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Environmental management accounting for strategic decision-making: A systematic literature review

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Abstract

Heightened environmental concerns have prompted businesses to align with regulatory demands, fostering a need for internal accounting tools aiding managerial decision-making. While environmental management accounting (EMA) has become pivotal in supporting eco-efficiency decisions within organizations, a gap persists in comprehending its genuine, proactive implementation for sustainable development in the existing literature. This study investigates why and how EMA is used for strategic decision-making. A systematic literature review of 89 studies was conducted, and factors influencing EMA usage for strategic decision-making were identified using the drivers–enablers–outcomes–barriers framework. Three reasons for EMA use in strategic decision-making were identified: legitimacy, organizational efficiency, and strategic sustainable development. This study highlights the evolving use of EMA within organizations, moving from short-term applications to recognizing its long-term potential for strategic sustainable development. It explains the changing motives behind EMA adoption, driven by factors that encourage the use of advanced EMA tools for proactive, long-term decision-making in sustainable development. The integration of these tools depends on internal organizational factors like management's environmental responsibility, and proactive leadership commitment to sustainability. By exploring theoretical underpinnings and motivations of enhanced EMA usage, this research contributes to pragmatic approaches in sustainability accounting, illustrating how organizations, initially adopting EMA for legitimacy, recognize its benefits in guiding proactive, solution-oriented managerial decisions toward strategic sustainable development.

KEYWORDS
environmental management accounting, environmental strategy, pragmatism, strategic decision-making, sustainable development

1 | INTRODUCTION

Amid mounting apprehensions about climate change, businesses are progressively incorporating environmental and ecological objectives

Abbreviations: EMA, environmental management accounting; PRISMA, preferred reporting items for systematic review and meta-analyses.

into their business goals (Atia et al., 2020). The escalating societal emphasis on sustainability, coupled with a growing consumer preference for environmentally friendly products, has made the development and execution of effective strategies addressing environmental concerns a crucial imperative for corporate decision-makers (Christ & Burritt, 2013; Latan et al., 2018; Zhang et al., 2020). This integration of sustainability into business has also impacted the accounting field, prompting researchers to grapple with the challenge of seamlessly integrating sustainability into accounting practices. These investigations have resulted in the identification of two approaches: a critical perspective and a pragmatic perspective (Baker & Schaltegger, 2015; Gray, 2010; Lee & Schaltegger, 2018).

Critical researchers argue that sustainability accounting primarily serves the purpose of communicating organizational sustainability efforts to external stakeholders. They conceptualize sustainability accounting as a tool for enhancing transparency, accountability, and organizational legitimacy through a focus on auditing and reporting (Gray, 2002, 2010). On the other hand, pragmatic researchers argue that accounting plays a more active and solution-oriented role in sustainability, asserting that its primary function lies in supporting managerial decision-making for enhancing sustainability performance within organizations (Baker & Schaltegger, 2015; Lee & Schaltegger, 2018). They assert that accounting plays a crucial role in providing internal information crucial for taking managerial decisions (Baker et al., 2023). This internal management-oriented approach led to the introduction of managerial tools such as environmental management accounting (EMA), which supplies environmental information useful for organizational decision-making processes (Burritt et al., 2002; Jasch, 2006).

Over the last two decades, EMA has grown substantially as an accounting and managerial tool (Burritt et al., 2023). Organizations have increasingly embraced the tool of EMA, recognizing its inherent capacity to uncover concealed environmental costs and enhance eco-efficiency (Abdelhalim et al., 2023; Gunarathne et al., 2023). However, despite the development of EMA as a pragmatic decision-making tool within sustainability accounting (Baker et al., 2023), there has been a predominant emphasis on the control and accountability aspects of EMA (Gunarathne et al., 2023; Gunarathne & Lee, 2021). Often relying on past accounting information, the control and accountability dimensions align well with the critical perspective of sustainability accounting. This contrasts with strategic decision-making, which requires a more proactive and comprehensive set of environmental data, aligning more closely with the pragmatic approach (Baker & Schaltegger, 2015). Therefore, it is crucial to redirect focus toward a pragmatic decision-making approach, by examining the literature on how EMA facilitates strategic decision-making for sustainable development.

Prior literature reviews have extensively explored different areas, including the EMA's historical evolution as a discipline (e.g., Schaltegger et al., 2013); proliferation and implementation of various EMA tools (e.g., Blanco-Zaitegi et al., 2022; Olusanmi et al., 2021; Schaltegger & Zvezdov, 2015), and its role in control and accountability (e.g., Guenther et al., 2016; Johnstone, 2018). However, despite EMA intrinsically being a decision-making support tool, there is a lack of synthesized literature specifically addressing its utilization in decision-making processes across different timeframes and functions. This gap highlights the need for a comprehensive study examining the role of EMA in decision-making contexts.

Furthermore, amidst numerous literature reviews concerning EMA implementation, there remains ambiguity regarding the authenticity of such implementation. It is uncertain whether these implementations are genuine or merely superficial, potentially indicative of greenwashing. This critique holds particular significance as a heavy focus on auditing, reporting, and accountability could result in a superficial and merely formalistic adoption of EMA (Burritt et al., 2023). Typically, organizations resort to greenwashing as a reactive response to external stakeholder pressures aimed at addressing their legitimacy concerns. Such organizations often resort to mere symbolic usage of EMA practices without meaningful outcomes, in comparison to organizations with a proactive action-oriented approach, thereby having a substantially higher degree of EMA implementation (Hrasky, 2011; Lee & Herold, 2018). These organizations have a more strategic approach to sustainability, voluntarily and responsibly adopting EMA to manage and control sustainable development (Schaltegger & Burritt, 2018). Despite the substantial growth of EMA as an academic research field, it remains a subject of inquiry as to why EMA is primarily used; whether it is for short-term and reactive decisions – possibly motivated by greenwashing – or if it genuinely delves into the responsible implementation of EMA for proactive and strategic decision-making.

The type of environmental strategies implemented significantly influences organizational approaches to EMA utilization (Gale, 2006a; Gunarathne & Lee, 2021). Although the literature firmly establishes the necessity of environmental strategies as a prerequisite for EMA adoption (Christ & Burritt, 2013; Ferreira et al., 2010; Henri & Journeault, 2008) and highlights the essential integration of these strategies with EMA for achieving cleaner production and sustainable performance (Gunarathne et al., 2023; Latan et al., 2018; Solovida & Latan, 2017), there remains a gap in understanding about how these strategies impact the proactive or reactive decision-making processes within organizations – this warrants further investigation.

In addition to environmental strategies, organizational motivations for EMA utilization are influenced by various external factors, like stakeholder pressures, and internal factors, like corporate responsibility and top management commitment (Latan et al., 2018; Lee & Herold, 2018; Schaltegger & Burritt, 2018). Hence, this study aims to explore organizational motivations for using EMA, whether in reactive or proactive decisions. This investigation aligns with an exploration of the temporal aspects of strategic decision-making involving EMA, emphasizing the imperative to transcend the traditional dimensions of control and accountability in sustainability accounting. Through a systematic review, our study seeks to contribute to the existing literature by providing insights into how researchers conceptualize the utility of EMA for strategic decision-making.

Therefore, this study investigates why and how organizations utilize EMA for strategic decision-making using a systematic literature review. The study examines relevant peer-reviewed research papers

available via Scopus, Web of Science, Taylor & Francis, JStor, and Wiley databases for the period until 2023. Various quantitative and bibliometric themes – such as timeline of studies, geographical spread, research methods, and citation analysis – are examined in this study. Further, a qualitative thematic analysis based on the drivers–enablers–outcomes–barriers framework is conducted to identify the key factors that influence organizations utilizing EMA for strategic decision-making. To investigate the decision-making functions of EMA, the study employs the approach of Gunarathne et al. (2023), which described the decision function of EMA as the provision of accounting information to stakeholders, for the purpose of making multiple decisions. According to Gunarathne et al. (2023), the decision-making functions of EMA include cost and efficiency improvement decisions, pricing decisions, investment decisions, cost–volume–profit decisions, and product and market decisions.

The study identifies three primary reasons for EMA being utilized in strategic decision-making: legitimacy, organizational efficiency, and strategic sustainable development.[1] While there is a growing body of literature examining the use of EMA for strategic sustainable development, involving long-term decision-making and strategic sustainability goals, a significantly large number of studies (46.06%) still focus on using EMA for short-term decisions to achieve social legitimacy. However, the study indicates a growing inclination toward EMA usage for enhancing organizational efficiency and proactive, long-term decision-making toward sustainable development. These reasons for EMA usage evolve progressively due to various factors influencing and facilitating EMA usage, prompting the adoption of increasingly complex EMA tools. The evolving nature of EMA usage underscores the importance of implementing pragmatic managerial accounting tools like EMA for sustainable development. These tools, initially employed for short-term purposes, ultimately guide organizations toward sustainable development.

This study makes four main contributions to the literature on sustainability accounting. First, the study contributes to the literature that discusses the relation between EMA and strategies (Ferreira et al., 2010; Gunarathne et al., 2023; Latan et al., 2018) by highlighting the relevance of incorporating proactive decision-making in the discourse, particularly while integrating environmental strategies with EMA. Second, the study builds upon previous scholarly work which discusses the motives for EMA adoption (Amoako et al., 2021; Baumann et al., 2015; Christ & Burritt, 2013; Henri & Journeault, 2008) by exploring not only the theoretical reasons behind the implementation of EMA but also the reasons for increased usage post-implementation. Additionally, it elucidates the organizational transformations resulting from the increased utilization of EMA. Third, this study adds to the discourse on the pragmatic approach to sustainability accounting by demonstrating that organizations are not merely responsive to change toward sustainability, but are active agents of change. It emphasizes that organizational shifts toward sustainability are gradual and sustained over the long term (Baker et al., 2023; Baker & Schaltegger, 2015). The study contributes to the discourse by illustrating how organizations recognize the benefits of EMA in making proactive and solution-oriented managerial decisions, leading them toward strategic sustainable development, even if they initially adopt EMA for legitimacy reasons. Fourth, by emphasizing the need for the use of EMA toward proactive, long-term decision-making, the study also addresses the issue of greenwashing in sustainability efforts (Burritt et al., 2023; Schaltegger & Burritt, 2010). It points out that there is a gradual interest among organizations in the proactive use of advanced EMA tools once their utility is understood (Burritt et al., 2019). This shift signifies a move beyond symbolic EMA practices toward genuinely strategic and responsible adoption, thereby mitigating the risk of greenwashing.

The study also provides practical contributions by aiding managers in understanding the contexts, potential, and challenges related to EMA for decision-making. It assists policymakers in crafting innovative frameworks to encourage EMA adoption, and benefits business stakeholders by elucidating the necessity and advantages of employing EMA for strategic decision-making and sustainable development. The study also provides several avenues for future research.

The paper is structured as follows: Section 2 provides the background of the study. Section 3 explains the research methodologies used, while Section 4 gives summaries and a content overview of the papers chosen for the study. Section 5 presents the findings based on the drivers–enablers–outcomes–barriers thematic framework used. Based on the findings of Section 5, three reasons for EMA usage in strategic decision-making are identified and explained in Section 6. Section 7 provides discussions and scope for further research and Section 8 provides the conclusions.

2 | BACKGROUND OF THE STUDY

Proper planning and implementation of sustainability practices require an effective environmental management system that provides the organization's information needs. However, the inadequacy of conventional accounting methods to cater to the information needs for decision-making on environment management activities has been an issue for accountants for some time (Christ & Burritt, 2013; Jasch, 2006). This trend has led to an increased interest among researchers in accounting and managerial tools, seeking methods to incorporate environmental information and integrate environmental sustainability within organizational frameworks (Amoako et al., 2021). This section provides an overview of the study's foundation, exploring the emergence and comprehension of EMA among researchers and emphasizing the relevance of investigating this aspect of strategic decision-making.

2.1 | Sustainability accounting from a pragmatic approach

With organizations seeking accounting and assurance practices to identify and manage sustainability-related risks and opportunities,

[1]While the term "strategic sustainable development" can be applied at both micro and macro levels, this study specifically employs it within the context of corporate strategic sustainable development.

sustainability accounting has become a key focus of accounting researchers in the last four decades (Burritt & Schaltegger, 2010). Two distinct approaches have evolved to address the challenging issue of integrating sustainability with accounting: a critical perspective, and a pragmatic perspective (Lee & Schaltegger, 2018). The critical perspective focuses on achieving transparency and accountability through reporting internal organizational sustainability initiatives to external societal stakeholders. Those adhering to this approach believe that while sustainability accounting aids in reporting and communicating an organization's environmental efforts to external stakeholders, its role in initiating internal sustainability actions is notably limited. Additionally, they view sustainability more as a social goal rather than as an organizational one (Lee & Schaltegger, 2018; Milne & Gray, 2012).

The pragmatic approach, however, has a management-oriented emphasis in comparison with the reporting-oriented critical approach and focuses on possible managerial solutions that could help organizations incorporate sustainability in practice (Baker & Schaltegger, 2015; Lee & Schaltegger, 2018). This perspective highlights the role of management accounting in sustainability and provides a set of tools that could support sustainability-related decision-making (Burritt et al., 2002). Researchers adhering to this perspective have investigated and identified the capacity of accounting tools, such as EMA, to attain environmental and organizational performance, as well as enhance internal control (Chaudhry et al., 2020; Gunarathne et al., 2023). They view managers as an agent for change, who could influence organizations as well as society by taking proactive decisions to solve sustainability-oriented problems in organizational contexts (Baker et al., 2023). The pragmatic perspective takes a considerably interdisciplinary approach and emphasizes the significance of management accounting in furnishing environmental information to facilitate the implementation of sustainable strategies, evaluate environmental impact, and make decisions that aid in the integration of sustainability measures within organizations (Lee & Schaltegger, 2018). This approach is solution-oriented and internally focused and argues that environmental sustainability can be achieved at an organizational level by integrating sustainability focus within managerial decision-making.

Nonetheless, the challenges in merging environmental sustainability, as underscored by researchers in the critical paradigm (e.g., Gray, 2010) must not be disregarded. The critical researchers argue that sustainability is a societal vision and not contextually relevant to business organizations, and they would face dilemmas of choosing between internal organizational goals and societal sustainability goals. This is in conflict with the idea that pragmatic sustainability accounting tools like EMA can help in internal decision-making. Therefore, there is a necessity to investigate the effectiveness of sustainability accounting tools, particularly EMA, developed by pragmatic researchers, in integrating sustainability with accounting practices.

2.2 | EMA for decision-making and planning

While originating in the 1970s, EMA gained prominence with a defined framework in the 1990s, aided by publications from the United Nations Division for Sustainable Development (UN DSD) and the International Federation of Accountants (IFAC, 2005; Jasch, 2006; Schaltegger et al., 2013). The most widely used definition of EMA is given by the UN DSD (2001):

> "The identification, collection, estimation, analysis, internal reporting, and use of physical flow information (i.e., materials, water, and energy flows), environmental cost information, and other monetary information for both conventional and environmental decision-making within an organisation."
>
> (UN DSD, 2001, p. 11).

As the definition suggests, it generates and utilizes two types of information – physical information, through physical environmental management accounting (PEMA), and monetary information, through monetary environmental management accounting (MEMA) (UN DSD, 2001). Physical information assists organizations in evaluating the volume and material aspects of the business processes, such as the use, flow, and disposal of materials, energy, water, and waste. Monetary information, meanwhile, relates to the various environmental costs attributed to the organization (Che Ku Kassim et al., 2021; Jasch, 2003). Various simple EMA tools that examine these specific physical and monetary flows – such as energy accounting, material flow cost accounting, biodiversity accounting, water management accounting, and carbon management accounting – have been identified and developed. More complex tools that integrate multiple sources of information have also been developed, such as environmental capital budgeting, life cycle accounting, and sustainability balanced scorecard (Burritt et al., 2002; Gunarathne & Lee, 2021).

Traditionally, the functional use of EMA has been described by UN DSD (2001) as the generation and provision of environmental information for conventional and environmental decision-making. Even though decision-making is the primary function of EMA, there has been greater academic interest in other EMA functions, such as accountability and control, with less focus on decision-making. The strategic planning function of EMA has also been largely ignored in the literature, despite its significant potential in developing environmental plans and policies and in identifying environmental opportunities and threats.

Researchers have mostly explored EMA applications from a perspective of management accounting functions, with the functional roles divided into planning, decision-making, controlling, and performance evaluation (Drury, 2009). However, several recent studies, such as Gunarathne and Lee (2021) and Gunarathne et al. (2023), have classified the functional roles of the EMA into two categories: accountability and decision-making. While the scopes of these two approaches differ, they are both based on functional dimensions that are similar. Here, the accountability function of EMA involves environmental performance analysis, performance evaluation, and preparation of external reports, while the decision-making function includes decisions such as cost and efficiency improvement decisions, investment decisions, and product and pricing decisions. Several studies have

been conducted over the years on the accountability function, linking EMA with environmental performance, environmental performance indicators (EPIs), and external reporting (Burritt et al., 2009; Henri & Journeault, 2008; Phan et al., 2017).

Traditional controlling and performance evaluation functions of EMA overlap with the accountability functions mentioned by Gunarathne et al. (2023), whereas decision-making functions in both approaches are similar in scope. To examine the decision-making function, this study utilizes the approach of Gunarathne et al. (2023), which comprehensively lists the scope of the decision-making functions of EMA. Environmental management accounting helps provide information to various stakeholders for taking multiple decisions, including cost and efficiency improvement decisions, pricing decisions, investment decisions, cost–volume–profit decisions, and product and market decisions (Gunarathne et al., 2023). Furthermore, the study broadens EMA's functions to examine strategic planning, which is also an important function based on traditional functional classifications of EMA.

While the approach of Gunarathne et al. (2023), of categorizing EMA functional roles into accountability and decision-making, is quite comprehensive, it still excludes the critical planning function of management accounting. The long-term planning function of EMA has been described as environmental planning over strategic situations, while the short-term planning functions involve the preparation of environmental budgets (Burritt et al., 2002). Although mostly viewed as a control and appraisal tool, the usage of management accounting for planning purposes cannot be overstated. However, there has been hardly any research on how EMA aids organizational or environmental planning. In the management accounting literature, strategizing is also considered a function that overlaps with planning, and strategic planning is often viewed synonymously with long-term planning (Steiner, 1979). Strategic planning looks at the chain of consequences of intended decisions and the alternative courses of action to be made by organizations, as well as the identification of future threats and opportunities (Steiner, 1979). Therefore, strategic planning is inextricably linked with decision-making and thus, while the decision-making functions of EMA should be examined, strategic planning should not be left out. The study will examine the strategic decision-making function of EMA, which includes decision functions such as cost and efficiency improvement decisions, pricing decisions, investment decisions, cost–volume–profit decisions, and product and market decisions. It also includes strategic planning functions, such as environmental capital budgeting and environmental planning.

2.3 | Existing studies in EMA literature

There have been several studies done to explain the motivations and reasons for EMA use in organizations. Pivotal studies in the EMA literature, such as Ferreira et al. (2010) and Christ and Burritt (2013), identify contingent factors for EMA adoption, including strategy, environmental sensitivity, and organizational structure and size. The influence of institutional pressures on EMA adoption, such as coercive pressures from governmental regulations, normative pressures from industry, and mimetic pressures from competitors, was explained by Jalaludin et al. (2011) and Qian et al. (2011). However, while a variety of research has looked into the motivating factors underlying EMA adoption, the perceived intentions or reasons for which EMA is employed by firms have rarely been investigated. There is also a lack of studies explaining why organizations expand their EMA usage once they have adopted it (Table 1).

Previous literature review studies (Table 1) have focused on the growth of the discipline of EMA and its various sub-tools, such as material flow cost accounting and carbon accounting (e.g. Christ & Burritt, 2015; Schaltegger et al., 2013). Reviews of the literature have also been conducted to examine the usage of EMA for accountability and control (i.e. Amoako et al., 2021; Johnstone, 2018). While previous reviews, like van der Poll (2022), Schaltegger (2018), and Burritt (2004), have examined the external influences, drivers, and barriers of adopting EMA, there has been no study that synthesizes the drivers, enablers, barriers, and outcomes of EMA usage. Also, there has been no review examining reasons for EMA usage for strategic decision-making. With organizations now adopting a strategic focus toward EMA, the need to understand the utilities of EMA for strategic decision-making has expanded. While EMA in itself was originally developed from a pragmatic perspective, with a focus on managerial decision-making, there is a need to examine to what extent the researchers have focused on this perspective, and how effective EMA has been in providing long-term solutions at an organizational level. Furthermore, with rising interest in the literature on the relation between EMA and strategy, there is a need to examine the existing studies with a literature review to identify the literature gaps.

TABLE 1 Literature review studies done on EMA.

Themes	Key review studies
EMA frameworks for decision-making	(Burritt et al., 2002) (Burritt et al., 2023)
External influences, drivers, and barriers of EMA	(Burritt, 2004) (Javed et al., 2022) (Schaltegger et al., 2022) (Schaltegger, 2018) (Schaltegger & Zvezdov, 2015) (van der Poll, 2022)
Growth and development of EMA and its tools	(Blanco-Zaitegi et al., 2022) (Christ & Burritt, 2017) (Christ & Burritt, 2015) (Olusanmi et al., 2021) (Schaltegger et al., 2013) (Schaltegger & Csutora, 2012) (Stechemesser & Guenther, 2012) (Zhang et al., 2020)
EMA for control and accountability	(Amoako et al., 2021) (Guenther et al., 2016) (Johnstone, 2018)

3 | RESEARCH METHODS

A systematic literature review (SLR) method based on PRISMA (preferred reporting items for systematic review and meta-analyses) standards was chosen for the identification, selection, and analysis of documents. The PRISMA standards were chosen among other SLR methods because it helps maintain the study's transparency, comprehensiveness, and reproducibility while minimizing bias and random errors (Fink, 2005; Meijer & Bolívar, 2016; Parmentola et al., 2022). A systematic literature review is especially helpful for exploring research questions and applied methodologies in emerging fields of literature (Manetti et al., 2021), and, therefore, studying EMA with an SLR method is effective as it is still an emerging field. The study is approached from a two-dimensional method, with both a bibliometric review and a systematic review using thematic analysis. While bibliometric analysis helps us understand the literature's trends, patterns, and directions, a thematic review helps us analyze the key concepts, theories, practices, and developments in the field (Shoeb et al., 2022). Literature was primarily sourced from the electronic databases: Scopus and Web of Science.[2] Then the corpus of the studies was further cross-examined with JStor, Wiley, and Taylor & Francis databases to ensure greater validity of the identified literature.

3.1 | Data selection

To find suitable research papers for the study, the search words "environmental management accounting", "sustainability management accounting", "water management accounting", and "carbon management accounting" were searched within the titles, abstracts, and keywords field to scope the study within the EMA literature. The search terms "strategy*", "decision*", "business policy", and "planning" were then used to find studies that were related to the research issues in the study. The search string for Scopus is as follows: (TITLE-ABS-KEY ("environmental management accounting") OR TITLE-ABS-KEY ("sustainability management accounting") OR TITLE-ABS-KEY ("carbon management accounting") OR TITLE-ABS-KEY ("water management accounting") AND TITLE-ABS-KEY ("strategy*") OR TITLE-ABS-KEY ("decision*") OR TITLE-ABS-KEY ("business policy*") OR TITLE-ABS-KEY ("planning")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re") AND (LIMIT-TO [LANGUAGE, "English"]).

A research protocol based on PRISMA guidelines utilized by prior studies, like Madan and Ashok (2022), Manetti et al. (2021), and Parmentola et al. (2022), was followed when searching for and screening the studies, with the following parameters:

a. *Source*: limited to journal articles and review papers to ensure the quality of documents collected.
b. *Language*: only English-language articles were studied due to the language constraints of the authors.
c. *Year*: all studies until October 2023.
d. *Search domain*: all subjects; not limited to social sciences or management – to examine EMA's multidisciplinary utilities.

Selected records from the five databases were initially explored in "titles" to ensure the study's relevance to the topic and content. This was followed by an examination of "abstracts" and "keywords" to screen the selected studies further. Then the full texts were examined to ensure relevancy. The word searches were primarily done in the two databases, Scopus and Web of Science. Moreover, to further enhance validity, three other databases in Wiley, JStor, and Taylor & Francis that have a significant number of management and accounting studies, were further examined to look for any missing relevant studies in the main corpus. The initial search of Scopus and Web of Science gave results of 319 studies – including 116 studies from Scopus, and 203 from Web of Science. The additional searches included 97 studies from Wiley, 51 from JStor, and 57 from Taylor & Francis – the total adding to 524. The studies from Scopus and Web of Science were taken as the primary corpus and were cross-examined with the other three databases to remove duplication. Finally, the selection was reduced to 89 studies after removing duplicates and screening for content. The research methods were done based on the steps of the PRISMA protocol for identification, screening, and inclusion of documents, as explained in Figure 1.

3.2 | Bibliometric analysis

Bibliometric analysis is a quantitative method that helps deduce and describe research papers systematically, safely, and transparently (Ding & Yang, 2022). The VosViewer software was chosen for bibliometric analysis due to its ability to generate simple and effective visualizations and network diagrams that explain the relationship between studies and their various relevant topics (van Eck & Waltman, 2017). The 89 studies downloaded from the databases were converted to comma-separated value (CSV) format and uploaded to VosViewer for bibliometric analysis. Several citation network diagrams of the studies were plotted to analyze patterns and directions of the literature. In addition, source journals, authors, and geographical distribution were also analyzed to examine the development and depth of the literature to identify areas for future research.

After examining the various citation network diagrams, an overlay visualization of documents based on normalized citations was chosen for the study (see Figure 4). While a citation network diagram of total citations is useful for studying the growth of the literature, a network diagram of normalized citations is more effective in identifying recent developments in the literature that have had the greatest impact. The normalized number of citations of a document equals the number of citations of the document divided by the average number of citations of all documents published in the same year and included in the data. Normalized citations were also taken to counter the problem of older documents having had more time to receive citations than more recent documents (van Eck & Waltman, 2015). The overlay

[2]These two databases were selected primarily for their reputation as leading academic databases known for their data quality, data source availability, and comprehensive coverage within the field of academic research (Falagas et al., 2008; Zhu & Liu, 2020).

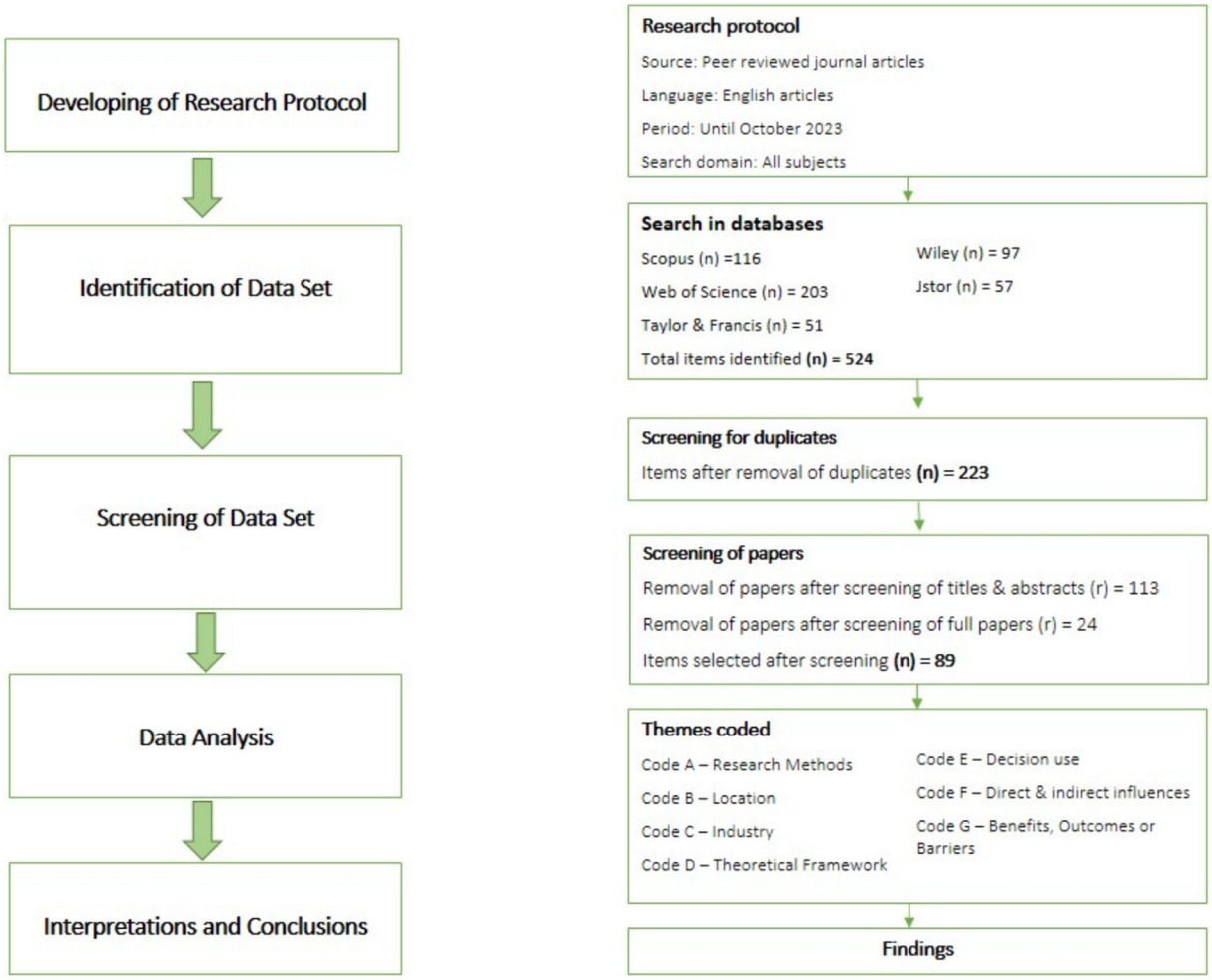

FIGURE 1 Review process based on PRISMA guidelines.

visualization diagram was chosen because it represents the year of publication in the diagram; older studies are depicted as a darker shade of blue, with the color becoming a lighter green shade as the studies become more recent.

3.3 | Thematic analysis

A thematic analysis of various quantitative and qualitative themes was carried out to identify patterns, trends, and relevant themes within the field of literature. A coding framework was developed, partly based on similar units of analysis adopted in previous SLRs – like Dumay et al. (2018), Ki et al. (2020), and partly developed ad hoc in this paper to enrich our understanding of the role of EMA in strategic decision-making. Seven different categories were identified for coding, and in each category, codes were identified and grouped separately. They included the following:

i. *Code A – Research methods*: Coding done using previously used frameworks, such as Manetti et al. (2021) and Parmentola et al. (2022). Broadly classified into theoretical and empirical research. Theoretical includes literature reviews and theoretical development studies. Empirical research is further classified into qualitative, quantitative, and mixed-method studies. Qualitative studies were coded A1, quantitative studies were coded A2, mixed method studies were coded A3, literature review studies were coded A4, and theoretical development studies were coded A5. In the course of the study, an additional group, resulting from a combination of empirical and theoretical studies, was identified and labeled as A6.

ii. *Code B – Location*: Studies were classified based on the geographical area in which they were conducted. Initially, the study followed a five-continent approach, mirroring prior studies. However, upon identifying patterns and similarities among studies within subcontinental regions, a reclassification was performed based on these subcontinents. The coding involves the following: Europe coded B1, South Asia coded B2, Southeast Asia coded B3, Middle East coded B4, East Asia (including China, Japan, and Korea) coded B5, Oceania (including Australia, New Zealand, and Pacific Island nations) coded B6, Africa coded B7, The Americas (including both North and South America) coded B8, and studies conducted across multiple continents coded B9.

iii. *Code C – Industry*: The studies were categorized according to the industries they examined. Studies involving the primary sector, including agriculture, forestry, and mining, were coded C1; all production and manufacturing industries, including electrical, construction, chemical, pharmaceutical, paper mill, and food-processing industries, were coded C2; service industries, including hospital, banking, educational institutions, and local authorities, were listed C3. Studies done across multiple sectors were coded C4.

iv. *Code D – Theoretical framework*: Theories used were identified and coded in the following manner: studies done using contingency theory coded D1; institutional theory (including new institutional theory and institutional logics) coded D2; natural resource-based view coded D3; legitimacy theory coded D4; stakeholder theory coded D5; value-added theory, D6; and use of any theory not mentioned above was coded D7. The use of multiple theories mentioned above was coded D8, and if no theory is used, it was coded D9.

v. *Code E – Decision use*: The EMA use for various decision-making purposes was examined. The codes were developed ad hoc but adapted based on the classification of decision use of EMA in Gunarathne and Lee (2021) and Gunarathne et al. (2023). If EMA was used for short-term or past-oriented decisions, such as regulatory compliance, cost allocation, or waste management, it was coded E1; if EMA was used for budgeting decisions, value-chain analysis, supply-chain decisions, make-or-buy decisions, and decisions on cost and efficiency improvements, it was coded E2; if EMA was used for long-term and proactive decisions, such as replacement and expansion decisions, pricing decisions, capital budgeting, sustainability investment decisions, and any other strategic decisions or long-term environmental planning, it was coded E3.

vi. *Code F – Direct and indirect influences*: After a preliminary analysis of the studies, multiple codes were identified as ad hoc. During the analysis of documents, new codes were added as various influencing factors were identified through an open coding approach. The following codes were used: environmental strategy was coded F1; governmental and regulatory influences were coded F2; societal and communal influences were coded F3; industrial and professional body influences were coded F4; and market pressures were coded F5; top management commitment was coded F6; external uncertainties were coded F7; environmental proactivity of the management was coded F8; and environmental responsibility of the management coded F9. The influence of other systems like EMS and EMCS was coded F10.

vii. *Code G – Benefits, outcomes, or barriers*: Various outcomes for the use of EMA sought by the organization were identified and coded during the analysis of the document. If EMA was used for environmental performance objectives, including waste management, emission reduction, and eco-efficiency, it was coded G1. Similarly, economic performance objectives, like cost effectiveness, resource efficiency, and pricing, were coded G2. Competitive advantage objectives were coded G3, and eco-innovation objectives were coded G4. Strategic sustainable development initiatives, such as green investment, asset replacement and expansion, green capital budgeting, and development of environmental policies, were coded G5. Any barrier identified that prevented further use of EMA was coded G6.

The article analysis proceeded through an iterative process, starting with an initial framework and then utilizing subsequent open coding, mirroring the approach used by Dumay et al. (2018). The initial coding framework was developed by the first author. All the coding was done by the first author, but to enhance the reliability and validity of the analysis, the third author independently also carried out the analysis using the coding rules developed. The results were compared and any discrepancies and disagreements between authors were discussed and settled with the second author mediating the discussions. To bolster the reliability of the coding process further, an inter-coder reliability assessment using Krippendorff's alpha test was performed between the two coders. A perfect score of 1.0 was achieved for code groups A, B, C, and D, and a score of high agreement of over 0.85 was achieved for code groups E, F, and G.

Finally, the analysis was done with the help of NVivo12 software and was tabulated in a Microsoft Excel spreadsheet. The results of the coding groups A, B, C, and D are discussed in Section 4, which mainly involves quantitative content descriptions. This is followed by the qualitative thematic findings from the coding groups E, F, and G, discussed in Section 5. Given the qualitative nature of these themes, extra care was taken to ensure greater validity of findings. A theoretical framework encompassing drivers, enablers, outcomes, and barriers was employed to analyze these codes.

The key factors that directly affect the usage of EMA for strategic decision-making are identified as the drivers (van der Poll, 2022). In comparison, enablers are auxiliary factors that indirectly affect activity – that is, enablers support the usage of EMA for strategic decision-making (Ki et al., 2020). Factors that are perceived or actual outcomes that are derived out of the usage of EMA for strategic decision-making have been identified as outcomes, and the factors that prevent the usage of EMA for strategic decision-making are identified as barriers (Xu et al., 2023). Given the central emphasis on uncovering the underlying motives that drive organizations to adopt EMA for their decision-making processes, it becomes paramount to conduct an outcome-focused search. This approach enables a comprehensive exploration of the tangible results and consequences that stem from the implementation of EMA within organizations. By examining the outcomes and impacts across various dimensions, such as environmental performance, financial efficiency, and strategic sustainability, we can gain profound insights into the real-world implications of EMA utilization and how it aligns with organizational objectives. Moreover, examination of drivers and barriers to the use of EMA is helpful to recognize the main reasons why there is a use or disuse of EMA tools (van der Poll, 2022). Unlike previous review studies that have examined the drivers and barriers of EMA, this study makes a distinction between 'drivers' and 'enablers' of EMA usage. This distinction is important in understanding the direct and indirect factors that

enhance and support the usage of EMA for strategic decision-making. This distinction has helped us understand the key enhancing factors that, although not very significant to the initial adoption of EMA, are very important for the enhanced use of EMA tools within organizations.

The coding group E was established based on the theoretical framework employed by Gunarathne and Lee (2021) and Gunarathne et al. (2023) to elucidate the utilization of EMA tools in organizational decision-making. This framework was chosen for its comprehensive list of decisions and the corresponding EMA tools adopted by organizations. The codes within group E were analyzed alongside the codes within groups F and G to identify commonalities, emerging trends, and recurring patterns that offer insights into the application of EMA in strategic decision-making. These findings are discussed in Section 6.

The next section gives the quantitative descriptions of results from aforementioned coding groups A, B, C, and D, in addition to relevant bibliometric findings.

4 | CONTENT DESCRIPTION OF STUDIES

This section explains the statistical descriptions of results from both bibliometric analysis and content analysis. Quantitative results of the study, including the number of papers published each year, the geographical spread of the publications, and citation analysis of studies, authors, and sources, are explained in this section. The section also presents the quantitative findings of content analysis, including the study's target audience, industries examined, research methods, and theoretical frameworks utilized.

4.1 | Timeline of studies and research methods utilized

The number of studies published per year is given in Figure 2. There was no specific starting point defined for the search. The earliest study identified for the corpus was from 2004. There were comparatively fewer studies (approximately 1.7 papers per year) from 2004 to 2014. Moreover, an increasing trend is observed from 2015 onwards, with a maximum of 13 papers in 2020. In comparison, a previous systematic literature review on the discipline of EMA by Schaltegger et al. (2013) mentions that the field of EMA grew from the 1990s onward, and there was an explosion of studies on EMA during the early 2000s. However, the literature in the 1990s and early 2000s focused on defining and theorizing EMA, and therefore there were limited studies done on the decision-making function of EMA.

Based on the contribution to the literature, the studies were broadly classified into theoretical research and empirical research. The theoretical studies were further divided into literature reviews and theoretical developments, while the empirical studies were classified into qualitative, quantitative, and mixed methods, based on the research method utilized for the study. The vast majority (79 out of

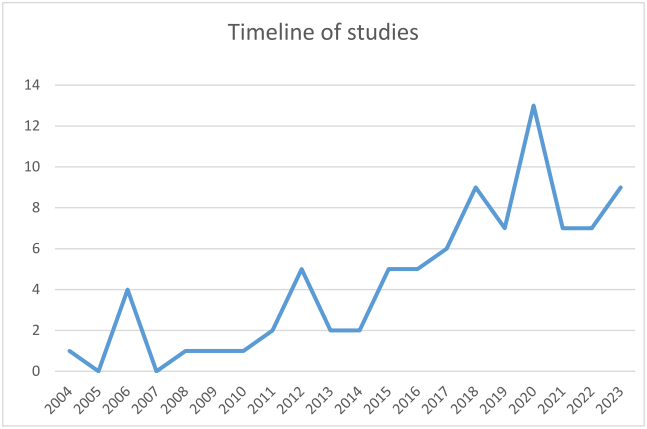

FIGURE 2 Timeline of studies identified.

89) of research studies chosen for the review were empirical, with only eight studies being theoretical. The theoretical studies included six literature reviews and three studies of theoretical development. There were also two studies that were a combination of theoretical and empirical qualitative studies. Among the empirical studies, 33 were quantitative, 38 were qualitative, and seven studies used a mixed approach (see Table A1). Interestingly, qualitative research has been conducted throughout the timeline, whereas quantitative research is a relatively modern phenomenon (see Figure 3). The growing quantitative literature could indicate the widespread usage of EMA in recent times and the greater generalizability of the functional use of EMA across multiple industries and areas.

Among the qualitative studies identified, a majority of them were done based on a case study method, in which multiple examinations were carried out – including the interview of managerial personnel, and the analysis of internal records, documents, and external reports. Only one qualitative study was identified to be done purely on an interview method (i.e., Mbedzi et al., 2020), while Figge and Hahn (2013) were studied using analysis of data from public reports. Quantitative studies were mostly done using the survey method. Also, most empirical studies were cross-sectional, and only four studies were analyzed using the longitudinal method. Previous studies, such as Latan et al. (2018) and Burritt (2004), have shown the need for more mixed-method and longitudinal studies, but these studies are still scarce.

4.2 | Industrial and geographical spread of studies

As seen in Figure 4, Europe and Southeast Asia have the highest number of studies, with eighteen each. Multiple studies were also identified from several other regions, such as South Asia, Oceania, and Africa. The highest number of studies from a single country comes from Australia, followed by Indonesia and Malaysia. While there are a substantial number of studies from Western Europe, there are extremely few studies from the Americas. Research in developing countries in Africa and South Asia is also expanding. Only two studies identified were cross-continental.

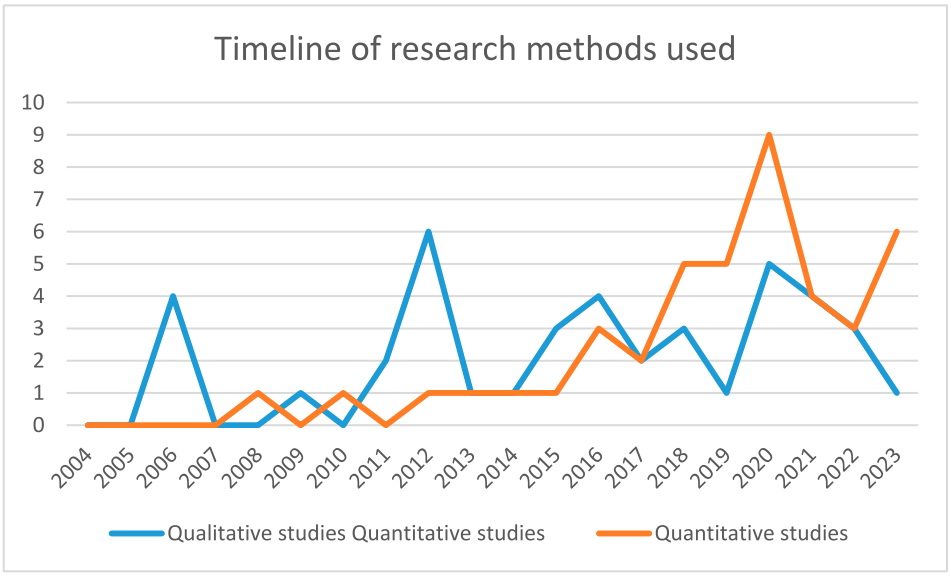

FIGURE 3 Timeline of research methods used in studies.

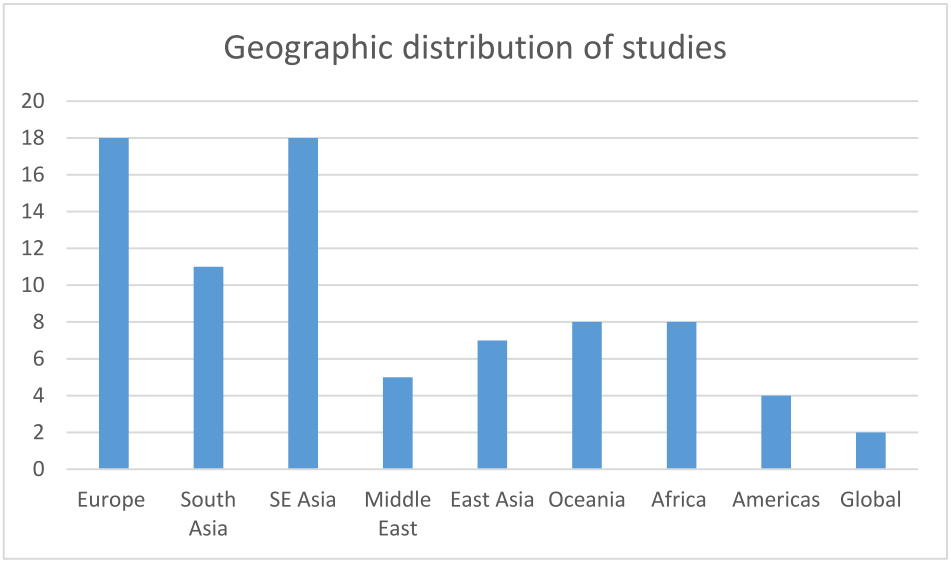

FIGURE 4 Geographical distribution of studies.

Across the empirical studies, the secondary or manufacturing sector has been dominant in terms of the sectors studied. Thirty-four percent of studies were conducted in the secondary sector, with just 8% conducted in the primary sector and 7% conducted in the tertiary sector. Nonetheless, a significant number of empirical studies (51%) were conducted across multiple sectors (see Table B1). Interestingly, there were four studies done in the paper production industry and nine studies in the food and beverages industry, while 22 studies were carried out in multiple manufacturing industries (Figure 5).

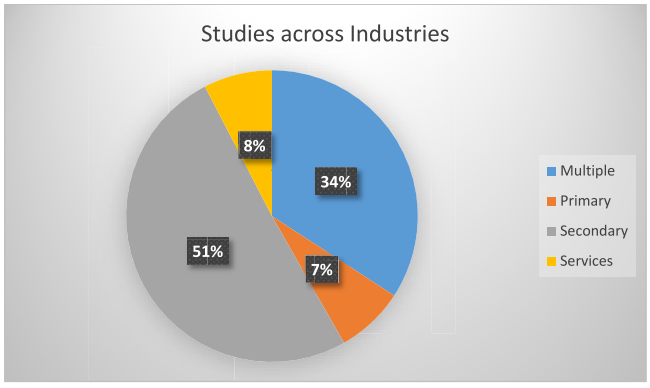

FIGURE 5 Empirical studies across industrial sectors.

4.3 | Citation analysis of the studies

While there were many authors with two or fewer publications, like most emerging fields, a large contribution (22.5%) of the total literature was co-authored by the top six authors. Research papers in the select studies with the highest number of citations were by pioneer researchers in the field of EMA, Dr. R. L. Burritt, and Dr. S. Schaltegger. Dr. S. Schaltegger is also the leading academic in the field of pragmatic approaches to sustainability accounting.

Dr. R. L. Burritt had authored six papers in the corpus, which added to a total of 427 citations, and Dr. S. Schaltegger had 410 citations from six papers as well. Titles with the highest proportion of published papers were *The Journal of Cleaner Production* (Elsevier) with 17 papers, followed by *Sustainability* (Switzerland) with nine, and *Business Strategy and the Environment* (Wiley) with five.

Figure 6 provides the citation network diagram of the research papers identified; the spheres are research studies connected by citation links, denoted by lines. Overlay visualization networks were used for the study to represent the year of study in the diagram. Earlier studies are represented by darker blue spheres, whereas more recent studies are represented by yellow and light green spheres. Network diagrams weighted by normalized citations were used for the study. This was chosen because it aids in the identification of major studies that provide more recent advancements in the literature, which are sometimes overshadowed in the diagram with total citations.

Interestingly, studies such as Gunarathne et al. (2021), Burritt et al. (2019), and Chaudhry and Amir (2020), are depicted with larger spheres in this diagram. These studies make significant contributions to the EMA–strategy literature. Burritt et al. (2019), for instance, evaluated the diffusion level of EMA tools and discovered that organizations initially accepted simple EMA tools, but after studying their benefits and learning about other tools, they adopted more complex, integrated EMA tools. According to Gunarathne et al. (2021), the utility of higher levels of EMA usage is related to strategic proactivity and to companies with reactive environmental strategies in place that use simpler EMA instruments. As the companies' techniques grow more proactive, they use more advanced EMA tools. The study also identifies institutional pressures, such as governmental regulations and public environmental awareness, as key factors affecting the adoption of EMA. Chaudhry and Amir (2020) reaffirmed the significance of institutional pressures for EMA adoption, which was aided by enhanced strategic proactivity.

The research with the higher citations and citation linkages are older pivotal papers in the field, such as Christ and Burritt (2013) and Ferreira et al. (2010). Both these papers emphasized the importance of an environmental strategy for improved present and future use of EMA in businesses. These findings were expanded upon by Latan et al. (2018), who discovered that environmental uncertainty and top management commitment were important variables that enhanced the usage of EMA in firms with environmental strategies.

4.4 | Theoretical framework used in studies

A significant majority of the selected research (41 out of 89) lacked an underlying theory. However, this is similar to other reviews done in sustainability literature, like Fiandrino et al. (2022). Among the theories used, contingency theory was used most often, represented by twelve studies; the next most used theory was the natural resource-based view, with eight (see Table C1). Social system-based theories were also used in several studies, of which institutional theory was used most often. Seven studies used multiple theories, of which institutional theory and contingency theory were used more frequently together. There were also other theories used only once, such as the diffusion of innovation theory (Burritt et al., 2019) and Islamic social responsibility (Mulyasari & Mayangsari, 2020).

The next section discusses the key qualitative themes identified using the coding groups E, F, and G mentioned in Section 3.

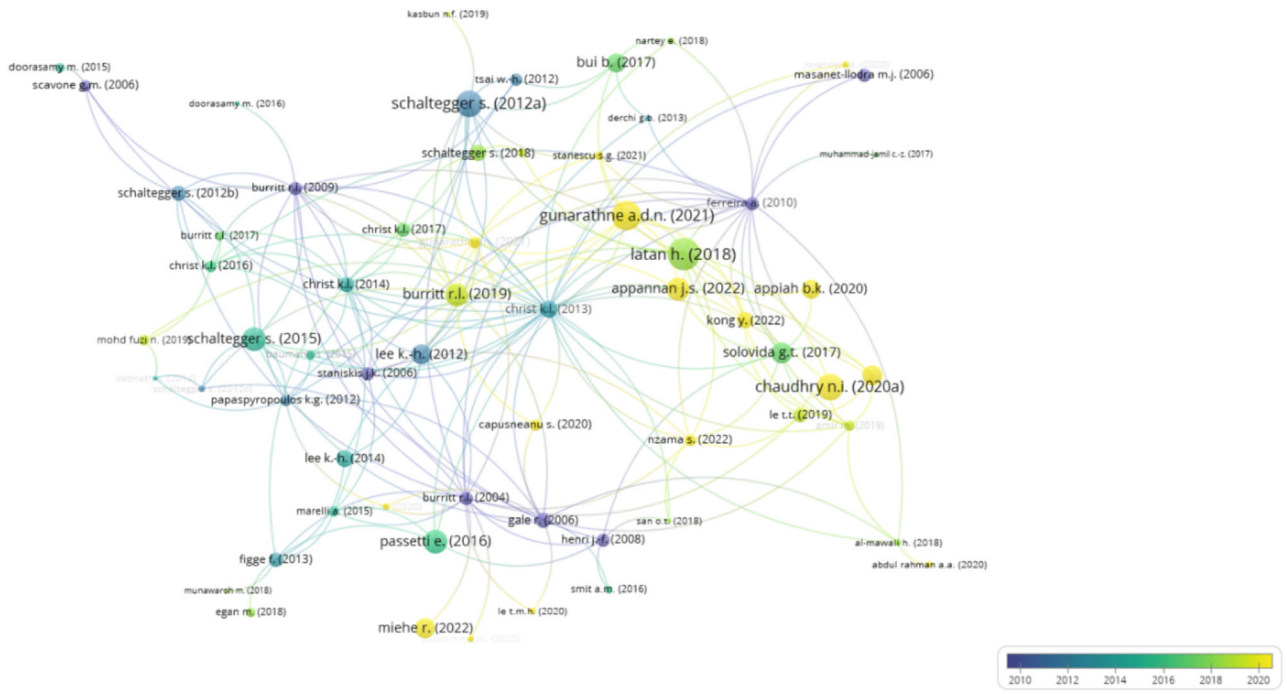

FIGURE 6 Citation network diagram of studies. Source: VosViewer.

TABLE 2 Drivers of EMA usage for strategic decision-making.

Drivers	Theory	Descriptions	Percentage of papers discussing the theme	References
Environmental strategy (ES)	Contingency theory	• EMA practice is associated with the proactive nature of decision-making in organizations and how they link the natural environment with their corporate policies and plans. • It helps provide information for making strategies and decisions required to adopt innovative technologies and internal changes when faced with uncertain external conditions.	10.11%	(Al-Mawali et al., 2018; Amir & Chaudhry, 2019; Baumann et al., 2015; Christ & Burritt, 2013; Ferreira et al., 2010; Gunarathne et al., 2023; Gunarathne & Lee, 2021; Le et al., 2019; Qian et al., 2011)
	Institutional theory	• EMA helps implement ES required to reduce air, water, and soil emissions for regulatory reasons. • It minimizes environmental consequences of the products and services due to long-term commitment toward the environment. • It helps take precautionary measures to protect the environment and aids in strategic planning.	5.62%	(Chaudhry & Amir, 2020; Gunarathne et al., 2021; Kong et al., 2022; Latifah & Soewarno, 2023; Nguyen, 2022)
	Resource-based view	• EMA assists organizations in properly managing their natural resources in order to satisfy their environmental responsibility goals. • It provides information necessary to develop environmental strategies, which helps organizations develop environmental sustainability goals.	6.74%	(Appannan et al., 2022; Christine et al., 2019; da Rosa et al., 2020; Kasbun et al., 2019; Latan et al., 2018; Portillo-Tarragona et al., 2018)
	Stakeholder theory, Legitimacy theory	• To gain legitimacy from stakeholders, organizations adopt structures and policies like EMA and environmental strategies to establish suitability, credibility, and legitimacy to stakeholders.	5.62%	(Andrian et al., 2023; Le et al., 2019; Mbedzi et al., 2020; Nguyen, 2022; Nzama et al., 2022)
Regulatory pressures	Institutional theory	• The need for compliance with international and national environmental standards demands environmental information. • Regional emission laws, pollution prevention laws and conservation regulations affect EMA adoption.	7.87%	(Christ, 2014; Gibassier, 2017; Gunarathne et al., 2021, 2023; Kong et al., 2022; Le et al., 2019; Yusoh & Mat, 2020)
Community environmental expectations	Institutional theory, Stakeholder theory, Legitimacy theory	• Increased environmental awareness among the public leads to higher expectations of accountability from businesses.	7.87%	(Andrian et al., 2023; Gunarathne et al., 2021, 2023; Imtiaz Ferdous et al., 2019; Le et al., 2019; Nzama et al., 2022; Scavone, 2006)

TABLE 2 (Continued)

Drivers	Theory	Descriptions	Percentage of papers discussing the theme	References
		• Organizations perceive that their public image is improved by adopting environmental objectives. • Organizations strive to obtain public legitimacy by catering to their environmental expectations, which implies a need for environmental knowledge for decision-making.		
Professional bodies	Institutional theory	• Organizations move toward professionalization through support, education, and training from professional associations, industrial groups, corporate sustainability associations, etc. • Non-governmental organizations and peer groups influence businesses to act more sustainably, thereby increasing the need for internal environmental information.	4.49%	(Chaudhry & Amir, 2020; Gunarathne et al., 2021; Nguyen, 2022; Qian et al., 2011)
Market pressures	Institutional theory, Stakeholder theory	• Environmentally informed customers seek greener products for better value of money. • Increased competition in industry leads to organizations trying to adopt best practices of industry and outperform competitors. • Suppliers and creditors demand more sustainable initiatives in their value chains.	4.49%	(Chaudhry & Amir, 2020; Gunarathne et al., 2021; Imtiaz Ferdous et al., 2019; Scavone, 2006)

5 | KEY FACTORS AFFECTING EMA USAGE FOR STRATEGIC DECISION-MAKING

The framework of drivers–enablers–outcomes–barriers was used to explain key themes and codes. This section lists these themes, which include variables on how and why organizations use EMA for strategic decision-making, based on the framework's theoretical foundations.

5.1 | Drivers of EMA usage for strategic decision-making

The factors directly impacting the use of EMA for strategic decision-making are summarized in Table 2. Notably, the presence of environmental strategies stands out as the primary driver behind organizations adopting EMA for strategic decision-making. Organizations perceive EMA as a means to implement the goals and objectives outlined in their environmental strategies while evaluating the effectiveness of their execution (Chaudhry & Amir, 2020; Latan et al., 2018). Organizations with proactive environmental strategies are more inclined to utilize environmental information systems like EMA, compared to those with reactive strategies (Ferreira et al., 2010; Gunarathne & Lee, 2021). Proactive strategy adopters rely on a higher level of environmental information to analyze future environmental risks, identify opportunities for innovation, and maintain a competitive edge (Appannan et al., 2022; Gunarathne & Lee, 2021).

External institutional factors and stakeholders also exert significant influence on the adoption and use of EMA for internal decision-making. These factors encompass regulatory pressures, community

TABLE 3 Factors that enable the usage of EMA for strategic decision-making.

Enablers	Theory	Descriptions	Percentage of papers discussing the theme	References
Top management commitment	Contingency theory	• When top management recognizes the value of environmental activities, they will support decisions that commit to implementing systems that provide environmental information. • Top management that moves away from financial performance-centred goals to achieving qualitative strategic organizational goals is more likely to take capital budgeting decisions involving sustainability action. • Committed top management is always vigilant about environmental policies and initiatives, communicates them effectively, and reviews them periodically.	7.87%	(Amir & Chaudhry, 2019; Appiah et al., 2020; Frost & Rooney, 2021; Latan et al., 2018; Lutfi et al., 2023; San et al., 2018)
Environmental responsibility	Legitimacy theory, Resource-based view	• Environmental and social responsibility of owners, establishing corporate social responsibility (CSR) reputations, and meeting environmental responsibility goals are all strategic reasons driving management toward sustainability.	4.49%	(Frost & Rooney, 2021; Mulyasari & Mayangsari, 2020; Nzama et al., 2022) (Andrian et al., 2023)
Environmental uncertainty	Contingency theory, Institutional theory	• External uncertainties, such as changing government environmental policies, international environmental standards, political situations, market needs, competitor environmental strategies, and industrial technology, require management to make timely and proactive decisions, which necessitate the use of efficient information systems.	8.98%	(Amir & Chaudhry, 2019; Appiah et al., 2020; Bui & de Villiers, 2017; Chaudhry & Amir, 2020; Latan et al., 2018; Le et al., 2019; Nartey, 2018; San et al., 2018)
Environmental proactivity	Contingency theory, Institutional theory	• Environmental proactivity moderates the use of EMA in companies because it derives from the firm's willingness to participate voluntarily in environmental management practices. • Environmental proactivity helps with resource management and better prepares the company to adhere to environmentally friendly decisions and actions.	3.37%	(Ali et al., 2023; Chaudhry & Amir, 2020; Gunarathne & Lee, 2021)
Environmental management and control systems	Contingency theory, Stakeholder theory	• EMS is used for strategy and process reasons, followed by EMA for decision-making and disclosure, and EMCS for	4.49%	(Appiah et al., 2020; Laurinkevičiūtė & Stasiškienė, 2011; Staniskis &

TABLE 3 (Continued)

Enablers	Theory	Descriptions	Percentage of papers discussing the theme	References
		performance appraisal and control, in order to execute sustainable development.		Stasiskiene, 2006; Yagi & Kokubu, 2020)

expectations, market dynamics, and normative pressures from professional bodies and peer groups. Regulatory pressures stem from governmental and international bodies, compelling businesses to conform to environmental standards and emissions and biodiversity regulations (Chaudhry & Amir, 2020; Gunarathne et al., 2021; Le et al., 2019). Market pressures emerge from customer demands for eco-friendly products, as well as requirements for enhanced environmental information from creditors, suppliers, and industry competitors aiming to gain a competitive advantage (Gunarathne et al., 2021; Imtiaz Ferdous et al., 2019; Scavone, 2006). Additionally, institutional normative pressures emanate from professional organizations and peer groups, advocating for high environmental standards among their members and supporting organizations in providing training and expertise (Nguyen, 2022; Qian et al., 2011). Organizations also employ EMA to secure public legitimacy and meet the environmental sustainability expectations and aspirations of stakeholders (Gunarathne et al., 2021; Imtiaz Ferdous et al., 2019; Nzama et al., 2022).

5.2 | Factors that enable the usage of EMA for strategic decision-making

While the driver-factors mentioned in Table 2 are directly responsible for the initial adoption and implementation of EMA in organizations, there are some other factors that, while without a role in initial adoption, play a significant role in the enhanced use of EMA in strategic decision-making. Such enabling factors are listed in Table 3. They include top management commitment toward the adoption of EMA and related environmental systems and objectives, environmental responsibility of the organization, external environmental uncertainties perceived by the organization, environmental proactivity of the organization, and environmental systems implemented by the organization, such as environmental management systems (EMS) and environmental management control systems (EMCS). An uncertain environment leads to organizations needing to plan for mitigating risks and trade-off situations and, therefore, necessitates the use of management information like EMA. Other management control systems, such as EMS and EMCS, supplement EMA in strategic decision-making by assisting in the implementation, audit, and control of environmental management and cleaner production processes. Furthermore, proactive organizations with committed and environmentally responsible top management are likely to adopt integrated and complex EMA tools, like life-cycle assessment and environmental capital budgeting (Frost & Rooney, 2021; Gunarathne & Lee, 2021; Latan et al., 2018).

5.3 | The outcomes from the usage of EMA for strategic decision-making

The multiple benefits and outcomes that are derived from the use of EMA for strategic decision-making are reiterated across the literature. Table 4 lists the primary outcomes of the strategic use of EMA for decision-making as thematically defined elements separated into broad first-order outcomes and specialized second-order outcomes.

Organizations utilize EMA to attain environmental performance objectives, such as increased eco-efficiency, reduced air, water, and soil emissions, better waste management and control, better identification, and better quality of timely environmental information for internal usage (Figge & Hahn, 2013; Gunarathne & Lee, 2021; Qu et al., 2022). It could also be used for developing environmental budgeting and identification of environmental risks and hazards (Frost & Rooney, 2021; Nartey, 2018). Usage of EMA for decision-making also leads to economic performance achievements such as cost efficiency, waste reduction, and better product pricing (Le et al., 2019; Munawaroh et al., 2018; Nzama et al., 2022; Solovida & Latan, 2017). Studies also posit the role of EMA in assisting in reporting and communication of information to various stakeholders by supporting the preparation of sustainability reports, GRI reports, climate risk reports, CSR reports, etc. (Egan & Tweedie, 2018; Maughan, 2022; Mulyasari & Mayangsari, 2020; Staniskis & Stasiskiene, 2006). Organizations also see EMA as a tool that can provide both product and process innovation (Chaudhry et al., 2020; Ferreira et al., 2010; Portillo-Tarragona et al., 2018).

Additionally, two more key outcomes in competitive advantage and strategic decisions for sustainable development were identified. Moving away from a short-term approach, firms are now using EMA to make environmental investment decisions, capital budgeting decisions, and long-term environmental planning for strategic objectives in order to achieve long-term sustainable development (Burritt et al., 2009; Frost & Rooney, 2021; Gunarathne & Lee, 2021). Due to its ability to provide cost-effectiveness, eco-efficiency, and innovation, organizations also see EMA as a tool for gaining a competitive advantage through cost leadership and market differentiation (Abdul Rahman et al., 2020; Gunarathne et al., 2021; Gunarathne & Lee, 2021).

5.4 | Barriers to EMA usage for strategic decision-making

In addition to the previously mentioned factors that influence EMA usage for strategic decision-making, a few factors that prevent

TABLE 4 Outcomes from EMA usage for strategic decision-making.

First order outcomes	Second order outcomes	Descriptions	Percentage of papers discussing the theme	References
Environmental performance	Eco-efficiency	• Aids in the reduction of environmental impact for a unit of value added by providing information on environmental information otherwise not easily identified. • Efficiency in the use of resources such as energy, water, and natural raw materials. • It helps in taking decisions relating to trade-off problems between environmental performance, resource use, and business profits.	11.23%	(Appannan et al., 2022; Christ et al., 2016; Egan & Tweedie, 2018; Figge & Hahn, 2013; Gunarathne & Lee, 2021; Henri & Journeault, 2008; Latifah & Soewarno, 2023; Munawaroh et al., 2018; Passetti & Tenucci, 2016; Schaltegger et al., 2012a)
	Waste management	• Aids in the identification, reduction, reuse, or resale of wastes and hazardous outputs. • Aids in the segregation and classification of wastes in different groups for recycling and disposal.	10.11%	(Chaudhry & Amir, 2020; Doorasamy, 2016; Nagirikandalage et al., 2023; Nzama et al., 2022; Qian et al., 2011; Qu et al., 2022; San et al., 2018; Yagi & Kokubu, 2020; Yang et al., 2021)
	Emission reduction	• Helps reduce environmental impact of products and processes. • Helps reduce soil, water, and air pollution from the operational activities. • Reduces greenhouse gas and carbon emissions and impact.	7.87%	(Burritt et al., 2009; Debnath, 2014; Kasbun et al., 2019; Lee, 2012; Miehe et al., 2022; Schaltegger & Csutora, 2012; Tsai et al., 2012)
	Environmental budgeting	• Aids in the preparation and control of environmental budgets for energy flows, water flows, and material usage. • Environmental budgeting helps in efficient resource use.	4.49%	(Frost & Rooney, 2021; Qu et al., 2022; Scavone, 2006; Staniskis & Stasiskiene, 2006)
	Quality of environmental information	• Timely, broad, and apprehensible environmental information for prompt decision-making.	3.37%	(Le et al., 2020; Nartey, 2018)
	Mitigation of environmental risks and hazards	• Identifies information related to climate change risk exposure. • Helps reduce environmental accidents and pollution hazards. • Helps identify future environmental uncertainties.	8.64%	(Debnath, 2014; Giunta et al., 2018; Gunarathne & Lee, 2021; Miehe et al., 2022; Passetti & Tenucci, 2016; Schaltegger & Csutora, 2012; Yagi & Kokubu, 2020)
Economic performance	Cost-effectiveness	• Reduces waste disposal and emission costs. • Lowering of manufacturing costs due to identification of hidden inefficiencies. • Identifies unaccounted environmental costs. • Lowers risk of environmental fines and penalties.	8.64%	(Gale, 2006b; Gunarathne & Lee, 2021; Le et al., 2019; Munawaroh et al., 2018; Schaltegger et al., 2012a; Taufiq et al., 2017; Yang et al., 2021)

TABLE 4 (Continued)

First order outcomes	Second order outcomes	Descriptions	Percentage of papers discussing the theme	References
	Resource efficiency	• Reduces water and energy consumption. • Optimum utilization of scarce natural resources.	4.94%	(Latan et al., 2018; Solovida & Latan, 2017; Taufiq et al., 2017; Yang et al., 2021)
	Waste reduction	• Identification of hidden wastes. • Recycling of wastes and revenue generation from wastes. • Lowers prevention costs and efforts.	7.87%	(Burritt et al., 2009; Doorasamy, 2016; Duarte et al., 2023; Gale, 2006b; Nzama et al., 2022; Qu et al., 2022; San et al., 2018)
	Material and product pricing decisions	• Aids in the selection of materials for less expensive and less damaging alternatives. • Helps in distributing the environmental costs to output for pricing of greener products.	3.37%	(Fakoya & Imuezerua, 2021; Le et al., 2019; Schaltegger et al., 2012a)
Competitive advantage	Cost leadership and market differentiation	• Cost efficiency, waste reduction initiatives, and lower emission rates would lead to cost leadership. • Unique greener products and production processes with improved greener technologies also promote a competitive edge and market differentiation.	6.74%	(Abdul Rahman et al., 2020; Agustia, 2020; Gunarathne et al., 2021; Gunarathne & Lee, 2021; Latan et al., 2018; Taufiq et al., 2017)
Strategic sustainable development	Investment decisions	• Post-assessment and appraisal of environmental investments. • Environmental impact assessment of individual projects. • Information for cleaner production investment decisions. • Investment analysis, including pay-back period, sensitivity analysis, and environmental evaluation of projects.	8.98%	(Burritt, 2004; Burritt et al., 2009; Gunarathne et al., 2021, 2023; Gunarathne & Lee, 2021; Nzama et al., 2022; Schaltegger et al., 2012b; Staniskis & Stasiskiene, 2006)
	Capital budgeting decisions	• Asset replacement and expansion decisions. • Environmental capital impact accounting. • Setting, appraisal, and reviewing of environmental capital budgets.	6.74%	(Figge & Hahn, 2013; Frost & Rooney, 2021; Gunarathne & Lee, 2021; Qu et al., 2022; Schaltegger et al., 2012b; Staniskis & Stasiskiene, 2006)
	Environmental planning	• Aids in framing of environmental policies. • Helps in the setting of environmental goals and objectives. • Develops long-term plans and allocates environmental responsibilities for environmental action. • Setting of internal environmental audits and environmental training programs.	6.74%	(Aranda-Usón et al., 2020; Duarte et al., 2023; Egan & Tweedie, 2018; Henri & Journeault, 2008; Passetti & Tenucci, 2016; Qu et al., 2022)

(Continues)

TABLE 4 (Continued)

First order outcomes	Second order outcomes	Descriptions	Percentage of papers discussing the theme	References
	Sustainability goals	• Integrating circular economy initiatives • Incorporate UN SDGs into corporate goals. • Involve ecosystem, planetary boundaries, and climate change considerations in strategic planning. • Set and evaluate zero-emission targets and carbon neutrality plans.	5.62%	(Aranda-Usón et al., 2020; Kokubu et al., 2023; Latifah & Soewarno, 2023; Miehe et al., 2022; Schaltegger, 2018)
Reporting	Sustainability reporting	• Supports the preparation of external reports, such as sustainability reports, CSR reports, climate risk reports, GRI reports, environmental performance reports, etc.	8.98%	(Christ & Burritt, 2017; Egan & Tweedie, 2018; Henri & Journeault, 2008; Maughan, 2022; Mulyasari & Mayangsari, 2020; Qu et al., 2022; Staniskis & Stasiskiene, 2006; Vitale et al., 2019)
	Internal environmental reporting	• Aids in communicating information and reporting to the top management and owners about environmental costs, environmental actions, and initiatives.	4.49%	(Egan & Tweedie, 2018; Laurinkevičiūtė & Stasiškienė, 2006; Scavone, 2006; Staniskis & Stasiskiene, 2006)
Eco-innovation	Process innovation	• Development of new technologically advanced production processes. • Aids in the modification of operational activities to minimize emissions.	5.62%	(Agustia, 2020; Chaudhry et al., 2020; Ferreira et al., 2010; Portillo-Tarragona et al., 2018; Taufiq et al., 2017)
	Product innovation	• Improvement of existing products with lower environmental impact. • Aids in environmental product design. • Development of new green and ecological products with improved quality and sustainability.	4.49%	(Chaudhry et al., 2020; Ferreira et al., 2010; Portillo-Tarragona et al., 2018; Taufiq et al., 2017)

EMA from being employed further were identified. These include the difficulty in the valuation of non-quantified knowledge, the limited role of accountants, a lack of expertise among staff, and a lack of environmental accounting standards (Table 5).

A major barrier, identified by several studies, preventing the adoption of EMA in organizations was the issue of non-quantified and non-financial knowledge. Organizations desire numerical performance, and the non-economic benefit of sustainability is sometimes overlooked due to its difficulty in evaluation (Frost & Rooney, 2021). The qualitative value of sustainability brought in by the strategic decision tools of EMA, such as environmental capital budgeting and sustainability balance score cards, is often subjective and is not effectively communicated to the relevant stakeholders. Also, there is a lack of focus on value addition in accounting, and on accounting for the value of externalities, which leads to the reduced quality of non-financial information (Burritt, 2004; Miehe et al., 2022). This is compounded by the role of accountants, which is primarily financial in nature (Egan & Tweedie, 2018).

Another key issue that prevents the expanded use of EMA for strategic decisions is the lack of expertise of accountants and their limited role in decision-making. Accountants are mainly used to deal with financial and numerical knowledge and this often leads to the exclusion of non-financial and physical information, as well as non-quantifiable knowledge from EMA (Egan & Tweedie, 2018). Accountants are primarily viewed as control agents rather than as change agents who can influence strategic planning in firms; their participation in decision-making for environmental sustainability decisions is restricted (Egan & Tweedie, 2018). The issue of lack of awareness and

TABLE 5 Barriers to EMA usage in strategic decision-making.

Barriers	Descriptions	Percentage of papers discussing the theme	References
Valuation of non-financial knowledge	• Qualitative goals of sustainability are important, yet are not easily identified or recognized. • Problem of materiality of non-quantified qualitative information.	2.24%	(Egan & Tweedie, 2018; Frost & Rooney, 2021)
Role of accountants	• Role of accountants as control agents and not change agents. • Limited interest of accountants in getting involved in sustainable change.	1.14%	(Egan & Tweedie, 2018)
Expertise and knowledge in sustainability	• Utilization of environmental information requires complex knowledge and competences, which staff lack.	3.37%	(Burritt, 2004; Mbedzi et al., 2020; Nzama et al., 2022)
Lack of environmental standards	• Internal use of EMA, lack of widely used standards on maintaining, utilizing, and communicating environmental information.	3.37%	(Burritt, 2004; Le et al., 2020; Nwandu et al., 2021)

training among staff is not just limited to accountants. Since strategic decisions have significant financial and operational consequences, the influence of such decisions affects several departments and levels of personnel. However, many internal staff, particularly operational workers, lack the knowledge and competence required for accessing and utilizing environmental information for decision-making (Burritt, 2004; Mbedzi et al., 2020).

Accounting practices in organizations are primarily dependent on the regulations followed by accounting professional groups and international accounting bodies. However, there is still a dearth of widely utilized environmental accounting standards that firms can embrace (Burritt, 2004; Nwandu et al., 2021). This severely restricts the usage of EMA, especially when it comes to complex and integrated EMA tools.

In the following section, we analyze relationships existing between the themes and variables identified in this section regarding EMA usage in strategic decision-making. The examination is based on the decision-making uses outlined in coding group F, aiming to identify the reasons why organizations opt for EMA in their decision-making processes. This analysis is detailed in Section 6.

6 | REASONS FOR EMA USAGE IN STRATEGIC DECISION-MAKING

We identified various cause-and-effect relationships among the identified themes. Figure 7 shows the schematic diagram representation of the relationship between these factors.

In Figure 7, the key driving factors for using EMA in strategic decisions are environmental strategy and external institutional and stakeholder pressures. Organizations with established environmental strategies are more likely to implement EMA to evaluate the effectiveness of their environmental goals (Latan et al., 2018). Institutional and stakeholder pressures, including regulations, community expectations, professional bodies, and market influences, have a key role in influencing organizations to adopt EMA for organizational decision-making (indicated in blue in Figure 7). However, the relationship between EMA and environmental strategies is bi-directional, as EMA provides the necessary information to design and implement environmental plans and policies, which make up the environmental strategy (Gunarathne et al., 2021). Although most studies in the literature discuss strategy as a driver of the adoption of EMA, there are also some studies that have tried to explore the role of EMA in developing environmental strategies and sustainability initiatives. For instance, Egan and Tweedie (2018) discuss the role of accountants in developing sustainability agendas and practices. Gunarathne et al. (2023) also discuss how EMA evolves to enable organizations to deal with more-sophisticated environmental management activities.

In addition to the driving factors for EMA adoption mentioned above, there are some other themes identified in the literature that result in the enhanced usage of EMA, although they may not be the primary reasons for EMA adoption. They include environmental uncertainty, environmental proactivity, top management commitment, and environmental responsibility. Environmental responsibility influences enhanced EMA usage directly, as well as indirectly, by enhancing top management commitment. More environmentally responsible upper management is more likely to allocate resources and take on initiatives that necessitate EMA use (Latan et al., 2018). Similarly, environmental uncertainty indirectly impacts EMA usage by encouraging more proactive practices in response to perceived external uncertainties (Appiah et al., 2020). Management systems like EMS and EMCS also support EMA systems in collecting and utilizing environmental information (Yagi & Kokubu, 2020).

Organizations primarily use EMA for strategic decision-making to achieve environmental performance (indicated in green in Figure 7).

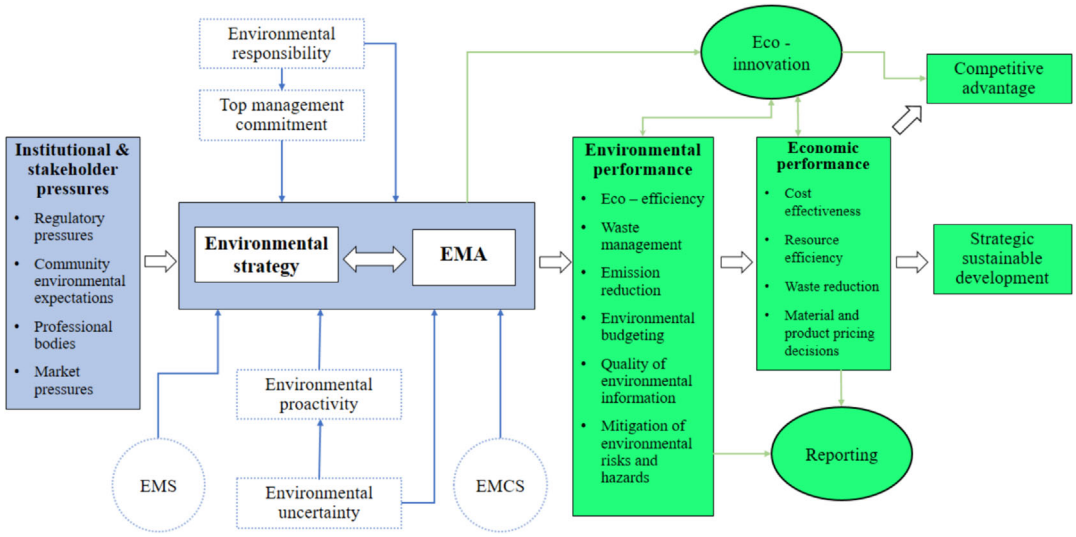

FIGURE 7 Factors affecting EMA usage for strategic decision-making.

TABLE 6 Reasons for EMA usage in decision-making.

Reason for decision use	Description	% of citations that examined decision use
EMA usage for legitimacy	• Reduce environmental impact, control emissions, and manage wastes for regulatory compliance. • Monitor and improve eco-efficiency for social legitimacy. • Maintain environmental information for external reporting.	46.06
EMA usage for organizational efficiency	• Identify and reduce hidden internal costs to increase cost-effectiveness. • Manage consumption of natural resources and enhance resource efficiency. • Manage wastes and reduce emissions to improve economic efficiency. • Improve the quality of environmental information for internal decision-making. • Identify areas for environmental risk mitigation.	35.96
EMA usage for strategic sustainable development	• Evaluate and assess investments in sustainable projects. • Capital budgeting and planning involving sustainable development goals. • Utilize environmental information to identify areas of technical innovation, competitive advantage, key competencies, cost leadership, and market differentiation. • Develop long-term plans and objectives, and allocate environmental responsibilities for environmental action.	17.98

They also utilize it for economic performance, eco-innovation, and reporting on environmental performance. Some seek long-term goals such as competitive advantage and strategic sustainable development through EMA (Gunarathne et al., 2021; Gunarathne & Lee, 2021).

Based on these factor relationships, the study identifies three key reasons why firms use EMA for strategic decision-making: legitimacy, resource efficiency, and strategic sustainable development. These reasons evolve as organizations expand their use of EMA tools, driven by enabling factors and greater integration of environmental strategy (see Tables 6 and 7).

6.1 | EMA usage for legitimacy

A large majority of studies find that organizations primarily adopt EMA in response to external pressures, aiming to align with sustainability practices. These pressures originate from various sources, including governmental bodies, international organizations, trade unions, professional associations, customers, competitors, and creditors. They drive organizations to develop strategies for reducing their environmental impact and enhancing eco-efficiency (Chaudhry & Amir, 2020; Gunarathne et al., 2021; Kong et al., 2022). Organizations tend to exhibit relatively low levels of strategic proactivity when they adopt EMA for legitimacy reasons. In such organizations, EMA is predominantly employed for reactive decision-making. They rely on basic EMA tools like energy accounting, water accounting, and carbon management accounting, using historical data to comply with regulatory standards and community expectations (Gunarathne et al., 2021; Gunarathne & Lee, 2021; Lee, 2012). They perceive themselves as environmentally accountable to stakeholders and are committed to meeting consumer and societal standards within their operational context (Gunarathne et al., 2021; Imtiaz Ferdous et al., 2019; Scavone, 2006).

TABLE 7 EMA usage for decision-making in different levels of environmental strategy and motives for EMA usage.

Motives for EMA usage	Environmental strategy stage	EMA tools	Decision-making
EMA usage for legitimacy	Reactive strategy	Simple EMA tools like energy accounting, water accounting, and carbon management accounting.	Past and short-term oriented decisions, such as short-term eco-efficiency decisions and waste management decisions.
EMA usage for organizational efficiency	Preventive strategy	Simple tools like energy accounting and water accounting, and integrated EMA tools like material flow cost accounting, material flow assessment, life cycle accounting, and life cycle assessment.	Used for environmental budgeting decisions, value chain analysis, supply chain decisions, pricing decisions, and decisions on cost and efficiency improvements.
EMA usage for strategic sustainable development	Proactive strategy	Integrated and advanced EMA tools, sustainable balanced score cards, sustainability index, environmental capital budgeting, environmental impact assessment, environmental impact accounting, and environmental sensitivity analysis.	Used for strategic and proactive decisions, expansion decisions, long-term investment decisions, capital budgeting, and environmental planning.

Sources: (Burritt, 2004; Burritt et al., 2019; Gunarathne et al., 2021; Gunarathne & Lee, 2021).

As a result, businesses leverage EMA to establish environmental legitimacy, subsequently enhancing their environmental performance by reducing emissions and environmental impact (Chaudhry & Amir, 2020; Kong et al., 2022). Meeting accountability requirements through EMA helps organizations communicate their environmental performance objectives and achievements to stakeholders through various forms of environmental reporting and disclosure. This practice becomes especially pronounced as their use of EMA is influenced by stakeholder expectations and pressures (Henri & Journeault, 2008; Maughan, 2022; Staniskis & Stasiskiene, 2006).

A large number of studies identified in the literature (46.06%) focus only on the use of EMA for legitimacy reasons. This may be because the actual implementation of EMA is still limited in practice, and the adoption of EMA may be limited to simple EMA tools for reactive decision-making.

6.2 | EMA usage for organizational efficiency

In comparison with studies that examine only the use of EMA for legitimacy reasons, fewer studies – yet still a considerable number of them – (35.96%) also examine the usage of EMA for organizational efficiency. These studies find that organizations see the benefit of EMA, utilizing it to improve their economic and organizational efficiency, in addition to improving environmental performance and sustainability reporting. As organizations implement EMA, they gradually recognize its economic and organizational benefits. They expand the use of advanced EMA tools across various departments through incremental changes in their processes and methods (Burritt et al., 2019). The strategic goal of adopting EMA shifts from seeking external social and institutional legitimacy to achieving internal organizational efficiency. EMA is now considered a tool for continuous improvement by organizations. It helps uncover hidden environmental costs, eliminate waste, streamline internal processes, and enhance organizational efficiency and economic performance (Appannan et al., 2022; Christine et al., 2019; Latan et al., 2018). EMA is crucial for developing effective environmental performance indicators (EPIs) that allow organizations to assess their performance and measure their progress toward strategic objectives (Henri & Journeault, 2008). Environmental management accounting acts as a critical link between environmental strategies, environmental performance, and economic performance, enhancing these aspects (Amir & Chaudhry, 2019; Appiah et al., 2020; Latan et al., 2018). Environmental management accounting is seen as a tool that can generate profits and improve cost-effectiveness for organizations. It helps lower compliance costs, reduce environmental liabilities, minimize wastage, and identify revenue opportunities from by-products and waste (Le et al., 2019; Munawaroh et al., 2018; Nzama et al., 2022).

Studies find that organizations when becoming environmentally proactive, seek more comprehensive and forward-looking environmental information due to various external uncertainties (Amir & Chaudhry, 2019; Bui & de Villiers, 2017; Latan et al., 2018; Nartey, 2018). These uncertainties – such as evolving government policies, international standards, political factors, market needs, competitor strategies, and technological advancements – drive organizations to take proactive environmental actions. Managers, facing a highly uncertain organizational environment, seek forward-looking, external, and non-financial information. Environmental management accounting furnishes this environmental information, helping organizations mitigate uncertainty factors, such as regulatory changes, uncertain waste disposal options, costs, and fluctuations in recycling market demands (Baumann et al., 2015; Latan et al., 2018; Le et al., 2019). Organizations use EMA tools to make proactive decisions that enhance cost and resource efficiency. These tools include energy accounting, water accounting, material flow cost accounting (MFCA), environmental budgeting, value chain analysis, and life-cycle costing

(Burritt, 2004; Gunarathne & Lee, 2021; Qu et al., 2022; Schaltegger et al., 2012b). Such tools aid in decision-making concerning real-world trade-offs between financial performance, carbon emissions, and water risk reduction (Christ et al., 2016; Lee, 2012).

6.3 | EMA usage for strategic sustainable development

In addition to the usage of EMA for legitimacy and organizational efficiency, some studies (17.98%) have also examined the use of EMA for strategic sustainable development. Such studies have focused on how EMA is utilized for making decisions that have long-term consequences, such as investment decisions, capital budgeting decisions, competitive advantage, and sustainable growth (Burritt et al., 2009; Frost & Rooney, 2021; Gunarathne et al., 2023; Gunarathne & Lee, 2021). Organizations with highly proactive environmental strategies tend to utilize more complex EMA tools, such as balanced score cards, sustainability indices, environmental impact accounting, environmental sensitivity analysis, and sustainable capital budgeting, to take proactive and long-term decisions.

Proactive environmental strategies, along with integrated EMA tools, aid these organizations in making long-term green investments and capital budgeting decisions. This shift reflects top management's transition from a financially centered approach to one focused on sustainability (Burritt et al., 2009; Frost & Rooney, 2021; Gunarathne & Lee, 2021). A highly strategically proactive organization, with top management committed to environmental responsibility and sustainability initiatives, further enhances EMA usage. Their increased demand for environmental information necessitates more complex and integrated EMA tools (Gunarathne & Lee, 2021; Latan et al., 2018). When top management values environmental sustainability, they demand high-quality environmental information to implement environmental strategies and meet sustainability targets (Amir & Chaudhry, 2019; Appiah et al., 2020; Gunarathne & Lee, 2021). In such organizations, environmental sustainability becomes a key strategic goal, leading them to implement EMA and proactive environmental strategies for making long-term, sustainable decisions that contribute to the organization's growth (Gunarathne & Lee, 2021).

Organizations also respond to changing market demands and evolving industrial technology by focusing on eco-innovation (Abdul Rahman et al., 2020; Agustia, 2020). Environmental management accounting plays a pivotal role in promoting the development of greener products and production processes through the use of environmental information in the decision-making process (Chaudhry et al., 2020; Ferreira et al., 2010; Taufiq et al., 2017). By leveraging unique green products, advanced technologies, cost leadership, and cost-effectiveness, organizations aim to attain sustainable competitive advantage through EMA-driven strategic decision-making (Abdul Rahman et al., 2020; Agustia, 2020; Gunarathne & Lee, 2021).

In summary, studies indicate that organizations adopt EMA primarily in response to external pressures, aiming to align with sustainability practices. This often leads to the use of basic EMA tools for reactive decision-making, driven by the need for environmental legitimacy. However, organizations gradually recognize the economic and organizational benefits of EMA, utilizing it to improve efficiency and performance. As organizations become more environmentally proactive, they seek forward-looking environmental information to mitigate uncertainties and make proactive decisions. Some studies also highlight the use of EMA for strategic sustainable development, where organizations employ complex EMA tools to make long-term, sustainable decisions that contribute to their growth and competitive advantage.

7 | DISCUSSIONS

This study examined why and how EMA is used for strategic decision-making through a systematic literature review of existing studies until October 2023. Bibliometric analysis and thematic analysis were used to deduce insights from the literature.

Several factors were identified that led to the use of EMA for strategic decision-making in organizations. The factors identified in the study included: drivers – factors that primarily influenced the organization to adopt and implement EMA for strategic decision purposes; enablers – factors that enhanced the usage of EMA for decision-making or that influenced the usage of EMA indirectly; and outcomes – the gains or perceived goals of the organizations while they were utilizing EMA for strategic decision-making. Environmental strategies were recognized as the key driving factor for the use of EMA for strategic decision-making, with varying levels of environmental strategy influencing the extent of EMA usage in businesses for making various decisions. Organizations view EMA as a mediating and enhancing system between environmental strategies and environmental performance, as it provides information to assess the effective implementation of environmental strategies that are frequently set by organizations to improve their environmental performance (Chaudhry & Amir, 2020; Gunarathne et al., 2021; Solovida & Latan, 2017). Environmental management accounting provides the environmental performance indicators that help organizations to evaluate the implementation of set strategic objectives (Henri & Journeault, 2008). While environmental performance is still a primary perceived outcome for organizations that use EMA, the economic benefits of lowering environmental costs and wastage and of supporting material, price, and resource efficiency decisions are also significant (Gale, 2006b; Le et al., 2019; Qu et al., 2022).

The study discovered that, while external pressures such as regulatory pressures from the government, community environmental expectations, professional body influence, and organizational market pressures were often the main influencing factors for why organizations initially adopt and implement EMA, primarily for short-term decision purposes like eco-efficiency and waste management (Burritt & Saka, 2006; Qian et al., 2015), there were other factors at play that further expanded the usage of EMA in organizations toward more long-term and strategic goals. These factors, primarily internal and organizational – such as top management commitment, environmental

responsibility, environmental uncertainty, and environmental proactivity – influenced organizations to not only expand their EMA usage but to also transform perceived motives and intentions behind their usage.

Based on the analysis of the relation between identified factors, three main reasons for the use of EMA for strategic decision-making were identified: legitimacy, organizational efficiency, and strategic sustainable development. The study observes that only 17.98% of the literature examined focused on the use of EMA for decisions motivated by the desire to achieve corporate strategic sustainable development, with a significantly large number of studies focusing on legitimacy reasons (46.06%) followed by those focused on organizational efficiency (25.96%). This points toward a significantly lesser focus of research on EMA for strategic decision-making for proactive and strategic solution-oriented managerial applications. While the study shows a steady growth of literature in the past two decades, there is still scope for research into how EMA can be utilized for strategic decision-making to achieve corporate and global sustainable development.

Nonetheless, the study identifies an evolving transition of motives of organizational interests from legitimacy to organizational efficiency to strategic sustainable development. This transition from using EMA for legitimacy, then evolving into applications for organizational efficiency, and ultimately reaching strategic sustainable development, aligns with the research by Burritt et al. (2019). Their findings suggest that the adoption of advanced EMA tools increases progressively as various departments within organizations recognize the multifaceted benefits, even if the initial implementation was primarily driven by the quest for legitimacy.

The prevailing theme in the literature underscores that organizations, in their pursuit of legitimacy, predominantly adopt EMA practices to fulfill the demands of their stakeholders. Initially, organizations adopt simple EMA tools like water accounting, energy accounting, and carbon management accounting to gain legitimacy and meet short-term environmental goals in response to institutional and stakeholder pressures. These pressures emanate from various entities, including governments, professional bodies, customers, and competitors (Chaudhry & Amir, 2020; Gunarathne et al., 2021). This emphasis on short-term goals aims to present the organization as environmentally accountable to its stakeholders.

However, as organizations delve deeper into EMA implementation, they recognize its economic and operational benefits. This realization prompts them to adopt more advanced tools like life-cycle assessment and material flow cost accounting (Burritt et al., 2019). This strategic shift moves them from mere legitimacy-seeking to achieving operational efficiency. Their focus now expands to include waste reduction, resource management, and cost efficiency. Their drive for economic performance encompasses reducing environmental costs and generating revenue from previously unrecognized waste and by-products (Burritt et al., 2009; Fakoya & Imuezerua, 2021). Furthermore, organizations actively seek innovation in greener technologies, driven by a desire to mitigate risks and gain a competitive edge, ultimately enhancing cost-effectiveness (Chaudhry et al., 2020).

Some organizations extend their utilization of EMA to incorporate advanced tools such as environmental capital budgeting, sustainability indices, environmental impact accounting, and environmental sensitivity analysis for capital budgeting and green investment decisions (Burritt et al., 2009; Qu et al., 2022). This broadening of EMA applications is driven by their commitment to achieving strategic sustainable development. These organizations are perceived as being environmentally proactive and responsive to change, owing to visionary and committed leadership interested in promoting environmentally sustainable initiatives. Environmentally responsible top management sets visionary objectives and actively seeks qualitative environmental information, fostering a high level of EMA integration (Appiah et al., 2020; Frost & Rooney, 2021).

This phenomenon is often explained in the literature using the contingency theory and the resource-based view. Organizational contextual variables, such as environmental strategies, top management commitment, environmental proactivity, environmental responsibility, and environmental uncertainty, are viewed as major contingent variables that affect organizations' adoption of EMA (Christ & Burritt, 2013; Ferreira et al., 2010; San et al., 2018). With increasing external uncertainties regarding environmental issues, managers are influenced to adopt sustainable tools to find solutions to environmental issues and reduce environmental risks (Appiah et al., 2020; Kong et al., 2022; Latan et al., 2018). This is particularly evident in organizations that prioritize strategic proactivity (Chaudhry & Amir, 2020), reflecting a pragmatic approach to sustainability accounting. Such organizations have managers who are more solution-oriented and proactive in making decisions to stay ahead of the market and competition in terms of sustainability. The resource-based view theory further underscores this through the role of organizational resources and capabilities in achieving sustainable competitive advantage (Portillo-Tarragona et al., 2018; Solovida & Latan, 2021). Organizations with proactive environmental strategies and top management commitment leverage their resources to effectively utilize EMA tools for informed decision-making. By investing in EMA capabilities, these organizations gain a competitive edge by reducing environmental risks and capitalizing on green investment opportunities.

The initial adoption of EMA is also explained using social system-based theories such as legitimacy theory, stakeholder theory, and institutional theory. According to these theories, organizations are perceived as being responsible to their stakeholders and the environment, and they act to fulfill their demands and adhere to their norms (Le et al., 2019; Wang et al., 2018). While this may seem contrary to the pragmatic perspective of sustainability accounting, it is far from the case. As organizations evolve in their use of EMA for decision-making, they are expected to progressively enhance their EMA practices once they recognize the broader significance and benefits of EMA (Burritt et al., 2019; Gunarathne & Lee, 2021). Environmental management accounting has the long-term capacity to transition organizations into environmentally sustainable entities through institutional reflexivity (Gale, 2006b). As institutional agents, organizations can have a significant impact on society by addressing environmental issues and finding sustainable solutions (Imtiaz Ferdous et al., 2019).

The evolving use of EMA reflects a transformational shift in organizational decision-making, transitioning from historical data-driven approaches for short-term and reactive strategies to long-term and proactive sustainability initiatives. This underscores the active role of accounting in fostering environmental sustainability within organizations. Managers leverage sustainability accounting information not only to control environmental impacts for accountability but also to proactively address environmental risks and challenges while gaining strategic advantages for their organizations. While the initial adoption of sustainability accounting tools like EMA may be driven by legitimacy concerns, organizations increasingly recognize the economic benefits and strategic potential of EMA, leading to the adoption of more advanced and integrated tools. This progression supports the pragmatic perspective of sustainability accounting, highlighting the active transformative role these tools play in driving organizational change toward sustainability (Baker et al., 2023; Baker & Schaltegger, 2015).

The growing inclination of organizations toward embracing more advanced and integrated EMA tools reflects their genuine commitment to achieving meaningful environmental sustainability and advancing sustainable development goals (Burritt et al., 2019). While organizations may opt for simple EMA tools, like physical water accounting and energy accounting for superficial greenwashing purposes, adopting advanced and integrated EMA tools requires substantial investments in effort, time, and resources. However, the active engagement of organizations in utilizing advanced EMA tools to make proactive sustainability-driven decisions suggests a deeper commitment beyond mere token adoption for greenwashing (Burritt et al., 2023; Schaltegger & Burritt, 2018). Moreover, initial legitimacy-seeking behavior could also lead to organizations recognizing EMA's potential benefits for achieving economic gains or sustainability benefits, transitioning organizations toward more responsible adoptions (Schaltegger & Burritt, 2018).

Although there has been a notable increase in studies investigating EMA for strategic decision-making, several areas warrant further research attention. Specifically, there remains a gap in understanding the involvement of accountants in decision-making and strategic planning (Egan & Tweedie, 2018), as EMA literature tends to be focused more on managers than accountants. Further research on how accountants can facilitate sustainable problem-solving and strategic proactivity would enhance our understanding of the pragmatic approach to sustainability accounting. Furthermore, opportunities exist for pragmatic research to explore the roles of both accountants and managers in driving sustainable change within organizations and facilitating broader societal shifts toward sustainability.

A noticeable trend in EMA literature is the shift toward sustainability management accounting, which includes integrating social aspects into decision-making processes (Schaltegger et al., 2022). These social factors encompass areas like health and safety, work-life balance, and addressing issues related to modern slavery (Burritt et al., 2023; Pramono et al., 2023). This evolving emphasis on sustainability management accounting underscores the need for further exploration. Research efforts should be directed toward investigating how social factors can be effectively integrated into the strategic decision-making process through the utilization of EMA. Understanding the mechanisms and methods for integrating social considerations will be instrumental in promoting environmentally and socially responsible practices among organizations. Moreover, it will contribute to holistic decision-making that fosters sustainable development while considering a broader spectrum of environmental and social concerns.

The EMA literature significantly contributes to discussions on the interplay between EMA and strategy, highlighting the reciprocal relationship between accounting and strategies. However, there is potential for further research to explore this relationship in greater depth. While existing studies emphasize the importance of proactive environmental strategies for EMA implementation and the effectiveness of EMA in evaluating the execution of environmental strategies (Egan & Tweedie, 2018; Gunarathne et al., 2023; Gunarathne & Lee, 2021), there remains a research gap regarding how EMA can facilitate the development of environmental strategies. Despite previous research indicating the role of EMA in strategic planning by providing essential environmental data (Gunarathne et al., 2021; Latan et al., 2018; Le et al., 2019), this aspect requires more thorough investigation. By delving into the multifaceted relationship between EMA and environmental strategies, researchers can illuminate its critical role in strategic decision-making, thus enhancing organizational practices.

While the absence of factors enhancing decision-making functions serves as a barrier to EMA usage, there are also some other barriers to EMA adoption. One significant challenge involves extracting and evaluating non-quantifiable qualitative information for strategic decision-making (Frost & Rooney, 2021). This obstacle stems from the difficulty in quantifying non-economic values linked to sustainability goals, compounded by accountants' limited expertise in handling non-numerical data, hindering its integration into EMA practices. Additionally, the limited involvement of accountants in organizational decision-making and planning presents another barrier (Egan & Tweedie, 2018). Despite being often seen as compliance-focused professionals with minimal engagement in strategic planning, there is increasing evidence of accountants' potential to influence environmental strategies within organizations (Egan & Tweedie, 2018; Gunarathne et al., 2023), highlighting the importance of integrating their expertise into strategic environmental decision-making processes. Overcoming these barriers requires training for both accountants and other professionals to enhance their proficiency in EMA utilization, particularly in its qualitative aspects. Moreover, international accounting bodies could aid by developing standardized environmental accounting policies to promote widespread and standardized EMA usage (Burritt, 2004; Nwandu et al., 2021). Policymakers should also consider crafting regulations that compel organizations to adhere to these international environmental standards and policies, fostering more widespread and standardized EMA utilization, given the significant influence of regulatory pressures on EMA adoption.

Regional variations observed in the utilization of EMA for strategic decision-making can be attributed to disparities in environmental

regulations. Western Europe, Southeast Asia, and Oceania exhibit higher EMA implementation, likely due to the pronounced impact of government regulatory pressures. Qian et al. (2011) support this notion, highlighting the Australian government's role in promoting environmental sustainability initiatives and EMA adoption. This perspective finds further support in studies conducted in Southeast Asia, including Yusoh and Mat (2020), Le et al. (2019), and Nguyen (2022). Additionally, the increased use of EMA in the Asia-Pacific region is influenced by national cultural factors (Gunarathne & Senaratne, 2018; Lee & Herold, 2018). National culture significantly shapes the adoption of accounting practices across various regions. For instance, Radebaugh and Gray (1993) explained how the implementation of accounting systems and practices is affected by cultural dimensions like power distance, individualism, masculinity, and uncertainty avoidance. Hofstede (2007) expanded this to add short-term/long-term orientation in his examination of cultural differences in Asian countries and mentioned the importance of the role of family values and ethics for openness to change and future-oriented dynamic values. Studying the influence of cultural values on EMA is crucial, particularly given the added dimension of sustainability. Conducting multinational research can further enrich the literature by uncovering distinctive cultural values that account for variations in the usage of sustainability tools like EMA.

Furthermore, the research in EMA has been focused on the manufacturing industry because of its easier identification and explicability of environmental information (Gunarathne & Lee, 2015). This is also due to the literature's focus on environmentally sensitive manufacturing industries, such as chemical and smelting, which tend to embrace EMA more (Ferreira et al., 2010). However, the need for environmental information for decision-making is now broadening to all sectors, and even the less environmentally sensitive industries, such as IT or banks, are now being coerced to take up sustainability activities. While studies have been done in the hotel and tourism sectors, there is a lack of studies in environmentally sensitive service industries such as health-care industries; these could be further explored. This is especially the case, in recent times, for recurring global pandemics, which have brought increased public attention to the health-care sector and how they manage their material, water, and waste flows. A growing interest has also emerged in employing EMA for the promotion of strategic sustainability within the agriculture sector, which has a considerable environmental footprint (Duarte et al., 2023). Nevertheless, the existing literature on this subject remains limited, underscoring the need for more comprehensive, multidisciplinary approaches to investigate and address these pertinent areas.

While EMA serves as a potent tool for assessing an organization's immediate environmental impact, there remains ambiguity concerning the precise quantification of this impact and its applicability across the organization's supply chains. As businesses increasingly prioritize strategic sustainability, there arises a heightened necessity for more advanced EMA tools that leverage artificial intelligence, innovative digital technologies, and automation (Abdelhalim et al., 2023; Burritt et al., 2023). However, current literature predominantly focuses on the institutional and contextual environments, offering limited attention to the technological landscape. Further research emphasis is required to explore the technological, social, and physical environments' influences on organizations. Moreover, in the context of evolving technological environments, where artificial intelligence (AI) is increasingly recognized as a vital accounting and managerial tool, it is imperative to investigate the influence of technological advancements and innovations in facilitating organizations to manage environmental information.

An investigation into how organizations are affected not only by their market and institutional environment but also by their social and physical environments could be productive. Environmental management accounting tools, including biodiversity accounting and carbon management accounting, offer the capability to assess an organization's impact on the physical environment, ecosystems, and climate change (Lee, 2012; Roberts et al., 2021). Understanding how organizations can utilize sustainability tools like EMA to contribute positively to the natural environment, by lessening ecological impact on ecosystems and addressing issues like climate change, is imperative (Schaltegger et al., 2022). Equally crucial is evaluating an organization's impact on the physical health of the community in its vicinity. Moreover, greater research attention should be directed toward internal stakeholders such as employees, who grapple with social impacts linked to organizational practices, including concerns about modern slavery, work-life balance, chemical pollution, and mental health issues (Burritt et al., 2023).

8 | CONCLUSIONS

This study identifies different factors affecting EMA usage for strategic decision-making, including different levels of environmental strategies, external institutional pressures, top management commitment, and environmental uncertainty. It also identifies the main reasons why organizations utilize EMA for strategic decision-making: legitimacy, organizational efficiency, and strategic sustainable development. Moreover, it demonstrates how this shift in motives drives organizational transformations toward greater responsibility and the adoption of more advanced and integrated EMA tools, enabling proactive decision-making for sustainable development.

The study provides four contributions to the body of sustainability accounting literature. First, the study contributes to the EMA–strategy discussions by reiterating the significance of environmental strategies for EMA implementation, the effectiveness of environmental strategies for EMA implementation, the effectiveness of EMA for executing environmental strategies, and the scope for EMA to support strategic planning (Ferreira et al., 2010; Gunarathne et al., 2023; Latan et al., 2018). The study further extends the literature on integrating environmental strategies with EMA by emphasizing the need to align different decision timeframes with appropriate levels of environmental strategies and EMA tools. It advances the insights of Gunarathne and Lee (2021) by delving deeper into the reasons for organizations to become more proactive in their environmental strategies,

specifically elucidating how these strategies relate to strategic decision-making processes.

Second, the study extends prior scholarly research on motivations for EMA adoption (Amoako et al., 2021; Baumann et al., 2015; Christ & Burritt, 2013; Henri & Journeault, 2008) by exploring not only the theoretical foundations of EMA implementation but also emphasizing the motivations driving increased usage post-implementation. This study also distinguishes between direct factors influencing EMA usage (drivers) and indirect factors impacting its application (enablers), shedding light on the continuance and expansion of EMA within organizational contexts (van der Poll, 2022). Moreover, the research builds upon the analysis of Burritt et al. (2019) by detailing the internal organizational transformations resulting from its adoption. The study research reassesses the work of Schaltegger and Burritt (2010) on the rationale behind sustainability accounting usage, affirming and elaborating on the evolution of these factors and their profound influence on strategic decision-making within organizations. By integrating motives for EMA utilization, its diffusion, and the stages of environmental strategy into the decision-making landscape within organizations, this study lays a foundation for comprehending the gradual adoption of various sustainability management, control, and audit tools (Frost & Rooney, 2021).

Third, the study extends discourse on the pragmatic approach to sustainability accounting by demonstrating that organizations are not merely responsive to change toward sustainability, but are active agents of change by being responsible, internally motivated, and proactive in taking sustainable decisions. It extends the discussions on the role of accounting in creating sustainable change within organizations as well as at the societal level. The study emphasizes that organizational shifts toward sustainability are not merely responses to external legitimacy demands, but also responsible commitments to environmental sustainability created by organizational contextual factors. The organizational change toward sustainability is progressive and sustained over the long term (Baker et al., 2023; Baker & Schaltegger, 2015). The study contributes to the discourse by illustrating how organizations recognize the benefits of EMA in making proactive and solution-oriented managerial decisions, leading them toward strategic sustainable development, even if they initially adopt EMA for legitimacy reasons.

Fourth, by stressing the importance of utilizing EMA for proactive, long-term decision-making, the study also contributes to addressing the issue of greenwashing in sustainability efforts. It contributes to the issue of greenwashing in EMA implementation by pointing out that organizations move toward proactive use of advanced EMA tools once their utility is comprehended (Burritt et al., 2019). This transition indicates a departure from mere symbolic EMA practices toward genuinely strategic and responsible adoption, thereby reducing the risk of greenwashing (Burritt et al., 2023; Schaltegger & Burritt, 2010). Moreover, it underscores the significance of organizational learning and adaptation in fostering sustainable practices over time, leading to more authentic and effective EMA utilization.

The paper also offers practical contributions in various domains. It aids managers and corporate stakeholders by providing insights into the contexts, potential, and challenges related to EMA for decision-making purposes. This understanding enables them to enhance their organizational structures and internal environments, fostering more effective utilization of EMA in diverse strategic scenarios. It also facilitates the identification of key elements crucial for making environmentally conscious decisions, thereby promoting both strategic sustainability and economic development. It also aids policymakers in developing innovative policy frameworks, regulations, and guidelines to encourage the adoption of EMA. Through a comprehensive exploration of the motivations underpinning EMA utilization in organizations, this research can play a pivotal role in advancing environmental sustainability within the economy. Furthermore, identifying the principal driving factors and obstacles to EMA usage, provides valuable insights for policymakers to concentrate on strengthening and enhancing these aspects. Moreover, the paper benefits business owners, promoters, and shareholders by elucidating the necessity and advantages of employing sustainability tools such as EMA for long-term and strategic decision-making. This understanding empowers them to strengthen their sustainability actions, leading to enhanced environmental sustainability, competitive advantage, and sustainable development.

The study presents various avenues for future research, encouraging researchers to delve deeper into these areas to advance this field. The current research has been focused on the role of EMA in providing environmental performance by means of eco-efficiency and eco-control. There is a need for more research on how EMA could support strategic growth and sustainable development with the support of more digital and automated technologies with minimal impact on the physical and social environment. Furthermore, more research is needed to explore the usefulness of EMA in primary and tertiary sectors and how it could assess organizational performance across multiple levels throughout the supply chains.

Like any other study, this study has several limitations. To start with, the study restricts its scope to only five databases for quality control, leaving out numerous other papers in other databases, such as Google Scholar. The study is also constrained by the small number of keywords employed, and there may be additional studies related to the literature that do not use the terms searched in this study. Future studies could overcome these limitations by including more databases and keywords, further extending the findings of the study.

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APPENDIX A

TABLE A1 Methodology of studies identified.

Methodology	No. of studies	Percentage
Theoretical	9	10.11
a. Literature review	6	6.74
b. Theoretical development	3	3.37
Empirical	78	87.64
a. Qualitative studies	33	37.08
b. Quantitative studies	38	42.69
c. Mixed method studies	7	7.87
Theoretical and empirical	2	2.25
a. Qualitative + theoretical studies	2	2.25
Total	**89**	**100**

APPENDIX B

TABLE B1 Target sectors within studies.

Industry	Frequency	Percentage
1. Multiple	27	30.33
2. Primary	6	6.74
a. Agriculture	2	2.24
b. Mining	2	2.24
c. Forestry	2	2.24
3. Secondary	40	44.94
a. Manufacturing	22	24.72
b. Paper production	4	4.49
c. Food and beverages	9	10.11
d. Energy	1	1.12
e. Chemical	2	2.24
f. Automobile	1	1.12
g. Textiles	1	1.12
4. Tertiary	6	6.74
a. Hospitality	3	3.37
b. Consumer goods	1	1.12
c. Waste and water treatment	2	2.24
5. N/A	10	11.24
Total	**89**	**100**

APPENDIX C

TABLE C1 Theories used in studies identified.

Theory	Frequency	Percentage
Contingency theory	12	13.48
Institutional theory	7	6.74
Natural resource-based view	8	8.98
Legitimacy theory	3	3.37
Stakeholder theory	4	4.49
Value-added theory	3	3.37
Other theories	4	4.49
Multiple theories	7	6.74
No theories applied	41	46.07
Total	**89**	**100**

APPENDIX D

TABLE D1: Reasons for use of EMA in decision-making.

Reason for EMA use	Cite %	References
Legitimacy	46.06	Abdelhalim et al. (2023); Andrian et al. (2023); Lutfi et al. (2023); Nagirikandalage et al. (2023); Kong et al. (2022); Maughan (2022); Nguyen (2022); Nzama et al. (2022); Nwandu et al. (2021); Stanescu (2021); Appiah et al. (2020); Capusneanu et al. (2020); Le et al. (2020); Mbedzi et al. (2020); Mulyasari and Mayangsari (2020); Yusoh and Mat (2020); Kasbun et al. (2019); Latan et al. (2018); Nartey (2018); San et al. (2018); Christ and Burritt (2017); Passetti & Tenucci (2016); Solovida and Latan (2017); Doorasamy (2016); Magdalena Smit & Kotzee (2016); Baumann et al. (2015); Marelli (2015); Christ (2014); Debnath (2014); Christ and Burritt (2013); Lee (2012); Papaspyropoulos et al. (2012); Reynolds & Mangos (2012); Tsai et al. (2012); Jankovic et al. (2011); Laurinkevičiūtė and Stasiškienė (2011); Masanet-Llondra (2006); Scavone (2006).
Organizational efficiency	35.96	Duarte et al. (2023); Kamran Ali et al. (2023); Qu et al. (2022); Fakoya & Imuezerua (2021); Gunarathne et al. (2021); Yang et al. (2021); Agustia (2020); Chaudhry et al. (2020); Hájek & Vrabcová (2020); Yagi and Kokubu (2020); Amir and Chaudhry (2019); Burritt et al. (2019); Christine et al. (2019); Le et al. (2019); Al-Mawali et al. (2018); Munawaroh et al. (2018); Portillo-Tarragona et al. (2018); Christ & Burritt (2017); Bui and de Villiers (2017); Gibassier (2017); Taufiq et al. (2017); Christ et al. (2016); Gunarathne et al. (2016); Gunarathne and Lee (2015); Schaltegger and Zvezdov (2015); Figge and Hahn (2013); Schaltegger et al. (2012a); Schaltegger and Csutora (2012); Schaltegger et al. (2012b); Ferreira et al. (2010); Henri and Journeault (2008); Gale (2006b); Staniskis and Stasiskiene (2006).
Strategic sustainable development	17.98	Kokubu et al. (2023); Latifah and Soewarno (2023); Appannan et al. (2022); Gunarathne et al. (2023); Miehe et al. (2022); Frost & Rooney (2021); Gunarathne and Lee (2021); Abdul Rahman et al. (2020); Chaudhry and Amir (2020); Aranda-Uson et al. (2020); Vitale et al. (2019); Egan and Tweedie (2018); Schaltegger (2018); Burritt et al. (2009); Burritt (2004).