerged *et al.* (2024) and Zeng *et al.* (2024) highlight its relevance to financial and operational efficiency. Deb *et al.* (2023) similarly show that EMA can contribute to both environmental and financial performance, depending on its integration with other management systems and strategic orientation. Given the variability in EMA's impact across performance types, it is essential to investigate the moderating role of performance type in the EMA–performance relationship. This study classifies performance into three categories – environmental, financial and other forms of performance – and hypothesizes:

*H3.* Performance type moderates the relationship between EMA and organizational performance.

#### *2.4 Moderator effect of company's size*

Company size is a significant factor influencing the adoption and effectiveness of EMA practices. Larger organizations typically have greater access to financial and technical resources, established systems for sustainability reporting, and in-house expertise, enabling them to implement EMA more systematically and strategically (Appannan *et al.*, 2023; Asiaei *et al.*, 2022; Christine *et al.*, 2019; Latan *et al.*, 2018). They are also more likely to face heightened public and regulatory scrutiny, which incentivizes the adoption of sophisticated environmental management tools to ensure compliance and preserve corporate reputation (Qian *et al.*, 2011; Qian *et al.*, 2018a, b). This institutional and operational readiness makes larger firms better positioned to leverage EMA for performance improvements across environmental, financial and operational domains.

Conversely, small and medium-sized enterprises (SMEs) often encounter barriers such as limited financial capacity, shortage of technical skills and lower regulatory pressure (Javed *et al.*, 2022). These constraints may reduce the extent to which SMEs adopt or benefit from EMA; however, SMEs are not without potential. They may achieve quick wins in areas like waste minimization and energy efficiency, where EMA can deliver immediate cost-saving opportunities (Jasch, 2003; Somjai *et al.*, 2020) and can exhibit greater agility in implementing innovative environmental initiatives (Gerged *et al.*, 2024). For example, Huynh and Nguyen (2024) found that while large firms benefit from scale, smaller firms often respond more quickly to competitive and regulatory changes when supported by EMA.

The NRBV offers a theoretical foundation for understanding how company size moderates the EMA–performance relationship (Hart, 1995). According to NRBV, larger firms possess more abundant and diverse resource bundles, which enhance their capacity to exploit strategic

tools like EMA. These resources enable them to integrate EMA into broader strategic functions such as risk management, compliance, stakeholder engagement and green innovation (Silva *et al.*, 2019). In contrast, SMEs may prioritize short-term profitability due to resource scarcity, which can limit their commitment to long-term sustainability efforts unless external support or institutional pressure is present (Gunarathne and Lee, 2021; Papagiannakis *et al.*, 2019). Empirical research supports this view. Deb *et al.* (2023) found that large Bangladeshi firms were more successful in integrating EMA to achieve environmental and financial performance improvements. Chaudhry and Amir (2020) also emphasize the role of size in enabling sophisticated EMA implementation in Pakistani manufacturing firms. Meanwhile, Hasan *et al.* (2024) suggest that firm size influences both the depth of EMA application and its resulting performance benefits, especially in developing economies.

Given these differences in capability, resource availability, and strategic orientation, the relationship between EMA and performance is unlikely to be uniform across firms of varying sizes. To explore this heterogeneity, the current study categorizes firms as either small or large and investigates how company size moderates the EMA–performance relationship across environmental, financial and operational dimensions.

H4. The company's size moderates the relationship between EMA and organizational performance.

### 3. Methodology

#### 3.1 Sampling

The main aim of this research is to examine the relationship between EMA and organizational performance. To identify as many relevant studies as possible, a comprehensive literature search was conducted using multiple databases, including ScienceDirect, Web of Science, Wiley, ProQuest, ABI/Inform and Google Scholar. The search strategy focused on combinations of key terms related to both EMA and organizational performance. Specifically, the following keywords were used: (“Environmental Management Accounting,” “EMA,” “Sustainable Management Accounting,” “Green Management Accounting”) × (“Firm Performance,” “Financial Performance,” “Environmental Performance,” “Sustainability,” “Growth,” “Business Success”). This broad search approach ensured the inclusion of a diverse and representative set of empirical studies for meta-analysis.

Based on the work of Schmidt and Hunter (2016), this study adopted the following steps to conduct the meta-analysis. First, because of the major question of this research, as there is a link between EMA and organizational performance, all papers must consider this relationship as one of the hypotheses or indicate the result of this relationship. Second, all papers should be available in full-text format. Thirdly, the research exploring the link between EMA and performance should include a measure of correlation, represented by “*r*” or similar statistics. Alternatives to the correlation coefficient may include the *t*-value (*t*) or beta coefficient ( $\beta$ ). Reporting these statistics is essential for performing meta-analytical evaluations. To convert the *t*-value or beta coefficient ( $\beta$ ) to *r* correlation following formula has been used (Schmidt and Hunter, 2016):

$$(1) \text{ } T\text{-value to } r: \frac{t}{\sqrt{t^2 + df}}$$

$$(2) \text{ } \beta \text{ value to } r: \beta\sqrt{R^2} \text{ or } r: \frac{\beta \cdot SD_x}{SD_y}$$

Following the search procedures and inclusion criteria listed above, we considered 388 publications. In the next step, the authors analyzed the titles and abstracts of these papers to find if the publications included EMA and performance. This concluded with 189 papers. Additionally, we read the chosen articles to figure out that the papers specifically considered the relationship between these two variables and provided statistical quantitative results.

Finally, we identified 36 papers equals 13,010 observations that are eligible, and they included the following journals as a publisher: *Management Accounting Research*, *Business Strategy and the Environment*, *Journal of Knowledge Management*, *Journal of Accounting and Organizational Change*, *Journal of Cleaner Production*, *Sustainability Accounting, Management and Policy Journal*, etc. Figure 2 provides a PRISMA flow diagram and an overview of the systematic literature review. Also, Table 1 details the final sample involved in this study, which covers 8 years (2017–2024).

3.2 Variables and coding process

The correlation coefficient and sample size must be collected to conduct the meta-analysis research that is provided by studies under the demographic and statistical information. Furthermore, this paper has one independent variable, one dependent variable, three moderate variables and two controller variables.

*Independent variable:* **EMA** refers to creating and using accounting systems to oversee a company’s environmental and operational activities (International Federation of Accountants, 2005). It encompasses resources, planning, and processes that support the development, execution, evaluation and maintenance of environmental policies, addressing financial, physical and non-financial aspects (Chaudhry and Amir, 2020; Christ and Burritt, 2013). EMA aids in planning, controlling and decision-making to align business operations with environmental goals (Asiaei et al., 2022; Gerged et al., 2024; Gunarathne and Lee, 2021).

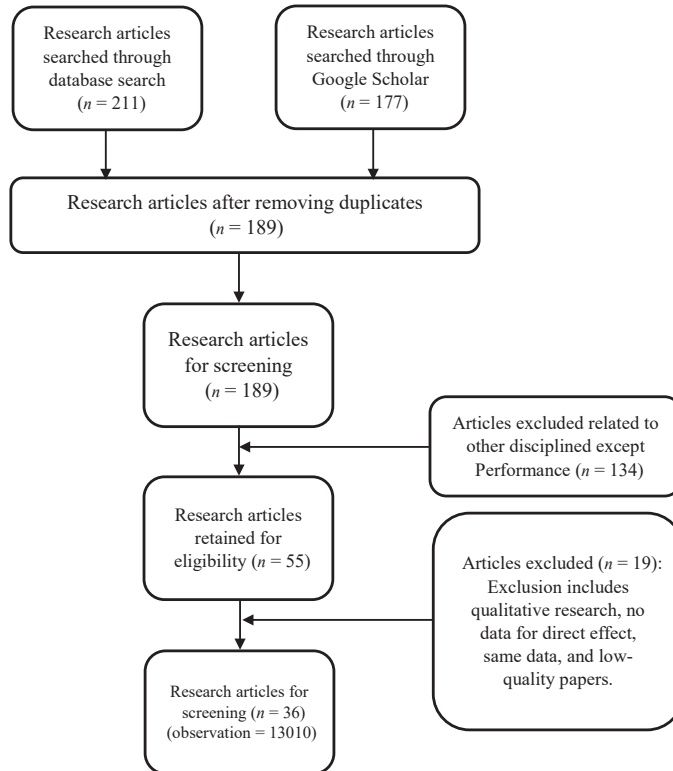


Figure 2. PRISMA flow diagram

**Table 1.** Overview of included studies and EMA index scores

Row	Authors	Journal	year	DV	Sample size	Firm size	Context	Type eco	EMA index
1	Agustia D. <i>et al.</i>	<i>International Journal of Energy Economics and Policy</i>	2019	Firm Value	277	Large	Indonesia	Developing	High
2	Ali K. <i>et al.</i>	<i>Environmental Science and Pollution Research</i>	2023	Environmental Sustainability	308	SMEs	Pakistan	Developing	Low
3	Amir M. <i>et al.</i>	<i>Journal of Management and Research</i>	2020	Environmental Performance	304	na	Pakistan	Developing	Low
4	Appannan J. S. <i>et al.</i>	<i>Business Strategy and the Environment</i>	2023	Environmental performance	145	SMEs	Malaysia	Developing	High
5	Appiah B. K. <i>et al.</i>	<i>International Journal of Energy Economics and Policy</i>	2020	Environmental Performance	317	na	China	Developing	na
6	Asiaei K. <i>et al.</i>	<i>Business Strategy and the Environment</i>	2022	Environmental performance	106	Large	Iran	Developing	Low
7	Bresciani S. <i>et al.</i>	<i>Journal of Knowledge Management</i>	2023	Environmental performance	329	Large	Pakistan	Developing	Low
8	Chaudhry N. I. and Amir M	<i>Business Strategy and the Environment</i>	2020	Environmental Performance	454	Large	Pakistan	Developing	Low
9	Chichan H. F. <i>et al.</i> (1)	<i>Journal of Accounting Science</i>	2021	Economic Performance	45	na	Iraq	Developing	na
10	Chichan H. F. <i>et al.</i> (2)	<i>Journal of Accounting Science</i>	2021	Environmental Performance	45	na	Iraq	Developing	na
11	Chichan H. F. <i>et al.</i> (3)	<i>Journal of Accounting Science</i>	2021	Social Performance	45	na	Iraq	Developing	na
12	Christine D. <i>et al.</i> (1)	<i>International Journal of Energy Economics and Policy</i>	2019	Economic Performance	317	SMEs	Indonesia	Developing	High
13	Christine D. <i>et al.</i> (2)	<i>International Journal of Energy Economics and Policy</i>	2019	Environmental Performance	317	SMEs	Indonesia	Developing	High
14	Deb B.C. <i>et al.</i>	<i>Journal of Accounting and Organizational Change</i>	2023	Environmental performance	323	Large	Bangladesh	Developing	Low
15	Gerged <i>et al.</i> (1)	<i>Management Accounting Research</i>	2024	Financial performance	204	SMEs	Pakistan	Developing	Low
16	Gerged <i>et al.</i> (2)	<i>Management Accounting Research</i>	2024	Non-financial performance	204	SMEs	Pakistan	Developing	Low
17	Gunarathne A. D. N. <i>et al.</i>	<i>Business Strategy and the Environment</i>	2021	Organizational performance	144	Large	Sri Lanka	Developing	Low
18	Hasan S. R. S. <i>et al.</i> (1)	<i>Cogent Business and Management</i>	2024	Environmental Performance	299	SMEs	Yemen	Developing	Low
19	Hasan S. R. S. <i>et al.</i> (2)	<i>Cogent Business and Management</i>	2024	Financial Performance	299	SMEs	Yemen	Developing	Low
20	Hoai T. T. <i>et al.</i>	<i>Corporate Social Responsibility and Environmental Management</i>	2023	Environmental performance	394	Large	Vietnam	Developing	High

(continued)

Table 1. Continued

Row	Authors	Journal	year	DV	Sample size	Firm size	Context	Type eco	EMA index
21	Jamal N. M. <i>et al.</i> (1)	<i>Journal of Sustainability Science and Management</i>	2020	Environmental Performance	121	na	Malaysia	Developing	High
22	Jamal N. M. <i>et al.</i> (2)	<i>Journal of Sustainability Science and Management</i>	2020	Economic Performance	121	na	Malaysia	Developing	High
23	Kadir M. R. A. <i>et al.</i>	<i>IIM Kozhikode Society and Management Review</i>	2024	Sustainable Business Performance	307	Large	Oman	Developing	Low
24	Latan H. <i>et al.</i>	<i>Journal of Cleaner Production</i>	2018	Corporate Environmental Performance	107	Large	Indonesia	Developing	High
25	Le T. T. <i>et al.</i> (1)	<i>Sustainability</i>	2019	Financial Efficiency	418	Large	Vietnam	Developing	High
26	Le T. T. <i>et al.</i> (2)	<i>Sustainability</i>	2019	Environmental efficiency	418	Large	Vietnam	Developing	High
27	Liem V. T. and Hien N. N	<i>Heliyon</i>	2024	Competitive advantage	234	Large	Vietnam	Developing	High
28	Nkundabanyanga S. K. <i>et al.</i>	<i>Journal of Accounting and Organizational Change</i>	2021	Environmental Performance Disclosure	102	Large	Uganda	Developing	na
29	Phan T. N. <i>et al.</i>	<i>Australasian Journal of Environmental Management</i>	2017	Environmental performance	208	na	Australia	Developed	High
30	San O. T. <i>et al.</i>	<i>International Journal of Economics and Management</i>	2018	Environmental performance	114	SMEs	Malaysia	Developing	High
31	Saputra K. A. K. <i>et al.</i>	<i>Journal of Sustainability Science and Management</i>	2023	Sustainable Business Performance	287	Large	Indonesia	Developing	High
32	Sari R. N. <i>et al.</i>	<i>Business Process Management Journal</i>	2020	Organizational performance	118	Large	Indonesia	Developing	High
33	Sidik M. H. J. <i>et al.</i> (1)	<i>International Journal of Energy Economics and Policy</i>	2019	Environmental Performance	280	SMEs	Indonesia	Developing	High
34	Sidik M. H. J. <i>et al.</i> (2)	<i>International Journal of Energy Economics and Policy</i>	2019	Competitive Advantage	280	SMEs	Indonesia	Developing	High
35	Solovida G. T. and Latan H	<i>Sustainability Accounting, Management and Policy Journal</i>	2017	Environmental performance	68	Large	Indonesia	Developing	High
36	Somjai S. <i>et al.</i>	<i>International Journal of Energy Economics and Policy</i>	2020	Firm Performance	303	SMEs	Indonesia	Developing	High

(continued)

**Table 1.** Continued

Row	Authors	Journal	year	DV	Sample size	Firm size	Context	Type eco	EMA index
37	Susanto A. and Meiryani	<i>International Journal of Energy Economics and Policy</i>	2019	Environmental Performance	249	SMEs	Indonesia	Developing	High
38	Uyar M	<i>Ege Academic Review</i>	2020	Sustainability Performance	126	SMEs	Turkey	Developing	Low
39	Wachira M. M. and Wang'ombe D	<i>Environmental reporting and management in Africa</i>	2019	Financial Performance	30	na	Kenya	Developing	High
40	Wisesa S. A. (1)	<i>International Conference on Digital, Social, and Science</i>	2024	Financial Performance	208	Large	Indonesia	Developing	High
41	Wisesa S. A. (2)	<i>International Conference on Digital, Social, and Science</i>	2024	Environmental Performance	208	Large	Indonesia	Developing	High
42	Yusoh N. N. A. M. et al. (1)	<i>Management and Accounting Review</i>	2023	Economic Performance	205	Large	Malaysia	Developing	High
43	Yusoh N. N. A. M. et al. (2)	<i>Management and Accounting Review</i>	2023	Environmental Performance	205	Large	Malaysia	Developing	High
44	Yusoh N. N. A. M. et al. (3)	<i>Management and Accounting Review</i>	2023	Social Performance	205	Large	Malaysia	Developing	High
45	Zandi G. and Lee H	<i>International Journal of Energy Economics and Policy</i>	2019	Environmental Performance	303	SMEs	Indonesia	Developing	High
46	Zandi G. R. et al.	<i>International Journal of Energy Economics and Policy</i>	2019	Environmental Performance	223	SMEs	Indonesia	Developing	High
47	Zeng Y. et al. (1)	<i>Sustainable Development</i>	2024	Corporate Environmental Performance	1,343	Large	Japan	Developed	High
48	Zeng Y. et al. (2)	<i>Sustainable Development</i>	2024	Corporate Financial Performance	1,343	Large	Japan	Developed	High

**Note(s):** That Chichan H. F. et al., Christine D. et al., Gerged et al., Hasan S. R. S. et al., Jamal N. M. et al., Le T. T. et al., Sidik M. H. J. et al., Wisesa S. A., Yusoh N. N. A. M. et al., and Zeng Y. et al. each contribute more than one observation because they measure different types of performance outcomes, which result in distinct correlation estimates for each outcome. Consequently, a single study may appear multiple times if it examines, for example, both financial and environmental performance with the same sample but reports different correlation values

*Dependent variable:* **Organizational performance** refers to organizational achievements based on its goals and objectives that could involve different aspects of performance like financial, environmental and operational performance (Zeng *et al.*, 2024). This concept of organizational performance has been used in central of most accounting and management studies (Asiaei *et al.*, 2020; Hizarci-Payne *et al.*, 2021; Lu and Taylor, 2016).

*Moderator variables:* Based on the hypothesis developed in the previous section, this study adopted various moderator variables that may have an impact on the relationship between EMA and organizational performance. **EMA at the country level** was measured as a moderating variable by using information from the World Economic Forum called The Future of Growth Report (World Economic Forum, 2024), which has been widely used in previous studies (Kraft and Bausch, 2018; Xie *et al.*, 2023). Four factors from this report have been considered to measure the EMA index indirectly: (1) Sustainability: “captures the extent to which an economy’s trajectory can keep its ecological footprint within finite environmental boundaries.” (2) Innovativeness: “captures the extent to which an economy’s trajectory can absorb and evolve in response to new technological, social, institutional and organizational developments to improve the longer-term quality of growth.” (3) Inclusiveness: “captures the extent to which an economy’s trajectory includes all stakeholders in the benefits and opportunities it creates.” (4) Resilience: “captures the extent to which an economy’s trajectory can withstand and bounce back from shocks.” For the countries included in this study, scores related to these dimensions were extracted, and the EMA Index was calculated using the following formulation. The median value of the calculated EMA Index across all countries was computed. Countries with an index above the median were classified as having a high level of EMA maturity, while those below the median were classified as low level. Table 1 provides detailed information.

$$\text{EMA Index} = (\text{Sustainability} * 50\%) + (\text{Resilience} * 20\%) + (\text{Inclusiveness} * 15\%) \\ + (\text{Innovativeness} * 15\%)$$

**Performance Type** is another moderator factor that is used in this research. We split samples into three dummy subgroups and coded them as Environmental performance, Financial Performance and those are not classified into these two groups (like Social Performance, Operational Performance, etc.). Furthermore, **Industry Size** was also used as a moderator in this study, which classified two main categories: Large, Small and Medium-sized Enterprises.

### 3.3 Control variables

Two control variables have been used to avoid exogenous influences on firms’ performance. First, this study adopted **publication year** as the dummy variable to control for any time effects (Kraft and Bausch, 2018; Xie *et al.*, 2023). We split studies into two groups published before and after 2020. Second, the **quality of journals** is considered as controller where top-ranked journals may, because of the in-depth review process, underestimate some papers that could have an effect. The present study follows quartiles (Q1–Q4) to categorize the studies that journals with Q1 rank add in high-quality and others in low-quality (Barroso-Méndez *et al.*, 2024; Velte, 2022).

### 3.4 Meta-analytic procedures

This study used the software package (CMA) based on the method introduced by Hedges and Olkin (2014). Bivariate meta-analytic procedures were adopted to examine the relationship between EMA and performance. First, the effect size ( $r$ ) was transferred into Fisher’s  $z$  coefficients, while weighing the effect sizes by their variances helped to correct the sampling error (Hedges and Olkin, 2014). The aggregation of corrected individual effect sizes into an overall effect size has been done in the next stage. Like other studies in the meta-analysis

(George *et al.*, 2019; Lu and Taylor, 2016; Xie *et al.*, 2023), this study used the random effects model instead of the fixed effects model. The random effects model provides more reliable insight since it assumes within-study and between-study variance, which means that this method avoids the bias of underestimating small sample weights or overestimating large sample weights. Next, two common methods, the  $Q$ -value test and the  $I^2$ -value test, were adopted to measure the heterogeneity (Higgins and Thompson, 2002). The moderator effect exists where the value for  $Q$  and  $I^2$  is greater than 75%, which means that there is a heterogeneity of effect sizes. The result of the  $Q$ -value and  $I^2$ -value are presented in Table 2, which indicates that there is a heterogeneity between EMA and performance ( $Q = 1766.914$ ,  $p < 0.01$ ; and  $I^2 = 97.340$ ). This implies that a large part of the variance was caused by factors other than sampling error (Sarooghi *et al.*, 2015). These findings also confirm that the random effect size is more suitable for this study (Higgins and Thompson, 2002).

On the next step, the effect of moderator variables on the effect size was assessed through subgroup analyses (Alfi *et al.*, 2024). Subgroup analyses test whether the effect sizes varied significantly between the subgroups. This study considers the homogeneity statistic ( $Q_b$ ) between groups, where the significance of the  $Q_b$  means the variable is a moderator (Hedges and Olkin, 2014).

### 3.5 Publication bias

Based on Schmidt and Hunter (2016), two methods can be used to be sure about the reliability of results in terms of publication bias: funnel plot and file drawer analysis. First, the file drawer was searched to check if the significant results from the studies were possibly overestimated (Lu and Taylor, 2016). Table 2 indicates that the number of all fail-safes is larger than the adopted numbers used to calculate the mean effect size, which means there is no serious concern about the file drawer problem (Xie *et al.*, 2023). The funnel plot was used as the second method for publication bias. This method indicates that the dispersion of small samples can be larger than that of large samples, where you can find small samples at the bottom of the plots and large samples at the top (Schmidt and Hunter, 2016). In this study, most samples are at the top of the plot while distributed on both sides of the midline (Figure 3), which means there is no publication bias (Xie *et al.*, 2023). Furthermore, Egger's regression intercept test was also performed to evaluate publication bias in the meta-analysis. The intercept value is 2.62109, with a standard error of 2.44142. The 95% confidence interval (CI) for the intercept ranges from  $-2.29324$  to  $7.53543$ , and the  $t$ -value is 1.07359. The  $p$ -value (0.14430) is above the 0.05 threshold, indicating no statistically significant evidence of publication bias.

## 4. Data analysis

### 4.1 Meta-analysis (main effect)

The result of the overall relationship between EMA and performance is presented in Table 3 based on the bivariate meta-analysis. The overall effect size, expressed as the 95% CI, ranged from 0.429 to 0.588, indicating a positive and statistically significant association between EMA and performance. The  $z$ -value of 10.299 further supports the strength and robustness of the relationship, confirming the observed effect. The significance levels were assessed using

**Table 2.** Heterogeneity test and publication bias test

Hypothesis	$K$	$N$	Heterogeneity $Q$ -value	$df$	$I^2$	Publication bias $Fail$ -safe $N$
EMA $\rightarrow$ performance	48	13,010	1766.9136 ***	47	97.340	39,474

**Note(s):** Significance level: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

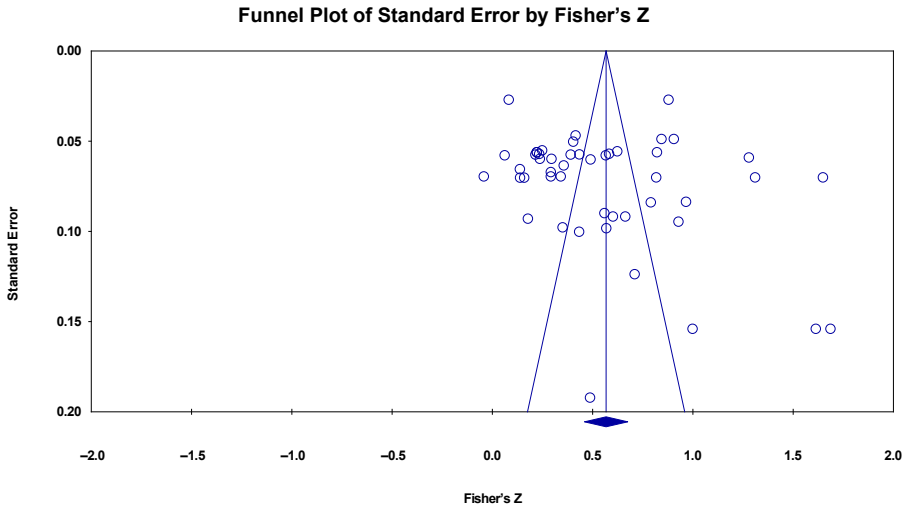


Figure 3. Funnel plot

Table 3. Results of the overall analysis

Hypothesis	k	N	r	95% CI	z	p
H1: Overall effect of EMA → performance	48	13,010	0.513	0.429: 0.588	10.299 ***	0.000

Note(s): Significance level: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

standard thresholds, with  $p < 0.01$  indicating a high level of statistical significance. The results emphasize the consistent and substantial role of EMA in enhancing performance, as indicated by the narrow CI range and strong  $z$ -statistics. These findings suggest that interventions aimed at improving EMA are likely to provide meaningful improvements in performance outcomes across diverse populations and contexts.

#### 4.2 Subgroup analysis

The moderating effect of the EMA level, performance type and company size on the relationship between EMA and performance was examined through a meta-analysis. Table 4 presents the results, including the number of effect sizes ( $k$ ), the total sample size ( $N$ ), the mean correlation coefficient ( $r$ ), the 95% CIs (lower and upper bounds),  $p$ -values,  $T$ -values and the  $Q_b$  statistic representing between-group heterogeneity.

**4.2.1 EMA at the country's level.** Two subgroups were analyzed, namely countries with low levels of EMA and those with high levels of EMA. For the high-level EMA group ( $k = 30$ ,  $N = 9,049$ ), the effect size ( $r$ ) is 0.5020, with a 95% CI ranging from 0.3824 to 0.6051. The results were statistically significant ( $p = 0.000$ ), with a  $T$ -value of 7.26, indicating a strong positive relationship between EMA and performance under high-level EMA conditions. In contrast, for the low-level EMA group ( $k = 13$ ,  $N = 3,407$ ), the effect size ( $r$ ) is 0.3909, with a 95% CI ranging from 0.2887 to 0.4842. Similarly, these results were statistically significant ( $p = 0.000$ ), with a  $T$ -value of 7.00, indicating a moderately strong positive relationship between EMA and performance under low-level EMA conditions. Furthermore, the heterogeneity across subgroups was assessed using  $Q_b$ , which yielded a value of 10.73. This result indicates a significant difference between the high- and low-level EMA groups.

**Table 4.** Results of the sub-group analysis

Hypothesis	k	N	r	95% lower	95% upper	p-value	t-value	Qb
<b>H2:</b> EMA at country's level								
High-level of EMA	30	9,049	0.5020	0.3824	0.6051	0.000	7.26	10.73
Low-level of EMA	13	3,407	0.3909	0.2887	0.4842	0.000	7.00	
<b>H3:</b> Type of performance								
Environmental performance	29	8,010	0.5216	0.4217	0.6090	0.000	8.80	0.14
Financial performance	10	3,190	0.4819	0.2685	0.6503	0.000	4.12	
Other types	9	1,810	0.5219	0.2884	0.6968	0.000	4.02	
<b>H4:</b> Industry size								
Large	23	7,803	0.5341	0.3978	0.6474	0.000	6.68	11.95
SMEs	16	3,971	0.3657	0.2652	0.4584	0.000	6.73	
Control variables								
Year								
After	26	7,840	0.5680	0.4387	0.6742	0.000	7.26	2.52
Before	22	5,170	0.4448	0.3528	0.5282	0.000	8.56	
Quality								
High	17	5,926	0.4052	0.2409	0.5471	0.000	4.57	3.41
Low	31	7,084	0.5680	0.4704	0.6519	0.000	9.43	

**Note(s):** Significance level: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

This suggests that country-level EMA serves as a significant moderator, with stronger relationships observed under high-level EMA conditions.

**4.2.2 Type of performance.** According to **H3** where the analysis distinguishes between environmental performance and financial performance as subcategories. In terms of environmental performance, the meta-analysis included  $k = 29$  studies with a total sample size of  $N = 8,010$ . The average effect size is 0.5216, with a 95% CI ranging from 0.4217 to 0.6090. The  $p$ -value ( $<0.001$ ) and  $T$ -value (8.80) indicate a highly significant positive relationship between EMA and environmental performance. In the case of financial performance,  $k = 10$  studies and  $N = 3,190$  participants were analyzed. The mean effect size is slightly lower ( $r = 0.4819$ ), with a 95% CI of 0.2685–0.6503. This relationship also demonstrated high significance ( $p < 0.001$ ,  $T$ -value = 4.12). Other types of performance were assessed based on  $k = 9$  studies comprising  $N = 1,810$  participants. The mean effect size is  $r = 0.5219$ , with a 95% CI of 0.2884–0.6968, showing a statistically significant relationship ( $p < 0.001$ ,  $T$ -value = 4.02). Interestingly, the Qb-statistic (0.14) is not significant, suggesting no substantial differences between the three performance types regarding their moderating effects on the EMA–performance relationship. These findings indicate that EMA exhibits a consistently positive and significant relationship across different performance types, with environmental performance showing the strongest effect.

**4.2.3 Industry size.** The results indicate that the mean effect size ( $r$ ) is 0.5341 and 0.3657 with  $t$ -values of 6.68 and 6.73 for large and SMEs, respectively. These findings indicate that the moderating effect of EMA on the performance of all company sizes is significant. The heterogeneity analysis revealed a between-group Qb = 11.95, suggesting that there is a statistically significant difference between the effect sizes of the two groups in the company size, underscoring the critical role that organizational size plays in shaping the EMA–performance relationship.

**4.2.4 Control variables.** The subgroup analysis detailed in **Table 4** reveals that the publication year within the sample period does not affect the relationship between EMA and performance. The findings indicate that the impact of EMA on performance is a bit greater in the years after 2020 compared to the years prior to 2020. This suggests an increasing importance of EMA in driving performance in more recent studies. However, our analysis

shows that although the relationship between EMA and performance in high-quality and low-quality journals is significant and meaningful, this relationship is greater in low-quality journals compared to high-quality journals.

#### 4.3 Supplementary analysis

This study also considers countries' economies in terms of developed and developing to provide further insight into the relationship between EMA and performance. Based on Table 5, the effect size for the relationship between EMA and performance in developing countries is 0.5204, with a highly significant  $T$ -value of 10.3737. The homogeneity test revealed a value of 1,328.624, indicating significant heterogeneity among studies. When the data were further disaggregated, the high-level EMA subgroup exhibited a stronger relationship ( $r = 0.5131$ ,  $T = 7.1093$ ) compared to the low-level EMA subgroup ( $r = 0.3909$ ,  $T = 6.9969$ ). This suggests that higher levels of EMA adoption are more strongly associated with performance improvements in developing countries. In terms of performance types, the relationship is consistently strong across categories, all demonstrate significant positive correlations. Firm size also played a role, with larger firms showing a stronger relationship compared to small and medium-sized enterprises.

In developed countries, the overall effect size is lower at 0.3974, and the relationship was not statistically significant ( $p = 0.1585$ ,  $T = 1.4100$ ). However, because the relationship is not statistically significant, further subgroup investigations (e.g. by EMA level, performance type or firm size) were not conducted. This lack of significant findings suggests that the relationship between EMA and performance may be weaker or more context-dependent in developed countries, warranting further research to uncover potential influencing factors.

#### 4.4 Robustness check

Two robust checks have been adopted to test the robustness of the findings. In the first step, the "Leave-one-out" procedure is used for sensitivity analysis (Rudolph *et al.*, 2020). This method has been recommended for no change in the results of the study when a single case in the estimate of the mean effect size is deleted (Viechtbauer and Cheung, 2010). Figure 4 indicates the results of Leave-one-out in this study. There is no significant change in the results in the absence of a single test on the 95% CI for the mean effect size. Thus, there is a proven robustness in the relationship between EMA and performance.

In the second step, this paper addressed concerns about outliers, defining them as effect sizes exceeding two standard deviations above or below the mean effect size (Xie *et al.*, 2023). Six studies that have substantial  $r$  size compared to other  $-0.04$ ,  $0.064$ ,  $0.084$ ,  $0.924$ ,  $0.929$  and  $0.934$  were deleted from the model. Findings from Tables 6 and 7 provide evidence that in the

**Table 5.** Supplemental analysis

Hypothesis	Developing countries				Developed countries			
	$r$	$p$ -value	$t$ -value	Qb	$r$	$p$ -value	$t$ -value	Qb
Overall effect	0.5204	0.0000	10.3737	1,328.624	0.3974	0.1585	1.4100	432.314
High level of EMA	0.5131	0.0000	7.1093	10.983	–	–	–	–
Low level of EMA	0.3909	0.0000	6.9969	–	–	–	–	–
Environmental performance	0.5209	0.0000	8.3608	0.000	–	–	–	–
Financial performance	0.5211	0.0000	4.1854	–	–	–	–	–
Other types	0.5219	0.0001	4.0224	–	–	–	–	–
Large	0.5420	0.0000	6.6546	14.531	–	–	–	–
SMEs	0.3657	0.0000	6.7256	–	–	–	–	–

**Note(s):** Significance level: \* $p < 0.1$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

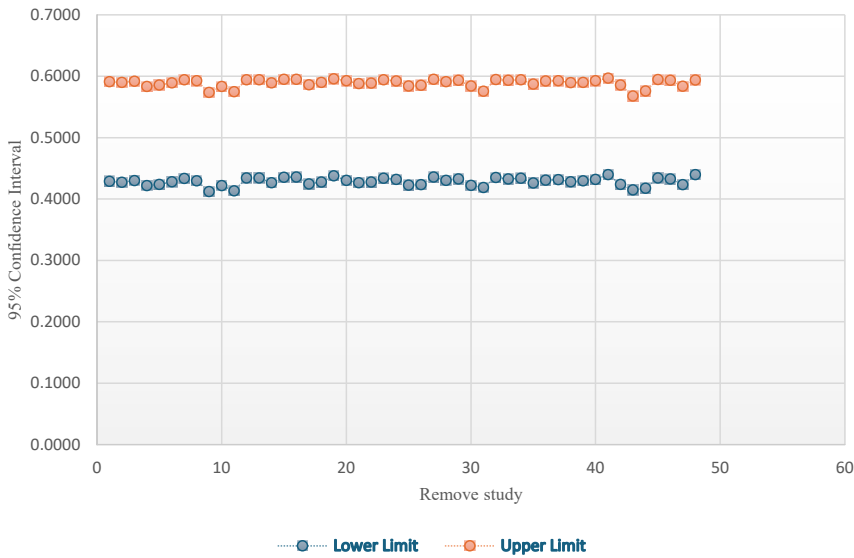


Figure 4. Sensitive analysis

Table 6. Robustness checks: results of the overall analysis without outliers

Hypothesis	<i>k</i>	<i>r</i>	95% CI	<i>z</i>	<i>p</i>
H1: Overall effect of EMA on performance	42	0.488	0.412: 0.557	10.943 ***	0.000

Note(s): Significance level: \**p* < 0.1, \*\**p* < 0.05, \*\*\**p* < 0.01

Table 7. Robustness checks: results of the sub-group analysis without outliers

Hypothesis	<i>k</i>	<i>r</i>	95% lower	95% upper	<i>p</i> -value	<i>t</i> -value	Qb
H2: EMA at country's level							
High level of EMA	27	0.5012	0.3957	0.5937	0.000	8.16	4.21
Low level of EMA	12	0.4154	0.3214	0.5012	0.000	7.96	
H3: Type of performance							
Environmental performance	27	0.5084	0.4204	0.5869	0.000	9.78	0.51
Financial performance	7	0.4684	0.2461	0.6438	0.000	3.88	
Other types	8	0.4311	0.1875	0.6247	0.001	3.33	
H4: Industry size							
Large	20	0.5383	0.4258	0.6343	0.000	8.03	5.96
SMEs	15	0.3842	0.2849	0.4753	0.000	7.09	
Control variables							
Year							
After	20	0.5320	0.4117	0.6341	0.000	7.49	1.40
Before	22	0.4448	0.3528	0.5282	0.000	8.56	
Quality							
High	16	0.4455	0.2977	0.5725	0.000	5.46	0.71
Low	26	0.5130	0.4270	0.5898	0.000	10.05	

Note(s): Significance level: \**p* < 0.1, \*\**p* < 0.05, \*\*\**p* < 0.01

absence of these papers, there is no considerable difference in results. As a result, strong support has been provided for the hypothesis of this study.

## 5. Discussion and implications

### 5.1 Discussion of key findings

This research contributes to the field by examining the moderation role of EMA level, performance type and company size in the EMA and performance relationship. Compared to prior studies, it is the first study that provides meta-analysis research, providing a comprehensive approach to the importance of EMA in organizational performance. This research is based on contingency theory, institutional theory and NRBV; it goes a step further by proposing which factors could strengthen the relationship. This understanding can help firms develop more effective strategies and contribute to a broader knowledge of how firms achieve organizational improvement.

The findings of the meta-analysis highlight totally the positive relationship between EMA and performance. With a substantial sample size ( $N = 13,010$ ) across 36 studies, the observed effect size highlights the critical role EMA plays in enhancing performance outcomes. This result aligns with previous literature suggesting that integrating sustainable practices into management systems is beneficial for both environmental and organizational outcomes (Appannan *et al.*, 2023; Asiaei *et al.*, 2022; Bresciani *et al.*, 2023; Gerged *et al.*, 2024). Given the consistency and statistical rigor observed in the results, it is imperative for organizations to view EMA as an integral component of their strategy.

Based on our second hypothesis, the findings reveal that the strength of this relationship varies significantly depending on the level of EMA adoption at the country level. Organizations operating in countries with high levels of EMA adoption demonstrated a stronger positive relationship between EMA and performance (Appannan *et al.*, 2023; Hoai *et al.*, 2023; Latan *et al.*, 2018; Phan *et al.*, 2017; Zeng *et al.*, 2024). This suggests that robust EMA practices, supported by advanced institutional frameworks and regulatory policies, provide a conducive environment for organizations to leverage EMA for improved performance. The broader institutional support may enhance resource efficiency, encourage sustainable decision-making and foster innovation, thus amplifying the impact of EMA on performance outcomes.

In contrast, organizations in countries with low levels of EMA adoption exhibited a weaker, albeit significant, relationship between EMA and performance (Asiaei *et al.*, 2022; Gerged *et al.*, 2024; Gunarathne *et al.*, 2021). While the positive relationship remains evident, the smaller effect size suggests that limited institutional support and regulatory enforcement in these contexts may constrain the effectiveness of EMA practices. This finding emphasizes the challenges organizations face in environments with underdeveloped EMA infrastructures, such as insufficient access to resources, expertise or incentives for implementing effective EMA systems. The significant between-group heterogeneity further reinforces the moderating role of country-level EMA. The findings indicate that the effectiveness of EMA is not uniform across contexts but is significantly shaped by external institutional and regulatory factors (Deb *et al.*, 2023; Gerged *et al.*, 2024; Nkundabanyanga *et al.*, 2021). High-level EMA environments appear to create a multiplier effect, enhancing the benefits of EMA practices on organizational performance. This aligns with institutional theory, which posits that external pressures and norms significantly influence organizational behaviors and outcomes (Appiah *et al.*, 2020; Chaudhry and Amir, 2020).

Regarding the third hypothesis, the results highlight several important insights into the moderating role of performance type on the relationship between EMA and performance. Environmental performance demonstrated the strongest relationship with EMA and CIs that strongly supported the robustness of the effect. This finding is consistent with prior studies that emphasize EMA's pivotal role in improving environmental outcomes through better resource allocation, reduced environmental costs and enhanced compliance with

environmental regulations (Burrirt and Schaltegger, 2010; Qian *et al.*, 2018a, b). Organizations implementing EMA practices are better equipped to monitor and manage their environmental impacts, thereby achieving superior environmental performance. Financial performance also showed a significant but slightly weaker positive relationship with EMA. This aligns with previous research indicating that EMA can contribute to cost savings, operational efficiency and enhanced profitability (Burrirt *et al.*, 2019; Deb *et al.*, 2023; Hasan *et al.*, 2024; Mohd Jamal *et al.*, 2020). However, the effect size is lower than for environmental performance suggests that the financial benefits of EMA might be indirect or take longer to materialize, as they often depend on the integration of EMA insights into broader strategic decision-making (Gunarathne and Lee, 2021; Liem and Hien, 2024; Tregidga and Laine, 2022).

Moreover, the significance of EMA on broader dimensions of performance, like social and operational performance, highlights the fact that the EMA enhances organizational transparency and accountability, which can improve stakeholder relationships and operational effectiveness (Falih Chichan *et al.*, 2021; Gunarathne and Lee, 2015; Solovida and Latan, 2021). Interestingly, the non-significant Qb-statistic (0.14) indicates that the type of performance does not significantly moderate the EMA–performance relationship. This result suggests that EMA has a consistently positive impact across different performance dimensions. While the strength of the relationship varies slightly, the overall trend emphasizes the broad applicability of EMA practices.

In terms of industry type, large enterprises indicate a strong positive relationship between EMA and performance, which is consistent with previous studies suggesting that larger firms are better positioned to adopt sophisticated environmental management systems (Huynh and Nguyen, 2024; Phan *et al.*, 2017; Pramono *et al.*, 2023). Large firms often have financial resources, skilled personnel, and established infrastructures to integrate EMA effectively, thereby leveraging it to enhance both financial and non-financial performance outcomes. Additionally, such firms often face greater regulatory scrutiny and public pressure, driving them to adopt advanced environmental practices that improve performance outcomes (Liem and Hien, 2024; Susanto and Meiryani, 2019; Zandi and Lee, 2019).

In contrast, SMEs exhibited a smaller but significant effect size. This finding aligns with prior research that highlights the resource constraints faced by SMEs, including limited financial capital, technical expertise and managerial capacity, which can hinder the full implementation of EMA (Johnson and Schaltegger, 2016). Moreover, SMEs tend to operate with more informal and reactive approaches to environmental management, which may result in less pronounced performance gains compared to larger firms (Aragón-Correa *et al.*, 2008). Furthermore, the existence of heterogeneity between groups highlights the important role of the firm's size effect in this study. It can be concluded that large firms are more likely to experience external pressures to adopt environmental practices and achieve improved performance. On the other hand, SMEs can still derive value from EMA by leveraging their unique capabilities despite their constraints.

### 5.2 Theoretical implications

The study provides significant theoretical contributions by integrating contingency theory, institutional theory and the NRBV to explain how EMA influences organizational performance. First, the findings validate contingency theory by demonstrating that the effect of EMA on performance is context-dependent, varying significantly with the level of national EMA maturity. This contextual dependency suggests that future research should explore EMA's effectiveness in different institutional settings to provide a more nuanced understanding of its role in organizational success. Second, the study advances institutional theory by highlighting the role of national-level institutional pressures in shaping the effectiveness of EMA practices. In high EMA adoption countries, organizations face stronger coercive, normative and mimetic pressures, which amplify EMA's positive impact on

performance. This indicates the need for policymakers to foster robust institutional environments to enhance EMA adoption and effectiveness.

Finally, the research aligns with and extends the NRBV by empirically confirming that EMA's strongest impact is on environmental performance. This finding supports the view that organizations investing in capabilities to manage natural resources can achieve superior environmental outcomes, which, in turn, contribute to broader sustainability goals. The relatively small overall effect size suggests that while EMA contributes to performance, it should be complemented by other organizational strategies and capabilities to maximize its benefits.

### *5.3 Practical implications*

The findings of this study have significant implications for policymakers, organizational leaders and sustainability advocates. Governments in countries with low levels of EMA adoption should prioritize creating regulatory frameworks and incentives to encourage the integration of EMA practices. Such measures could include tax benefits, grants, or recognition programs for organizations adopting EMA. For organizations, particularly in countries with low EMA adoption, the findings indicate the importance of investing in EMA practices. Incorporating EMA into decision-making processes can unlock environmental, financial and operational benefits. This is especially critical for multinational corporations, which should consider tailoring their EMA strategies to align with the maturity level of EMA practices in different countries. Managers and employees in organizations should receive training on the practical benefits of EMA. By fostering an understanding of how EMA improves not only environmental performance but also operational efficiencies, organizations can create a culture that prioritizes sustainable decision-making. Organizations aiming to maximize the benefits of EMA should emphasize environmental performance. The stronger relationship between EMA and environmental outcomes suggests that targeted investments in environmentally focused accounting practices can yield the highest returns. These practical steps can help bridge the gap in EMA adoption levels globally and amplify its contribution to performance enhancement.

## **6. Conclusion and policy implications**

This study contributes to the growing body of research on EMA by quantitatively synthesizing its relationship with organizational performance through a meta-analysis of 36 empirical studies across 16 countries. The findings confirm that EMA positively influences firm performance, with the strongest effects observed on environmental outcomes, followed by financial and operational dimensions. Furthermore, the results demonstrate that national EMA maturity, performance type and company size significantly moderate the EMA–performance relationship. These insights provide important theoretical and practical contributions by clarifying how and under what conditions EMA is most effective.

From a policy perspective, the results emphasize the importance of fostering institutional environments that support EMA adoption. Countries with higher EMA maturity, which are characterized by stronger regulatory frameworks, environmental reporting standards and stakeholder engagement, enable firms to achieve greater performance benefits from EMA practices. Policymakers in developing economies can strengthen national EMA readiness by investing in regulatory enforcement, professional training and environmental awareness campaigns to encourage broader adoption and integration of EMA tools. Similarly, organizations, especially large firms, can leverage EMA not only for environmental compliance but also for competitive advantage and strategic decision-making.

Despite these contributions, the study is subject to several limitations. First, the analysis is based on published empirical studies in English, which may introduce publication or language bias. Second, firm size classification was another limitation. Definitions of SMEs and large

firms vary across countries and industries, and some studies did not clearly define size or use different criteria (e.g. number of employees and annual revenue). In such cases, contextual cues such as industry type or average firm size were used to guide classification. Third, some studies included in this meta-analysis did not report correlation coefficients directly, requiring conversion from other statistical values such as beta coefficients or *t*-values. While standard conversion procedures were applied to ensure consistency, such estimates may introduce minor estimation errors. Lastly, variations in how EMA and performance were operationalized across studies may affect comparability. Future research could explore sector-specific applications of EMA, investigate longitudinal outcomes, and further examine how EMA functions within SMEs and emerging economies to build a more detailed understanding of its strategic value.

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