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Environmental Management Accounting Adoption in SMEs: A Mixed-Industry Systematic Review and Integrative Conceptual Framework

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ABSTRACT: Environmental Management Accounting (EMA) has increasingly gained importance as a mechanism for integrating environmental information into organisational decision-making, resource management, and sustainability-oriented business practices. However, research on EMA adoption among small and medium-sized enterprises (SMEs) remains fragmented across industries and theoretical perspectives. This systematic literature review synthesises evidence on EMA adoption across manufacturing, food and beverage, hospitality, chemical, quarrying, recycling, electronics-related, and service-sector SMEs. The review draws on a self-compiled bibliographic dataset comprising 219 entries covering EMA, green accounting, material flow cost accounting, environmental performance, and digital EMA, complemented by three established systematic literature reviews addressing EMA development, strategic decision-making, and green innovation. The synthesis identifies six major thematic dimensions: adoption drivers, implementation barriers, organisational capabilities, digital enablers, performance outcomes, and integration pathways. Building on these findings, the study integrates six theoretical perspectives—Institutional Theory, the Resource-Based View, the Natural-Resource-Based View, the Technology–Organisation–Environment framework, Stakeholder Theory, and Diffusion of Innovation Theory—into a unified conceptual framework for explaining EMA adoption in SMEs. The proposed framework conceptualises institutional pressures as external drivers, organisational capabilities as critical adoption resources, digital technologies as conditional enablers, stakeholder relationships as a mediating mechanism, and industry context as a moderator of adoption outcomes. Eight testable propositions are developed to explain the relationships among these constructs, including a configurational proposition suggesting that effective EMA adoption depends on the combined presence of institutional pressure, organisational capability, and technological readiness. The study contributes to the literature by providing an integrated theoretical explanation of EMA adoption across diverse SME contexts and by establishing a foundation for future empirical research examining cross-industry, cross-country, and longitudinal patterns of EMA implementation.

I. INTRODUCTION

1.1 Background

Environmental Management Accounting (EMA) has evolved from a relatively narrow management-control practice into an important approach for integrating environmental information into organisational decision-making and strategic management. Earlier applications primarily focused on identifying physical material flows and environmental costs, whereas contemporary EMA increasingly encompasses resource efficiency, sustainability performance, supply-chain accountability, stakeholder expectations, and digital technologies (Burritt et al., 2023). This evolution has increased the relevance of EMA for small and medium-sized enterprises (SMEs), which frequently operate under significant financial, technological, and human-resource constraints while facing growing environmental expectations from regulators, customers, investors, suppliers, and other stakeholders (Swalih et al., 2024; Van et al., 2025). The importance of EMA in the SME context is particularly significant because SMEs collectively represent a substantial component of economic activity and can generate considerable environmental impacts across diverse industries. However, their adoption of formal environmental-management and accounting practices is often constrained by limited financial resources, inadequate technical expertise, weak organisational capabilities, and restricted access to appropriate technologies. Consequently, the factors that influence EMA adoption among SMEs may differ considerably from those affecting larger organisations. Recent literature indicates that research on EMA adoption in SMEs has expanded beyond isolated case studies toward more systematic empirical investigations involving survey-based models, mediation and moderation analyses, and policy-oriented studies (Swalih et al., 2024; Van et al., 2025). At the same time, the development of EMA itself reflects a broader transition from physical-flow monitoring and environmental cost identification toward more integrated approaches that connect environmental information with strategic decision-making, sustainability reporting, supply-chain management, and digital transformation (Burritt et al., 2023). Three developments in the emerging EMA-in-SME literature provide a strong rationale for the present systematic review. First, the volume of research has increased substantially. The bibliographic dataset compiled for this study contains 219 entries addressing environmental management accounting, green accounting, material flow cost accounting (MFCA), environmental performance, and digital EMA in SME contexts. The dataset covers publications from 2003 to 2024 and includes evidence from multiple countries and industry settings, providing a sufficiently broad basis for thematic synthesis. Second, the industry coverage of the literature is more diverse than the manufacturing-focused orientation apparent in parts of the existing review literature. Although manufacturing studies remain prominent, the evidence also includes food and beverage businesses, hospitality and tourism enterprises, chemical and basic-material industries, textile and leather businesses, recycling operations, healthcare-related manufacturing, financial and service-sector organisations, and other environmentally sensitive activities. This diversity suggests that EMA adoption should not be interpreted solely through a manufacturing-oriented perspective because environmental pressures, resource requirements, stakeholder expectations, and technological conditions may vary substantially across industries. Third, the theoretical foundations of EMA adoption research remain fragmented. Existing studies draw on several theoretical perspectives, including Institutional Theory, the Resource-Based View (RBV), the Natural-Resource-Based View (NRBV), the Technology–Organisation–Environment (TOE) framework, Stakeholder Theory, and Diffusion of Innovation (DOI) Theory. However, these perspectives have generally been applied independently rather than integrated into a unified explanatory framework (Burritt et al., 2023; Van et al., 2025). As a result, the literature provides valuable explanations of individual determinants of EMA adoption but offers less clarity regarding how institutional pressures, organisational capabilities, technological conditions, stakeholder relationships, and industry characteristics interact to influence adoption and its outcomes. The present study addresses this fragmentation by systematically synthesising the available evidence and developing an integrative conceptual framework for EMA adoption among SMEs across multiple industry contexts. Rather than treating individual determinants as isolated predictors, the proposed framework considers EMA adoption as the outcome of interactions among external institutional pressures, internal organisational capabilities, technological enablers, stakeholder relationships, and industry-specific conditions.

1.2 Research Gap

The principal research gap is not the absence of studies on EMA adoption among SMEs, but the lack of an integrated theoretical explanation capable of accounting for the increasingly diverse industry and organisational contexts represented in the literature. The three anchor systematic literature reviews considered in this study address important but relatively distinct dimensions of EMA research (Burritt et al., 2023; Swalih et al., 2024; Van et al., 2025). The first review focuses primarily on the historical development and evolution of EMA concepts and frameworks. Although this work provides an important

foundation for understanding how EMA has developed, it does not fully explain how the resulting concepts can be applied to heterogeneous SME environments. The second review examines EMA in relation to strategic decision-making and highlights the importance of organisational and contextual factors but does not provide a comprehensive cross-industry theoretical architecture. The third review concentrates on the relationship between EMA and green innovation and identifies important research opportunities concerning technology, organisational conditions, and contextual influences. Collectively, these reviews demonstrate substantial progress in the field while also revealing the need for stronger theoretical integration.

A further limitation concerns the predominance of cross-sectional research designs. Although cross-sectional studies provide useful evidence regarding associations among EMA adoption variables, they provide limited insight into how adoption develops over time, how organisational capabilities evolve, and how firms respond to changing institutional and technological conditions. Longitudinal and comparative cross-country studies therefore remain important areas for future research. The geographical distribution of existing evidence also remains uneven. A considerable proportion of documented studies originates from Southeast Asian and Middle Eastern economies, whereas evidence from Sub-Saharan Africa and other developing regions remains comparatively limited. This imbalance is important because institutional environments, regulatory systems, access to technology, financial constraints, and industry structures can substantially influence the adoption of environmental accounting practices. The literature also remains relatively concentrated in manufacturing-oriented contexts. Other sectors, including hospitality, food services, chemical industries, recycling, and service businesses, have received less attention within integrated theoretical models. These industries may face substantially different environmental pressures and resource constraints. Consequently, industry context should be considered not merely as a descriptive characteristic but as a potential moderator of the relationships between EMA adoption determinants and organisational outcomes. Taken together, these gaps indicate the need for a systematic review that moves beyond the identification of individual adoption factors and develops an integrated explanation of why, how, and under what conditions SMEs adopt EMA.

1.3 Research Questions and Objectives

This study addresses the following research questions:

RQ1. What drivers and barriers influence EMA adoption among SMEs across different industry contexts?

RQ2. What organisational capabilities and digital-technology enablers support the depth and effectiveness of EMA adoption among SMEs?

RQ3. What environmental, economic, and social outcomes are associated with EMA adoption in SMEs?

RQ4. How can institutional, organisational, technological, stakeholder, and industry-related perspectives be integrated into a conceptual framework explaining EMA adoption among SMEs?

The study has two primary objectives. First, it seeks to systematically synthesise empirical evidence concerning the drivers, barriers, capabilities, technological enablers, and outcomes associated with EMA adoption among SMEs. Second, it aims to develop an integrative conceptual framework that brings together complementary theoretical perspectives and explains the relationships among the major determinants and outcomes of EMA adoption across diverse industry settings.

1.4 Scope and Contribution

The review focuses on peer-reviewed research concerning EMA and related environmental accounting practices in SME contexts. The scope encompasses environmental management accounting, green accounting, material flow cost accounting, sustainability accounting, carbon accounting, environmental performance, and digital technologies associated with environmental accounting and management. The study contributes to the literature in three principal ways. Methodologically, it applies a systematic and hybrid inductive–deductive synthesis approach to a heterogeneous body of SME research spanning multiple industries and geographical contexts. Theoretically, it integrates six complementary perspectives—Institutional Theory, RBV, NRBV, TOE, Stakeholder Theory, and DOI Theory—into a unified framework for explaining EMA adoption. Empirically and conceptually, it develops eight testable propositions that specify relationships among institutional pressures, organisational capabilities, technological enablers, stakeholder relationships, EMA adoption, and organisational outcomes. The study therefore seeks to provide a more comprehensive explanation of EMA adoption than models based on individual determinants alone. It also establishes a foundation for future empirical research examining whether the proposed relationships vary across industries, countries, organisational sizes, and levels of technological maturity.

2. METHODOLOGY

2.1 Research Design

This study adopts a systematic literature review (SLR) design following the PRISMA 2020 reporting guidelines. The review protocol is adapted to address a multi-industry SME corpus and draws on the synthesis approach documented in the strategic decision-making EMA SLR (Swalih et al., 2024). The review comprises four sequential stages: (1) development of the search strategy and selection of databases, (2) screening of studies according to predefined inclusion and exclusion criteria, (3) quality appraisal using a structured inter-rater protocol, and (4) hybrid inductive–deductive thematic synthesis.

The deductive component of the synthesis is informed by six theoretical perspectives identified in the EMA framework-genealogy literature: Institutional Theory, the Resource-Based View (RBV), the Natural-Resource-Based View (NRBV), the Technology–Organisation–Environment (TOE) framework, Stakeholder Theory, and Diffusion of Innovation (DOI) Theory (Burritt et al., 2023; Van et al., 2025). The inductive component identifies recurring themes, relationships, barriers, drivers, capabilities, technological enablers, and outcomes emerging from the reviewed literature.

The synthesis is further supported by a pre-compiled bibliographic dataset containing 219 entries. This dataset provides the basis for the descriptive statistics presented in Section 3, including publication trends, geographical distribution, industry composition, methodological characteristics, and thematic concentration.

2.2 Search Strategy and Inclusion Criteria

The literature search was conducted across five primary academic databases and supplemented through citation-chain retrieval from three anchor systematic literature reviews (Burritt et al., 2023; Swalih et al., 2024; Van et al., 2025). The search strategy combined three groups of keywords.

The first group comprised EMA-related concepts, including environmental management accounting, green accounting, material flow cost accounting, sustainability accounting, and carbon accounting. The second group consisted of SME-related terms, including small and medium enterprise, SME, and small business. The third group incorporated outcome- and technology-related terms, including environmental performance, sustainability performance, and digital transformation.

The search covered peer-reviewed publications published between January 2003 and December 2024. This period was selected to capture the development and consolidation of EMA research in SME contexts and to encompass the increasing attention given to environmental performance, resource efficiency, sustainability practices, and digital technologies (Burritt et al., 2023; Swalih et al., 2024).

Studies were included when they satisfied the following criteria:

1. The study was a peer-reviewed empirical, conceptual, or review article.
2. The study explicitly examined EMA or a substantively related construct, such as green accounting, sustainability accounting, or Material Flow Cost Accounting (MFCA).
3. The study addressed an SME context, established through the reported sample, geographical setting, or industry classification.
4. The study identified at least one relevant antecedent, process variable, capability, enabler, barrier, or outcome associated with EMA adoption.

Studies were excluded when they met one or more of the following conditions:

1. They were non-peer-reviewed grey literature, except where such material constituted part of the substantive evidence base of a peer-reviewed SLR included in the dataset.
2. They focused exclusively on large firms or listed companies without a separately identifiable SME component.
3. They were published in languages other than English.
4. They represented duplicate records identified through DOI, title, or bibliographic matching.

This screening strategy was designed to maintain sufficient breadth to capture the heterogeneous nature of EMA research while ensuring that the final corpus remained directly relevant to SME adoption.

2.3 Quality Appraisal

A structured quality-appraisal procedure was applied to assess the methodological and conceptual quality of the studies included in the review. Each entry was evaluated against nine indicators: research-design clarity, sample description, variable operationalisation, measurement validity, reliability reporting, theoretical anchoring, method–analysis alignment, clarity of findings, and articulation of contribution.

Each indicator was assessed using a 0–2 scoring scale, producing an overall quality index for each entry. A score of zero indicated that the criterion was not adequately addressed, a score of one indicated partial reporting or moderate adequacy, and a score of two indicated satisfactory reporting.

To enhance consistency between reviewers, inter-rater agreement was assessed using a calibration sample of 25 entries. Differences in assessment were resolved through discussion, with unresolved disagreements subject to third-reviewer adjudication. This procedure follows the calibration discipline documented in the strategic decision-making EMA SLR (Swalih et al., 2024).

Studies that received comparatively weak scores on combined validity and reliability indicators were not automatically removed from the descriptive corpus. Instead, they were retained for descriptive purposes but explicitly flagged during thematic synthesis. This approach allows the review to preserve potentially informative evidence while distinguishing stronger evidence from studies with methodological limitations.

2.4 Bibliographic Dataset as a Research Instrument

The descriptive component of the review is based on a self-compiled bibliographic dataset containing 219 entries related to EMA, green accounting, Material Flow Cost Accounting, environmental performance, and digital EMA in SME contexts.

The dataset was used to characterise the literature according to several dimensions, including:

- publication volume and temporal trends;
- geographical distribution;
- industry composition;
- research-method distribution;
- theoretical orientation;
- thematic concentration; and
- relationships among EMA adoption drivers, barriers, capabilities, technological enablers, and outcomes.

The dataset therefore serves as a research instrument for organising and characterising the evidence base rather than as an independent source of empirical findings. Claims concerning individual studies and their findings are interpreted through the underlying literature and the three anchor SLRs.

The distinction between the descriptive corpus and the thematic evidence base is important. Corpus-level statistics describe the composition of the 219-entry dataset, whereas the thematic synthesis focuses on recurring relationships and patterns relevant to EMA adoption in SMEs.

2.5 Data Synthesis and Analytical Procedure

The analysis combines inductive and deductive approaches. The inductive stage identifies recurring themes emerging from the literature without imposing a predetermined explanatory structure. The deductive stage subsequently maps these themes onto the six theoretical perspectives used in the study.

The synthesis resulted in six principal thematic clusters:

1. EMA adoption drivers
2. Barriers to adoption
3. Organisational capabilities
4. Digital and technological enablers
5. Environmental, economic, and social outcomes
6. Integration pathways connecting antecedents, adoption, and outcomes

The thematic clusters were subsequently examined in relation to the theoretical perspectives. Institutional Theory was used to interpret external regulatory, normative, and market pressures; RBV and NRBV were used to explain the role of internal resources and environmental capabilities; the TOE framework was applied to technological, organisational, and environmental conditions; Stakeholder Theory was used to interpret stakeholder-related pressures and relationships; and DOI Theory provided a basis for understanding the diffusion and adoption of EMA-related technologies and practices.

This combined analytical procedure enables the review to move beyond a descriptive catalogue of determinants and toward an integrated explanation of the conditions under which EMA adoption is likely to occur.

2.6 Development of the Conceptual Framework

The conceptual framework was developed by integrating the relationships identified through the thematic synthesis with the explanatory mechanisms offered by the six theoretical perspectives.

The framework distinguishes between antecedent conditions, adoption mechanisms, enabling conditions, mediating relationships, and outcomes. Institutional pressures represent the principal external antecedent, while organisational capabilities represent the internal resource base required to acquire and implement EMA. Digital technologies are positioned as conditional enablers rather than universally applicable drivers. Stakeholder relationships provide a connecting mechanism through which external expectations can influence organisational adoption decisions.

Industry context is incorporated as a moderating condition because the environmental pressures, resource structures, regulatory requirements, technological needs, and stakeholder expectations associated with EMA can differ substantially across industries.

Based on these relationships, the study develops eight testable propositions. The final proposition specifies a configurational relationship in which institutional pressure, organisational capability, and technological readiness are expected to operate jointly rather than as completely independent predictors of EMA adoption.

2.7 Analytical Logic of the Review

The overall analytical logic can therefore be represented as:

Institutional pressures → Organisational capabilities → EMA adoption

with digital technology functioning as a conditional enabler, stakeholder relationships providing a mediating layer, and industry context moderating the relationship between EMA adoption and its outcomes.

The framework also incorporates a feedback mechanism through which successful environmental, economic, and social outcomes can strengthen organisational resources and institutional legitimacy, potentially reinforcing subsequent EMA adoption and deeper implementation.

This analytical structure provides the foundation for the thematic synthesis presented in Section 4 and the conceptual framework and propositions developed in Sections 5 and 6.

3. DESCRIPTIVE FINDINGS

3.1 Publication Trends

The corpus of 219 entries demonstrates a clear increase in publication activity from 2012 onward, with the highest concentration of research on EMA adoption in SMEs occurring between 2018 and 2023. This upward trajectory is consistent with the broader development of sustainability-oriented accounting research and reflects the increasing recognition of EMA as a relevant mechanism for integrating environmental considerations into organisational decision-making (Burritt et al., 2023; Swalih et al., 2024).

The growth in publications also indicates that EMA research has gradually developed from a relatively specialised area of environmental accounting into a broader field encompassing resource efficiency, environmental performance, strategic decision-making, green innovation, and digital technologies. More recent studies increasingly examine EMA not only as an accounting practice but also as an organisational capability that can support sustainability-oriented decision-making and performance improvement.

The temporal distribution of the corpus therefore suggests that EMA-in-SME research has entered a period of greater empirical activity and theoretical development. However, the concentration of recent studies also indicates that many questions concerning long-term adoption, organisational evolution, and cross-industry differences remain insufficiently explored.

3.2 Geographical Distribution

The geographical distribution of the reviewed literature is uneven. A substantial proportion of the empirical studies originates from South-East Asian and Middle Eastern countries, with comparatively fewer studies focusing on Sub-Saharan Africa and other developing regions.

This geographical concentration is important because the institutional and economic conditions surrounding SME operations differ considerably across countries. Regulatory enforcement, access to financial resources, availability of professional expertise, technological infrastructure, environmental awareness, and stakeholder expectations can all influence the adoption

and implementation of EMA.

The concentration of evidence in particular geographical regions therefore limits the extent to which existing findings can be generalised across national contexts. Cross-country comparative research is particularly necessary to determine whether the relationships identified in the current literature are context-specific or represent broader patterns of SME EMA adoption.

The geographical imbalance also reinforces the need to distinguish between institutional drivers and firm-level capabilities. Regulatory pressure may be a strong adoption driver in jurisdictions with stringent environmental requirements, whereas customer expectations, cost efficiency, or managerial awareness may assume greater importance in less regulated environments.

3.3 Industry Distribution

The corpus covers a broader range of industries than a purely manufacturing-oriented review would capture. Manufacturing remains the dominant industry category, but the dataset also includes food and beverage, hospitality and tourism, basic and chemical processing, textile and leather manufacturing, recycling operations, healthcare-related manufacturing, banking and service activities, and other environmentally sensitive sectors.

The diversity of industry settings is significant because environmental impacts and resource-use patterns vary substantially across sectors. Manufacturing firms, for example, are more likely to encounter material-loss, energy-consumption, waste-generation, and production-efficiency issues. Hospitality businesses may place greater emphasis on water, energy, food waste, and stakeholder expectations, while recycling operations are particularly concerned with material recovery and process efficiency.

These differences suggest that the determinants and consequences of EMA adoption should not necessarily be assumed to be homogeneous across industries. Instead, industry context may influence both the relative importance of adoption drivers and the depth of EMA implementation.

Accordingly, the present review treats industry as a potential moderating condition rather than merely a descriptive characteristic. This approach provides the basis for the industry-moderator component of the conceptual framework developed later in the study.

3.4 Methodological Distribution

The reviewed literature is predominantly characterised by cross-sectional empirical designs, particularly questionnaire-based studies examining relationships between environmental accounting practices and organisational or environmental variables. Quantitative approaches are frequently used to evaluate adoption determinants, perceived benefits, organisational characteristics, institutional pressures, and environmental outcomes.

Qualitative case studies and conceptual contributions provide complementary evidence, particularly regarding implementation processes, organisational barriers, management practices, and the practical application of EMA techniques such as Material Flow Cost Accounting.

Despite the breadth of methodological approaches, longitudinal evidence remains comparatively limited. This represents an important methodological gap because EMA adoption is unlikely to be a single-stage decision. Rather, implementation may develop progressively as firms acquire knowledge, invest in technologies, develop organisational capabilities, and respond to changing institutional and stakeholder expectations.

Similarly, comparative cross-country and cross-industry studies remain relatively scarce. Greater use of comparative and longitudinal designs would therefore improve understanding of how contextual conditions influence the development and maturity of EMA practices over time.

3.5 Thematic Concentration

The thematic synthesis identifies six broad areas of concentration within the literature:

Drivers of EMA adoption

Barriers to implementation

Organisational capabilities

Digital and technological enablers

Environmental, economic, and social outcomes

Integration pathways linking adoption determinants to outcomes

The first two themes represent the most established part of the literature. Existing studies frequently examine regulatory requirements, stakeholder expectations, cost considerations, managerial commitment, resource limitations, knowledge gaps, and technological constraints as factors influencing EMA adoption.

More recent research has expanded attention toward organisational capabilities and digital technologies. This shift reflects the growing recognition that the availability of environmental information alone does not guarantee effective EMA implementation. SMEs must possess the organisational capacity, technical expertise, managerial support, and information infrastructure required to collect, process, interpret, and use environmental information.

The literature also increasingly considers the outcomes associated with EMA adoption. These include environmental performance improvements, resource efficiency, cost reduction, innovation, sustainability performance, and stakeholder-related benefits. However, the strength and consistency of these relationships vary across studies and contexts.

3.6 Overall Descriptive Interpretation

Taken together, the descriptive findings indicate that EMA research in SMEs is growing, geographically concentrated, methodologically dominated by cross-sectional studies, and increasingly diversified across industries and technological contexts.

Three broad patterns emerge from the corpus.

First, EMA adoption is influenced by a combination of external pressures and internal organisational conditions. Regulatory requirements, customer expectations, supply-chain pressures, and stakeholder demands may create incentives for adoption, while financial resources, managerial commitment, expertise, and organisational capabilities determine whether firms can respond effectively.

Second, the role of digital technology is becoming increasingly important. Digital systems can improve data collection, monitoring, environmental-cost identification, reporting, and decision support. However, technology should not be interpreted as an independent or universally sufficient driver of EMA adoption. Its effectiveness depends on organisational readiness, available resources, technical expertise, and the institutional environment in which the SME operates.

Third, the literature suggests that EMA adoption and its outcomes are context-dependent. Differences in industry characteristics, regulatory environments, resource structures, and stakeholder expectations may alter both the adoption process and the benefits obtained from EMA.

These findings provide the empirical foundation for the thematic synthesis presented in the following section. More importantly, they support the need for a theoretical framework that moves beyond isolated determinants and explains how institutional pressures, organisational capabilities, technological conditions, stakeholder relationships, and industry characteristics interact to shape EMA adoption and its outcomes.

4. THEMATIC SYNTHESIS

The thematic synthesis identifies six interconnected dimensions of EMA adoption in SMEs: adoption drivers, implementation barriers, organisational capabilities, digital-technology enablers, organisational outcomes, and integration pathways. Rather than treating these factors as independent determinants, the synthesis indicates that EMA adoption is shaped by the interaction between external institutional expectations and the internal ability of SMEs to respond to those expectations. Digital technologies further influence this process by strengthening information-processing and monitoring capabilities, while stakeholder relationships connect organisational practices with external accountability and legitimacy.

4.1 Drivers of EMA Adoption

The literature identifies three broad categories of drivers: institutional and regulatory pressures, market and stakeholder expectations, and economic and efficiency considerations. These drivers are not necessarily independent. In many SME contexts, regulatory requirements create the initial motivation to consider EMA, while stakeholder expectations and anticipated efficiency gains strengthen the organisational rationale for implementation.

4.1.1 Regulatory and Institutional Drivers

Environmental regulation is one of the most frequently identified antecedents of EMA adoption. Regulatory requirements, sustainability-disclosure obligations, environmental policies, and compliance expectations can encourage SMEs to establish environmental accounting practices to demonstrate compliance and maintain organisational legitimacy (Swalih et al., 2024; Van et al., 2025).

Institutional pressures can operate through three principal mechanisms. Coercive pressure arises from government regulation, statutory requirements, and supply-chain compliance conditions. Mimetic pressure occurs when SMEs imitate environmental practices adopted by competitors or industry peers. Normative pressure develops through professional accounting bodies, consultants, industry associations, and the wider diffusion of accepted environmental-management practices.

These mechanisms suggest that institutional pressure may influence EMA adoption even when the immediate financial return from implementation is uncertain. SMEs may adopt EMA because environmental accounting has become an expected organisational practice within their regulatory, professional, or commercial environment.

4.1.2 Market and Stakeholder Drivers

Market expectations constitute a second important driver of EMA adoption. Customers, investors, suppliers, employees, regulators, and other stakeholders increasingly expect firms to demonstrate responsible environmental practices. For SMEs participating in supply chains, environmental information may also become necessary for maintaining relationships with larger customers and business partners.

Stakeholder pressure can therefore translate environmental concerns into practical accounting requirements. Firms may need reliable information concerning resource consumption, waste generation, emissions, and environmental costs to respond to customer enquiries, supplier requirements, sustainability assessments, or other forms of external scrutiny.

The literature consequently suggests that stakeholder expectations can complement formal regulation. While regulatory pressure may establish a minimum level of environmental accountability, stakeholder expectations can encourage firms to move beyond minimum compliance and develop more systematic environmental information practices.

4.1.3 Resource Efficiency and Cost Drivers

Economic considerations provide another important motivation for EMA adoption. Environmental accounting can help SMEs identify material losses, excessive resource consumption, energy inefficiencies, waste-related costs, and other hidden environmental expenditures. Material Flow Cost Accounting (MFCA), in particular, provides a mechanism for linking physical material flows with associated monetary costs and identifying opportunities for process improvement.

Evidence from SME contexts indicates that MFCA can support both environmental improvement and economic efficiency by making material losses and process inefficiencies more visible (Sulong et al., 2015). Similarly, EMA applications have been associated with eco-efficiency and improved understanding of environmental costs (Burritt & Saka, 2006).

This economic dimension is particularly relevant to SMEs because environmental investments are more likely to receive managerial support when they can be connected to measurable operational benefits. Cost reduction, productivity improvement, resource conservation, and waste minimisation can therefore strengthen the business case for EMA adoption.

4.2 Barriers to EMA Adoption

Despite the potential benefits of EMA, SMEs face several barriers that can limit both adoption and implementation depth. The most prominent barriers identified in the literature concern financial resources, technical knowledge, organisational readiness, and perceived complexity.

4.2.1 Financial and Resource Constraints

Financial limitations represent a major obstacle for SMEs. Unlike larger organisations, SMEs often have limited budgets for specialised accounting systems, environmental monitoring technologies, employee training, and external consultancy.

The implementation of EMA may therefore be perceived as an additional administrative or technological cost, particularly when the benefits are uncertain or expected to emerge over a longer period. Evidence from South African SMEs indicates that resource constraints can influence the extent to which firms adopt environmental management accounting practices, with simpler and less costly forms of environmental information being more accessible than sophisticated monetary accounting systems (Nyahuna & Doorasamy, 2021).

Consequently, the availability of financial resources does not merely influence whether EMA is adopted; it can also determine the depth and sophistication of adoption.

4.2.2 Knowledge and Technical Expertise

A second major barrier is the limited availability of environmental accounting knowledge and technical expertise. SME managers and accounting personnel may possess conventional financial-accounting skills but have limited experience with environmental-cost identification, physical-flow measurement, carbon accounting, or MFCA.

Lack of awareness can reduce perceived usefulness and increase the perceived complexity of EMA. Conversely, greater awareness and understanding of EMA practices can facilitate implementation. Evidence from Thai SMEs, for example, indicates a positive relationship between awareness of EMA and its implementation (Klongyut & Jantori, 2024).

Training and professional development are therefore important mechanisms for reducing knowledge-related barriers.

4.2.3 Organisational Resistance and Implementation Complexity

EMA adoption may also be constrained by organisational resistance. Introducing environmental accounting can require changes to existing accounting procedures, information flows, managerial responsibilities, and performance-evaluation systems.

Resistance is particularly likely when EMA is viewed as an additional reporting requirement rather than as a decision-support mechanism. Successful implementation therefore requires management commitment and organisational willingness to integrate environmental information into routine business decisions.

The evidence suggests that adoption should consequently be understood as a process rather than a binary event. SMEs may begin with basic environmental data collection and gradually progress toward more sophisticated forms of environmental cost accounting, digital integration, and strategic use of EMA information.

4.3 Organisational Capabilities

The literature indicates that external pressure alone is insufficient to produce effective EMA adoption. SMEs require internal capabilities that allow them to acquire, interpret, and use environmental information.

Three capabilities are particularly important: management commitment, environmental awareness and organisational learning, and information-management capability.

4.3.1 Management Commitment

Leadership commitment is a critical organisational condition for EMA adoption. Senior managers determine whether environmental information is treated as strategically relevant and whether financial and human resources are allocated to environmental accounting initiatives.

Where senior management recognises environmental performance as a strategic concern, EMA is more likely to be incorporated into budgeting, investment, procurement, production, and performance-evaluation decisions.

4.3.2 Environmental Awareness and Organisational Learning

Environmental awareness enables organisations to recognise the relationship between operational activities, resource consumption, environmental impacts, and associated costs. Organisational learning further allows firms to convert this awareness into improved processes and routines.

This capability is particularly important for SMEs because formal environmental-management structures may be less developed than those of larger firms. In such circumstances, managerial awareness and employee knowledge can compensate, to some extent, for the absence of highly formalised systems.

4.3.3 Information-Management Capability

EMA depends on an organisation's ability to collect accurate environmental data, connect physical and monetary information, analyse resource flows, and communicate findings to decision-makers.

This capability becomes increasingly important as EMA moves from basic monitoring toward integrated digital systems. SMEs that lack appropriate information infrastructure may find it difficult to produce timely and reliable environmental information even when management is supportive of EMA.

4.4 Digital-Technology Enablers

Digital technologies represent an increasingly important dimension of EMA adoption. The literature identifies technologies

such as cloud-based accounting systems, Internet of Things (IoT) devices, enterprise systems, blockchain applications, and environmental data analytics as potential mechanisms for improving environmental information management.

Digitalisation can facilitate real-time data collection, automated monitoring, information integration, reporting accuracy, and managerial decision-making. These capabilities can reduce some of the information-processing burdens associated with EMA and make environmental information more accessible to SME managers.

However, the evidence does not support treating technology as an independent or sufficient determinant of EMA adoption. The benefits of digital tools depend on organisational readiness, financial resources, employee expertise, and the institutional environment.

Digital technology should therefore be conceptualised as a conditional enabler. Its contribution is likely to be greatest when SMEs possess sufficient organisational capability to absorb and apply the technology and when institutional or stakeholder pressures provide a clear rationale for investment.

4.5 Outcomes of EMA Adoption

The literature associates EMA adoption with three broad categories of outcomes: environmental, economic, and social performance.

4.5.1 Environmental Performance

EMA can improve environmental performance by providing organisations with more systematic information about resource consumption, emissions, waste, water use, and other environmental impacts. Improved visibility of these flows can help managers identify inefficiencies and design targeted interventions.

4.5.2 Economic Performance

Economic outcomes include cost reduction, improved resource productivity, reduced material losses, operational efficiency, and potentially improved market access. The economic benefits of EMA are particularly relevant to SMEs because they can provide a direct business rationale for environmental investment.

Research on EMA and eco-efficiency demonstrates that environmental information can support both environmental improvement and operational efficiency (Burritt & Saka, 2006). Similarly, MFCA provides a mechanism for identifying the monetary consequences of material losses and therefore creates a direct connection between environmental and economic performance (Sulong et al., 2015).

4.5.3 Social and Stakeholder Outcomes

EMA may also generate social and stakeholder-related benefits. Improved environmental information can strengthen transparency, stakeholder confidence, supply-chain accountability, and organisational legitimacy.

These outcomes are particularly relevant where SMEs operate within supply chains in which environmental performance increasingly influences business relationships. Environmental accounting can therefore function not only as an internal management tool but also as a mechanism supporting external accountability.

4.6 Institutional Theory and Theoretical Integration

Institutional Theory provides an important explanation for why SMEs respond to environmental expectations even when immediate economic benefits are uncertain. Organisations operate within institutional environments characterised by regulatory requirements, professional norms, market expectations, and established organisational practices.

Coercive, mimetic, and normative pressures can therefore influence the decision to adopt EMA (DiMaggio & Powell, 1983). Regulatory requirements represent coercive pressure, imitation of peer organisations represents mimetic pressure, and professional accounting guidance and consultancy dissemination represent normative pressure.

However, Institutional Theory alone does not fully explain differences in adoption depth among SMEs. Two firms exposed to similar institutional pressures may respond differently because they possess different levels of financial resources, managerial expertise, technological readiness, and environmental capabilities.

This limitation creates a strong rationale for integrating Institutional Theory with other theoretical perspectives. RBV explains the role of internal resources and organisational capabilities (Barney, 1991), while NRBV extends this logic to environmental capabilities such as pollution prevention and product stewardship (Hart, 1995). The TOE framework explains how

technological, organisational, and environmental conditions influence technology adoption (Tornatzky et al., 1990). Stakeholder Theory explains how external stakeholder expectations shape organisational responses, while DOI Theory helps explain the diffusion and adoption of new technologies and practices.

The resulting theoretical integration suggests that EMA adoption should not be explained through a single causal mechanism. Instead, adoption is likely to emerge from the interaction between external pressure, internal capability, technological readiness, stakeholder expectations, and industry context.

4.6.1 Research Gap and Framework Development

The thematic synthesis identifies three major gaps in the existing literature.

First, EMA-in-SME research remains theoretically fragmented. Although multiple theoretical perspectives are used across individual studies, they are generally applied independently rather than combined within a single explanatory architecture.

Second, the empirical literature remains heavily dependent on cross-sectional research. Longitudinal evidence is comparatively limited, restricting understanding of how EMA adoption develops over time and how organisational capabilities evolve after initial implementation.

Third, cross-industry and cross-country comparative evidence remains insufficient. Manufacturing has received substantial attention, whereas sectors such as hospitality, food services, recycling, chemical processing, and other environmentally sensitive activities remain comparatively under-theorised within integrated models.

These gaps provide the basis for the conceptual framework developed in the following sections. The framework treats institutional pressure as an antecedent, organisational capability as a central adoption mechanism, digital technology as a conditional enabler, stakeholder relationships as a connecting layer, and industry context as a moderator of outcomes.

This approach moves beyond simple additive explanations of EMA adoption and provides a basis for examining how multiple conditions jointly influence the depth and effectiveness of EMA implementation in SMEs.

5. CONCEPTUAL FRAMEWORK

The preceding literature synthesis indicates that Environmental Management Accounting (EMA) adoption among small and medium-sized enterprises (SMEs) is shaped by a combination of external pressures, internal organisational conditions, technological capabilities, and contextual characteristics. Institutional requirements and stakeholder expectations can create incentives for adoption, whereas organisational resources, managerial commitment, employee competencies, and technological readiness influence an SME's ability to translate these pressures into effective EMA practices. The resulting adoption can, in turn, contribute to environmental, economic, and social outcomes.

Building on the evidence synthesised in Sections 4.1–4.6, this study develops an integrative conceptual framework for explaining EMA adoption in SMEs. Institutional Theory provides an important foundation for understanding external pressures, particularly coercive, mimetic, and normative forces that influence organisational behaviour (DiMaggio & Powell, 1983). However, institutional pressure alone cannot adequately explain differences in the extent and effectiveness of EMA adoption across SMEs. Firms operating under similar institutional conditions may respond differently because they possess different levels of organisational resources, capabilities, technological readiness, and stakeholder engagement.

The proposed framework therefore integrates complementary theoretical perspectives to provide a broader explanation of EMA adoption. The Resource-Based View (RBV) highlights the importance of internal resources and organisational capabilities (Barney, 1991), while the Natural-Resource-Based View (NRBV) extends this perspective by emphasising environmental capabilities as potential sources of competitive advantage (Hart, 1995). The Technology–Organisation–Environment (TOE) framework provides a basis for examining technological, organisational, and external contextual conditions associated with adoption (Tornatzky et al., 1990). Stakeholder Theory explains the influence of customers, suppliers, regulators, investors, employees, and other stakeholders, while Diffusion of Innovation (DOI) Theory helps explain the adoption and diffusion of new technologies and management practices.

5.1 Structure of the Conceptual Framework

The framework comprises five principal components: institutional pressures, organisational capabilities, digital-technology enablers, EMA adoption, and organisational outcomes, with industry context incorporated as a moderating condition.

Institutional pressures represent the principal external antecedent of EMA adoption. These pressures include environmental regulations, compliance requirements, professional norms, customer expectations, supply-chain requirements, and

competitive imitation. Such pressures can create incentives for SMEs to develop more systematic environmental information and accounting practices.

Organisational capabilities represent the internal conditions that determine an SME's capacity to respond to these external pressures. The construct encompasses leadership commitment, environmental culture, employee competencies, organisational resources, management support, and information-management capabilities. SMEs with stronger organisational capabilities are expected to be better positioned to implement and institutionalise EMA.

Digital-technology enablers represent the technological infrastructure that can facilitate EMA implementation. Industry 4.0 technologies, Internet of Things (IoT) applications, cloud-based systems, blockchain, environmental data analytics, and other digital tools can improve environmental data collection, processing, monitoring, reporting, and decision support. However, the framework treats digital technology as a conditional enabler rather than an independent determinant, because its effectiveness depends on organisational readiness and the availability of appropriate resources.

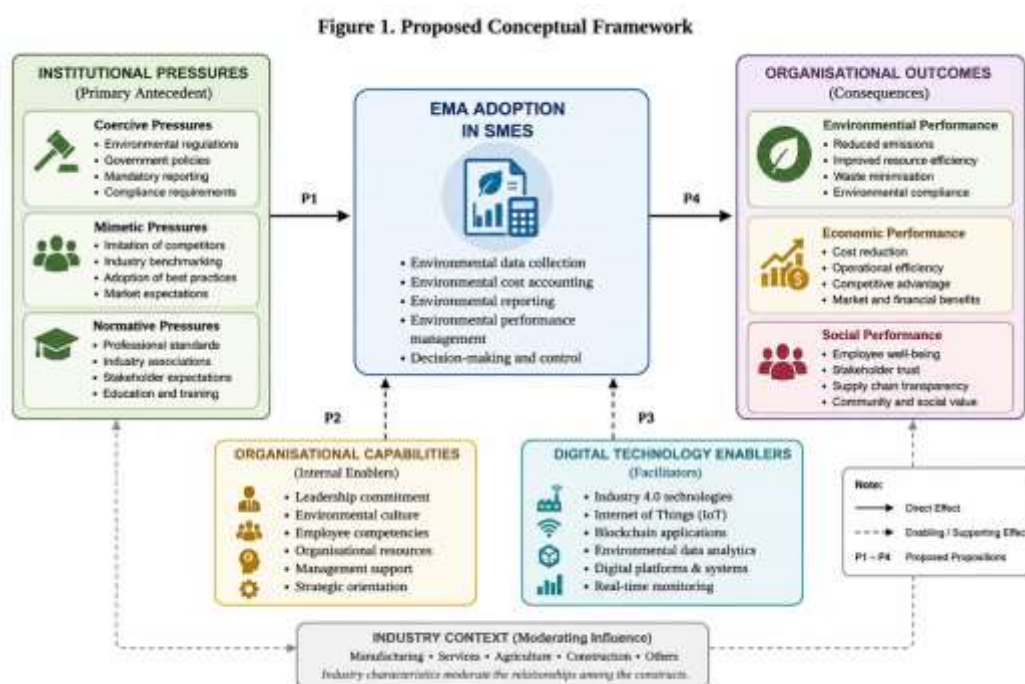
These antecedent and enabling conditions are expected to influence the extent of EMA adoption. Adoption is understood not simply as the initial decision to use EMA but as the extent to which environmental information is systematically incorporated into accounting systems, operational processes, managerial decisions, and strategic activities.

EMA adoption is subsequently expected to contribute to environmental, economic, and social outcomes. Environmental outcomes may include improved resource efficiency, reduced waste, lower emissions, and better environmental performance. Economic outcomes may include cost reduction, improved operational efficiency, reduced material losses, and enhanced productivity. Social and stakeholder outcomes may include improved transparency, stakeholder confidence, organisational legitimacy, and supply-chain accountability.

Finally, industry context is incorporated as a moderating variable. The strength of the relationships within the framework may vary according to differences in environmental impact, regulatory intensity, resource requirements, technological complexity, stakeholder expectations, and operational characteristics across industries. EMA adoption in manufacturing, for example, may be strongly associated with material and energy efficiency, whereas hospitality, food services, recycling, and service-sector organisations may face different environmental priorities.

The resulting framework therefore proposes that EMA adoption is not the consequence of a single factor. Rather, it emerges from the interaction of institutional pressure, organisational capability, technological readiness, and stakeholder-related expectations within a specific industry context.

Figure 1. Proposed Integrative Conceptual Framework for EMA Adoption in SMEs



5.2 Research Propositions

Based on the thematic synthesis and the integrated theoretical framework, eight research propositions are developed. These propositions translate the major relationships identified in the literature into empirically testable statements.

Proposition 1 (P1): Institutional Pressures and EMA Adoption

Institutional pressures positively influence the adoption of Environmental Management Accounting among SMEs.

Coercive pressures arising from environmental regulations and compliance requirements, normative pressures associated with professional and industry expectations, and mimetic pressures arising from competitive imitation can encourage SMEs to adopt EMA practices. Institutional Theory suggests that organisations respond to external pressures in order to maintain legitimacy and alignment with their institutional environment (DiMaggio & Powell, 1983).

Proposition 2 (P2): Organisational Capabilities and EMA Adoption

Organisational capabilities positively influence the adoption and implementation depth of Environmental Management Accounting among SMEs.

Leadership commitment, environmental awareness, employee competencies, financial resources, organisational learning, and information-management capabilities can strengthen an SME's ability to introduce and institutionalise EMA practices. From an RBV perspective, these resources and capabilities represent internal conditions that enable firms to convert external requirements into organisational action (Barney, 1991).

Proposition 3 (P3): Digital-Technology Enablers and EMA Adoption

Digital-technology capabilities positively influence the adoption and implementation depth of Environmental Management Accounting among SMEs, subject to organisational readiness.

Digital technologies can facilitate environmental data collection, real-time monitoring, cost identification, information integration, reporting, and decision support. However, their contribution is expected to depend on the SME's technological infrastructure, financial capacity, employee competencies, and management readiness.

Proposition 4 (P4): EMA Adoption and Environmental Performance

The adoption of Environmental Management Accounting positively influences the environmental performance of SMEs.

EMA can provide managers with more systematic information concerning resource consumption, material losses, waste generation, emissions, energy use, and other environmental impacts. Greater visibility of environmental information can support more effective resource management and environmental decision-making.

Proposition 5 (P5): EMA Adoption and Economic Performance

The adoption of Environmental Management Accounting positively influences the economic and operational performance of SMEs.

By identifying environmental costs, material losses, resource inefficiencies, and waste-related expenditures, EMA can support cost reduction, process improvement, resource productivity, and operational efficiency. MFCA provides a particularly relevant mechanism for connecting physical resource flows with monetary consequences (Sulong et al., 2015; Burritt & Saka, 2006).

Proposition 6 (P6): EMA Adoption and Stakeholder Outcomes

The adoption of Environmental Management Accounting positively influences stakeholder-related outcomes among SMEs.

The systematic generation and use of environmental information can strengthen transparency, accountability, stakeholder confidence, organisational legitimacy, and supply-chain relationships. Stakeholder expectations may therefore influence adoption while also representing an important outcome of improved environmental information practices.

Proposition 7 (P7): Industry Context as a Moderator

Industry context moderates the relationships between EMA adoption determinants and EMA-related outcomes among SMEs.

Differences in environmental impact, regulatory intensity, resource consumption, technological requirements, stakeholder expectations, and competitive conditions can alter the importance of particular EMA adoption mechanisms and the outcomes

achieved through implementation. Consequently, relationships identified in one industry should not automatically be assumed to apply with equal strength across other industries.

Proposition 8 (P8): Configurational Interaction among Institutional Pressure, Organisational Capability, and Technological Readiness

The effective adoption of EMA among SMEs is more likely when institutional pressure, organisational capability, and technological readiness are jointly present than when any one of these conditions operates independently.

This proposition represents the configurational element of the framework. Institutional pressure may create the motivation to adopt EMA, but organisational capability determines whether the SME can respond effectively, while technological readiness can facilitate the collection, integration, and use of environmental information. The proposition therefore suggests that EMA adoption may depend on the combined presence of external motivation and internal implementation capacity, rather than on isolated determinants.

5.3 Theoretical Integration

The framework brings together six complementary theoretical perspectives rather than treating any single theory as sufficient to explain EMA adoption.

Institutional Theory explains why SMEs experience pressure to adopt EMA through regulation, professional norms, stakeholder expectations, and competitive imitation (DiMaggio & Powell, 1983).

RBV explains whether SMEs possess the internal resources and capabilities required to respond to those pressures (Barney, 1991).

NRBV extends this explanation by positioning environmental capabilities as strategically relevant organisational resources (Hart, 1995).

TOE explains the role of technological, organisational, and environmental conditions in determining whether SMEs can successfully adopt technology-supported EMA practices (Tornatzky et al., 1990).

Stakeholder Theory explains how external stakeholders create environmental information demands and how EMA can strengthen accountability and stakeholder relationships.

Finally, DOI Theory explains how EMA-related technologies and practices may spread and become accepted within organisations.

The integration of these perspectives produces a multi-level explanation in which external institutional conditions interact with internal capabilities and technological readiness to influence EMA adoption. Adoption then generates environmental, economic, and stakeholder outcomes, while industry context determines the strength and form of these relationships.

5.4 Expected Contribution of the Framework

The proposed framework makes several contributions to EMA research.

First, it provides an integrated theoretical explanation of SME EMA adoption by connecting external institutional pressures with internal organisational capabilities and technological conditions. This addresses the fragmentation that characterises much of the existing literature.

Second, the framework moves beyond a simple adoption-versus-non-adoption distinction by considering implementation depth and the organisational use of environmental information. This distinction is important because SMEs may adopt basic environmental accounting practices without fully integrating EMA into strategic and operational decision-making.

Third, the framework incorporates digital technology as a conditional enabler rather than assuming that technological availability automatically produces effective EMA adoption. This provides a more realistic explanation of digital EMA implementation in resource-constrained SME environments.

Fourth, the inclusion of industry context as a moderator provides a basis for examining whether EMA adoption mechanisms and outcomes differ across manufacturing, food and beverage, hospitality, chemical, recycling, and service-sector SMEs.

Finally, the eight propositions provide a structured foundation for future empirical research. They can be examined through quantitative surveys, structural equation modelling, configurational methods such as fsQCA, longitudinal research designs, and comparative cross-industry or cross-country studies.

6. INTEGRATIVE MULTI-LENS FRAMEWORK

The systematic synthesis indicates that no single theoretical perspective is sufficient to explain the complexity of Environmental Management Accounting (EMA) adoption among small and medium-sized enterprises (SMEs). Institutional Theory explains the external pressures that motivate organisations to respond to environmental expectations, while the Resource-Based View (RBV), Natural-Resource-Based View (NRBV), Technology–Organisation–Environment (TOE) framework, Stakeholder Theory, and Diffusion of Innovation (DOI) Theory provide complementary explanations of organisational capability, environmental capability, technological readiness, stakeholder influence, and technology adoption. Accordingly, this study extends the initial Institutional Theory-based framework presented in Section 5 by developing an integrative multi-lens framework. The framework conceptualises EMA adoption as a process in which institutional pressures create external motivation, organisational capabilities provide the internal capacity for implementation, digital technologies enable information acquisition and processing, and stakeholder relationships connect these conditions with organisational adoption decisions.

The framework further distinguishes EMA adoption from EMA adoption depth. Adoption depth refers to the extent to which environmental accounting practices are embedded within organisational processes rather than merely being formally introduced. It therefore captures progression from basic physical-flow monitoring toward more comprehensive environmental-cost management, life-cycle accountability, and integrated sustainability reporting.

6.1 Structure of the Integrative Framework

The framework consists of four principal antecedent-side components, one focal adoption construct, a stakeholder-relational layer, an industry moderator, three outcome dimensions, and a feedback mechanism.

6.1.1 Institutional pressures

Institutional pressures constitute the primary external antecedent. These pressures include:

- coercive pressures, such as environmental regulation, mandatory disclosure requirements, and supply-chain compliance;
- mimetic pressures, arising from the adoption of EMA-related practices by competitors and peer organisations; and
- normative pressures, generated through professional accounting bodies, consultants, industry associations, and wider professional expectations.

These pressures create incentives for SMEs to adopt EMA in order to comply with external requirements, maintain legitimacy, respond to stakeholder expectations, and remain aligned with prevailing industry practices.

6.1.2 Organisational capabilities

Organisational capabilities represent the internal resource base that enables SMEs to translate external pressure into implementation. Consistent with RBV and NRBV perspectives, the framework incorporates:

- leadership commitment;
- environmental culture;
- managerial environmental awareness;
- employee competencies;
- organisational resources;
- pollution-prevention capabilities; and
- product-stewardship capabilities.

These capabilities determine the extent to which SMEs can absorb, implement, and institutionalise EMA practices.

6.1.3 Digital-technology enablement

Digital technology represents a complementary enabling mechanism within the framework. Relevant technologies include Industry 4.0 and Industry 5.0 instrumentation, Internet of Things (IoT) systems, blockchain applications, cloud-based information systems, and environmental-data analytics.

These technologies can facilitate continuous environmental-data collection, information integration, monitoring, reporting, and decision support. However, the framework does not treat digital technology as a universally independent driver. Instead,

digital enablement is conditional upon organisational readiness, resource availability, leadership support, and employee capabilities.

This positioning is important because technological availability does not automatically result in effective EMA implementation.

6.1.4 Stakeholder-relational mediation

Stakeholder relationships provide the connecting layer between external pressures, organisational capabilities, technological adoption, and EMA implementation. Regulators, customers, suppliers, investors, employees, and supply-chain partners can create expectations for greater environmental transparency and accountability.

These expectations influence how SMEs interpret institutional pressure and determine whether EMA is perceived as merely a compliance requirement or as a strategically valuable management practice.

The stakeholder-relational layer therefore represents a mediating mechanism through which institutional and organisational conditions are translated into adoption decisions.

6.2 EMA Adoption Depth

The focal construct of the framework is EMA adoption depth rather than simple EMA adoption.

This distinction is important because the presence of an environmental accounting practice does not necessarily indicate meaningful organisational integration. SMEs may initially adopt basic environmental monitoring while subsequently developing more sophisticated accounting and reporting practices.

Accordingly, adoption depth can be conceptualised across three broad levels:

Level 1: Physical-flow tracking

Monitoring material, energy, water, waste, and other environmental flows.

Level 2: Life-cycle accountability

Connecting environmental information with production processes, product life cycles, supply chains, and environmental costs.

Level 3: Integrated sustainability reporting and decision support

Embedding environmental information within strategic planning, performance evaluation, investment decisions, reporting, and broader sustainability management.

This progression provides a more meaningful representation of implementation maturity than a binary adoption measure.

6.3 Industry-Vertical Moderation

Industry vertical is positioned as a moderator between EMA adoption depth and organisational outcomes.

The underlying rationale is that the environmental relevance of accounting information differs across industries. Manufacturing SMEs may obtain substantial benefits from material-flow analysis, energy monitoring, pollution prevention, and production-efficiency improvements. Food and beverage and recycling businesses may derive significant value from waste and resource-flow management. Hospitality and food-service firms may place greater emphasis on water, energy, food waste, and market-access considerations. Service-sector organisations, including banking, may experience comparatively stronger stakeholder and market-access effects than direct environmental-performance effects.

Consequently, the framework does not assume that deeper EMA adoption will produce identical outcomes across all SME industries. Instead, industry characteristics are expected to condition the strength of the relationship between EMA adoption depth and environmental, economic, and social outcomes.

6.4 Outcomes of EMA Adoption

The framework identifies three principal categories of outcomes.

6.4.1 Environmental performance

Environmental outcomes include:

- reduced emission intensity;
- improved energy efficiency;

- reduced waste intensity;
- improved water-use efficiency;
- improved resource utilisation; and
- stronger pollution-prevention performance.

EMA provides environmental information that can help managers identify inefficiencies and implement targeted environmental improvements.

6.4.2 Economic performance

Economic outcomes include:

- operating-cost reduction;
- improved resource productivity;
- reduced material losses;
- process efficiency;
- productivity gains; and
- improved market access.

This dimension is particularly relevant to SMEs because environmental initiatives are more likely to be sustained when they generate identifiable economic benefits.

6.4.3 Social and stakeholder performance

Social outcomes include improvements in:

- worker safety;
- supply-chain due diligence;
- transparency;
- stakeholder confidence;
- accountability; and
- organisational legitimacy.

EMA can therefore contribute beyond environmental and financial performance by strengthening the quality of relationships between SMEs and their stakeholders.

6.5 Integrative Feedback Mechanism

An important extension of the framework is the inclusion of a feedback loop connecting outcomes back to the antecedent conditions.

Successful EMA implementation can generate environmental and economic improvements that strengthen an SME's resource base and organisational capabilities. From an RBV and NRBV perspective, these improvements can increase the firm's capacity to make further investments in environmental management.

At the same time, successful environmental performance can strengthen organisational legitimacy among regulators, customers, suppliers, and other stakeholders. This can reinforce institutional and stakeholder support for deeper EMA implementation.

The resulting process can therefore be represented as:

Institutional pressure → Organisational capability + Digital enablement → Stakeholder-relational mediation → EMA adoption depth → Environmental/Economic/Social outcomes → Resource and legitimacy reinforcement → Deeper EMA adoption

This feedback mechanism introduces a dynamic element into an otherwise largely cross-sectional literature and provides a basis for future longitudinal investigation.

6.6 Research Propositions

The integrative framework develops eight propositions for future empirical testing.

P1. Coercive Institutional Pressure

Coercive institutional pressures, including environmental regulation, mandatory sustainability disclosure, and supply-chain compliance requirements, are positively associated with EMA adoption depth among SMEs.

Regulatory and compliance requirements can create direct incentives for SMEs to establish environmental accounting systems and improve the systematic use of environmental information.

P2. Mimetic Institutional Pressure

Mimetic pressure arising from EMA adoption among peer firms is positively associated with EMA adoption depth among SMEs, particularly where coercive institutional pressure is moderate.

When regulatory pressure is neither sufficiently strong to mandate adoption nor sufficiently weak to remove environmental expectations, SMEs may rely more strongly on peer organisations as reference points for determining appropriate environmental-management practices.

P3. Normative Institutional Pressure

Normative pressures arising from professional accounting bodies, consultants, industry associations, and professional expectations are positively associated with EMA adoption depth among SMEs.

Professional guidance and knowledge dissemination can increase awareness of EMA and reduce uncertainty regarding appropriate implementation practices.

P4. Organisational Resource Endowment

Leadership commitment, environmental culture, managerial environmental awareness, and organisational resource endowment are positively associated with EMA adoption depth among SMEs.

Institutional pressure creates motivation for adoption, but the capacity to respond depends on internal resources and capabilities. SMEs with stronger organisational capabilities should therefore be better positioned to implement EMA at greater depth.

P5. Digital-Technology Enablement

Digital-technology enablement strengthens the relationship between organisational capability and EMA adoption depth among SMEs.

Technologies such as IoT, environmental-data analytics, Industry 4.0/5.0 systems, and blockchain can improve the collection, integration, processing, and utilisation of environmental information. Their effectiveness, however, depends on the organisational capability required to implement and sustain them.

P6. Stakeholder-Relational Mediation

Stakeholder relationships mediate the relationship between institutional and organisational conditions and EMA adoption depth among SMEs.

Stakeholder expectations can translate regulatory and organisational conditions into concrete adoption incentives by increasing the perceived importance, legitimacy, and strategic relevance of environmental information.

P7. Industry-Vertical Moderation

Industry vertical moderates the relationship between EMA adoption depth and organisational outcomes among SMEs.

The strength and nature of environmental, economic, and social outcomes are expected to vary according to industry-specific resource flows, environmental impacts, regulatory exposure, stakeholder expectations, and operational characteristics.

P8. Configurational Adoption Condition

EMA adoption depth is strongest when coercive institutional pressure, organisational capability, and digital-technology enablement are jointly present rather than operating as independent additive conditions.

This proposition represents the framework's principal configurational claim. The argument is that external pressure creates the motivation to adopt, organisational capability provides the capacity to respond, and digital technology facilitates sustained implementation. The absence of any one condition may therefore constrain adoption depth even when the other conditions are relatively strong.

6.7 Boundary Conditions

The proposed framework is subject to three principal boundary conditions.

First, it is bounded by the SME context. The propositions are formulated for small and medium-sized enterprises and should not automatically be generalised to large organisations, which may possess substantially greater financial, technological, and human resources.

Second, the framework assumes a resource-constrained organisational environment. The interaction between institutional pressure and organisational capability is therefore particularly important because SMEs may face difficulties in responding to external demands despite recognising their importance.

Third, the framework is designed for cross-industry application. The core antecedents are intended to remain broadly applicable across SME sectors, while industry-specific differences are captured through the moderator rather than by creating entirely separate adoption models for each vertical.

6.8 Configurational Specification

The configurational component represented by P8 distinguishes the proposed framework from conventional additive adoption models.

The framework proposes that substantive EMA adoption requires the joint presence of three conditions:

Institutional pressure + Organisational capability + Digital-technology enablement → EMA adoption depth

Under this interpretation, a high level of institutional pressure may not produce substantial adoption when an SME lacks the organisational capability to implement EMA. Similarly, strong organisational capabilities may not translate into deep adoption when external motivation is weak or when appropriate technological infrastructure is unavailable.

The proposition can therefore be examined using configurational research designs, including fuzzy-set Qualitative Comparative Analysis (fsQCA) or other necessary-condition and sufficient-condition approaches. Such methods may be particularly appropriate for identifying combinations of conditions associated with high or low EMA adoption depth.

However, because the present study is conceptual, P8 should be presented as a proposition for future empirical testing rather than as an established empirical finding.

6.9 Theoretical Contribution

The principal theoretical contribution of the framework lies in its integration of complementary theoretical perspectives into a single explanatory architecture.

Institutional Theory explains external motivation; RBV explains internal resource capacity; NRBV explains environmental capability development; TOE explains technology and organisational readiness; Stakeholder Theory explains relational and accountability pressures; and DOI explains the diffusion of EMA-related technologies and practices.

The framework therefore moves from a single-theory explanation toward a multi-level and configurational explanation of EMA adoption.

Its central argument is that EMA adoption should not be understood as the direct consequence of institutional pressure alone. Instead, institutional pressure must be translated through organisational capability, supported by appropriate technological conditions, interpreted through stakeholder relationships, and ultimately expressed through an implementation depth that varies across industry contexts.

This integrated perspective provides a stronger conceptual foundation for future empirical research examining EMA adoption across different SME industries and geographical settings.

7. DISCUSSION AND IMPLICATIONS

7.1 Discussion of the Integrated Findings

The findings of this systematic review indicate that Environmental Management Accounting (EMA) adoption among SMEs cannot be adequately explained by a single organisational or institutional factor. Instead, adoption emerges from the interaction of **institutional pressures, organisational capabilities, technological conditions, stakeholder relationships, and industry-specific characteristics**.

The literature consistently identifies regulatory requirements, stakeholder expectations, and economic considerations as important drivers of EMA adoption. However, these external pressures do not automatically result in effective implementation. SMEs must possess sufficient organisational resources, managerial commitment, environmental awareness, employee competencies, and information-processing capabilities to translate external expectations into operational practices.

This distinction between **pressure to adopt** and **capacity to implement** represents one of the central insights of the review. Institutional Theory explains why SMEs experience pressure to respond to environmental expectations, but complementary theoretical perspectives are required to explain differences in implementation depth. The RBV and NRBV perspectives help

explain the role of internal resources and environmental capabilities, while the TOE and DOI perspectives clarify the contribution of technological readiness and innovation adoption.

The synthesis therefore supports a shift from a simple **institutional-pressure** → **EMA-adoption** relationship toward a more comprehensive model in which institutional pressure is translated through organisational capability and supported by technological infrastructure.

7.2 Theoretical Implications

7.2.1 Extending Institutional Theory

The findings reinforce the importance of Institutional Theory in explaining EMA adoption among SMEs. Coercive pressures from governments and regulators, normative pressures from professional communities, and mimetic pressures arising from competitors can encourage organisations to adopt environmental accounting practices (DiMaggio & Powell, 1983).

However, the review also demonstrates that Institutional Theory alone provides an incomplete explanation. Similar institutional environments can produce different levels of EMA adoption because SMEs differ in their internal resources and capabilities.

The contribution of this study is therefore not to replace Institutional Theory but to **extend its explanatory reach** by connecting institutional pressure with organisational and technological mechanisms. In the proposed framework, institutional pressure establishes the motivation for change, whereas organisational capabilities determine whether that pressure can be converted into meaningful implementation.

7.2.2 Organisational Capability as the Adoption Mechanism

The review provides strong conceptual support for treating organisational capability as a central mechanism in the EMA adoption process.

Leadership commitment, environmental culture, employee competencies, organisational resources, and environmental-management capabilities determine an SME's ability to respond to external environmental expectations. This is consistent with the RBV, which views valuable organisational resources and capabilities as foundations of sustained performance (Barney, 1991).

The NRBV further strengthens this interpretation by positioning environmental capabilities, including pollution prevention and product stewardship, as strategically relevant capabilities (Hart, 1995).

Consequently, EMA adoption should not be interpreted simply as a response to external pressure. It is also a reflection of an SME's **capacity to absorb, implement, and institutionalise environmental management practices**.

7.2.3 Digital Technology as a Conditional Enabler

The increasing presence of digital technologies in EMA research represents an important development in the field. IoT systems, cloud platforms, environmental-data analytics, Industry 4.0 technologies, and other digital tools can improve the availability, accuracy, timeliness, and integration of environmental information.

Nevertheless, the review does not support a technologically deterministic interpretation. Digital technology can facilitate EMA implementation, but technology alone cannot overcome deficiencies in management commitment, employee expertise, financial resources, or organisational readiness.

The framework therefore positions digital technology as a **conditional enabler**. This distinction is theoretically important because it connects technology adoption with the organisational and environmental conditions specified by the TOE and DOI perspectives rather than treating digitalisation as an isolated driver.

7.3 Stakeholder and Relational Implications

The synthesis indicates that stakeholders play a dual role in the EMA adoption process.

First, stakeholders can create **adoption pressure**. Regulators, customers, suppliers, investors, employees, and supply-chain partners may require greater environmental transparency and accountability. These expectations can encourage SMEs to develop systematic environmental information systems.

Second, stakeholders can become beneficiaries of improved EMA practices. More reliable environmental information can strengthen transparency, accountability, supply-chain relationships, organisational legitimacy, and stakeholder confidence.

The framework therefore positions stakeholder relationships as a connecting layer between institutional conditions and

organisational adoption. This helps explain why the same regulatory or environmental requirement may produce different organisational responses depending on the stakeholder environment in which an SME operates.

7.4 Practical Implications for SME Managers

The findings provide several implications for SME managers.

7.4.1 Treat EMA as a Management System Rather Than a Compliance Exercise

SMEs should avoid treating EMA solely as an additional reporting obligation. Its greater value lies in providing decision-relevant information concerning resource consumption, environmental costs, material losses, energy use, waste, and operational inefficiencies.

Management should therefore integrate EMA information into:

- budgeting;
- production planning;
- procurement;
- investment decisions;
- performance measurement;
- resource-efficiency initiatives; and
- sustainability planning.

Such integration can increase the probability that EMA generates measurable operational and environmental benefits.

7.4.2 Strengthen Internal Capabilities Before Pursuing Complex Digital Systems

SMEs should not assume that purchasing sophisticated environmental software will automatically solve their EMA challenges. The evidence indicates that implementation depends heavily on organisational readiness.

A practical progression would therefore be:

Basic environmental-data collection → employee training → environmental-cost identification → integration with accounting systems → digital monitoring → strategic decision integration

This gradual approach may be more appropriate for resource-constrained SMEs than attempting to implement a highly complex system immediately.

7.4.3 Develop Employee Competencies

Managers should invest in training employees in environmental accounting concepts, environmental-cost identification, material-flow analysis, data management, and sustainability reporting.

Employee capability is particularly important because EMA requires interaction between accounting, operations, environmental management, procurement, and senior management. Cross-functional knowledge can therefore improve the quality and usefulness of EMA information.

7.4.4 Use EMA to Identify Economic Benefits

SMEs are more likely to sustain environmental initiatives when environmental benefits are accompanied by clear economic benefits.

Managers should therefore use EMA to identify:

- material losses;
- unnecessary energy consumption;
- waste-related costs;
- inefficient production processes;
- avoidable environmental expenditures; and
- opportunities for resource productivity.

This approach can strengthen the business case for environmental management by connecting sustainability objectives with operational efficiency.

7.5 Policy Implications

The findings also have implications for policymakers seeking to increase EMA adoption among SMEs.

7.5.1 Strengthen Regulatory and Institutional Support

Regulation can create important incentives for EMA adoption, but regulatory pressure should be accompanied by practical implementation support. Policymakers can provide SMEs with sector-specific guidance, simplified reporting frameworks, technical assistance, and accessible training programmes.

This is particularly important in developing economies where regulatory expectations may exist without sufficient technical or financial support for implementation.

7.5.2 Develop SME-Oriented Capacity-Building Programmes

Government agencies, professional accounting organisations, universities, and industry associations can collaborate to provide:

- EMA training;
- MFCA implementation workshops;
- environmental-data management guidance;
- digital-EMA training;
- sustainability-reporting support; and
- industry-specific implementation templates.

Such initiatives can reduce the knowledge and technical barriers identified in the literature.

7.5.3 Use Supply-Chain Channels

The framework suggests that policy interventions do not necessarily need to operate directly through individual SMEs. Large corporations and supply-chain leaders can also influence SME environmental practices through supplier standards, environmental-performance requirements, and sustainability programmes.

This is particularly relevant where SMEs operate as suppliers to larger organisations with established environmental commitments.

7.6 Industry-Specific Implications

The industry-moderator component of the framework has important practical implications.

In manufacturing, EMA initiatives should prioritise material-flow analysis, energy efficiency, waste reduction, pollution prevention, and process optimisation.

In food and beverage and hospitality, emphasis may be placed on food waste, water consumption, energy efficiency, waste segregation, and stakeholder-facing sustainability information.

In recycling and circular-economy activities, material-flow cost analysis and resource recovery metrics are likely to be particularly important.

In chemical and process industries, environmental-cost identification, emissions monitoring, regulatory compliance, and pollution prevention may represent stronger priorities.

In service-sector organisations, stakeholder expectations, environmental reporting, resource consumption, and organisational legitimacy may be more prominent than direct production-related environmental impacts.

These differences reinforce the argument that EMA frameworks should be adaptable to industry characteristics rather than implemented through a uniform model across all SMEs.

7.7 Implications for Digital EMA

The review suggests that digitalisation represents one of the most important future directions for EMA research.

However, future studies should move beyond simply identifying the availability of digital technologies. Research should examine the organisational capability required to absorb, implement, and derive value from digital EMA systems.

Three areas deserve particular attention.

First, researchers should operationalise absorptive capacity at the firm level, rather than relying primarily on employee-readiness measures.

Second, future studies should investigate how different technologies affect different stages of EMA maturity, from basic environmental-data collection to integrated decision-support systems.

Third, researchers should examine whether digital EMA produces stronger environmental and economic outcomes when combined with high levels of management commitment, employee competence, and institutional pressure.

These questions can help move digital-EMA research from technology description toward a more theoretically grounded explanation of adoption and performance.

7.8 Future Research Directions

The integrated framework generates several directions for future empirical research.

Longitudinal research

Future studies should track SMEs over time to determine how EMA adoption develops from initial awareness to deeper organisational integration. Longitudinal designs would also help establish whether improvements in organisational capability and environmental performance reinforce subsequent EMA adoption.

Cross-country comparisons

Comparative studies across developed and developing economies could determine whether coercive, mimetic, and normative pressures operate differently under varying institutional conditions.

Cross-industry testing

The proposed industry moderator should be empirically tested using comparable samples from manufacturing, hospitality, food and beverage, recycling, chemical processing, and service-sector SMEs.

Configurational analysis

The eighth proposition should be examined using configurational methods such as **fuzzy-set Qualitative Comparative Analysis (fsQCA)**. Such approaches can identify combinations of institutional pressure, organisational capability, and technological readiness associated with high levels of EMA adoption.

Digital absorptive capacity

Future research should develop firm-level measures of digital absorptive capacity to determine how effectively SMEs convert technological availability into operational EMA capability.

Under-represented geographical contexts

Greater empirical attention should be directed toward regions currently under-represented in the literature, particularly where environmental regulation, professional support, and digital infrastructure remain uneven.

7.9 Overall Theoretical and Practical Implication

Taken together, the findings suggest that EMA adoption is best understood as a capability-mediated institutional response rather than as a direct reaction to environmental pressure.

Institutional pressure creates the motivation to adopt. Organisational capabilities determine the ability to respond. Digital technologies facilitate information processing and implementation. Stakeholder relationships translate external expectations into organisational requirements. Industry context influences the relevance and magnitude of the resulting benefits.

This integrated interpretation provides a more comprehensive explanation of EMA adoption than approaches that examine these factors independently. It also establishes a clearer basis for future empirical testing across different SME contexts.

8. CONCLUSION AND FUTURE RESEARCH

8.1 Summary of Findings

This systematic literature review examined Environmental Management Accounting (EMA) adoption among small and medium-sized enterprises (SMEs) across a diverse range of industry contexts. The review employed a hybrid inductive–deductive synthesis approach and was supported by a self-compiled bibliographic dataset of 219 entries covering EMA, green accounting, Material Flow Cost Accounting (MFCA), environmental performance, and digital EMA in SME settings. The analysis was further informed by three anchor systematic literature reviews addressing EMA framework development, strategic decision-making, and the relationship between EMA and green innovation.

The synthesis demonstrates that EMA adoption is influenced by a combination of institutional pressures, organisational capabilities, digital-technology conditions, stakeholder relationships, and industry characteristics. Institutional pressures provide external motivation for adoption through regulatory requirements, professional expectations, competitive imitation,

and stakeholder demands. However, external pressure alone does not guarantee effective implementation.

The review consequently identifies organisational capability as a critical mechanism through which external pressure is translated into implementation. Leadership commitment, environmental awareness, employee competencies, organisational resources, and information-management capabilities determine the extent to which SMEs can adopt and institutionalise EMA practices.

Digital technologies represent an increasingly important enabling condition. Technologies such as IoT, cloud-based systems, Industry 4.0/5.0 technologies, blockchain, and environmental-data analytics can improve environmental information collection, processing, monitoring, and reporting. Nevertheless, their contribution is conditional upon organisational readiness and resource availability.

The review further demonstrates that EMA adoption should be considered in terms of adoption depth, rather than simply as a binary decision. SMEs may progress from basic physical-flow monitoring to life-cycle accountability and, ultimately, integrated environmental information systems that support strategic decision-making and sustainability reporting.

Industry context also plays an important role. Differences in environmental impacts, resource-use patterns, regulatory exposure, stakeholder expectations, and technological requirements mean that the consequences of EMA adoption are unlikely to be uniform across industries.

8.2 Theoretical Contribution

The principal theoretical contribution of this review is the development of an integrative multi-lens framework for explaining EMA adoption among SMEs.

The framework combines six complementary theoretical perspectives: Institutional Theory, RBV, NRBV, TOE, Stakeholder Theory, and DOI Theory. Rather than treating these perspectives as competing explanations, the framework assigns each perspective a distinct explanatory role.

Institutional Theory explains the external pressures that motivate adoption. RBV and NRBV explain the internal capabilities and environmental resources required for implementation. TOE and DOI explain the technological and organisational conditions associated with technology-supported adoption. Stakeholder Theory explains the relational mechanisms through which external expectations influence organisational decisions.

The framework consequently conceptualises EMA adoption as a capability-mediated institutional response rather than as a direct consequence of regulatory or stakeholder pressure.

A further contribution is the incorporation of industry vertical as an outcome moderator and the inclusion of a feedback mechanism connecting successful outcomes with organisational resource development and institutional legitimacy. This provides a more dynamic interpretation of EMA adoption and creates a foundation for future longitudinal research.

8.3 Research Limitations

Several limitations should be considered when interpreting the findings.

First, the review is affected by the single-author screening protocol. Although inter-rater calibration and methodological safeguards were incorporated, these procedures do not completely eliminate the possibility of researcher judgement influencing study selection and thematic interpretation.

Second, the review is restricted to English-language publications. This may limit the representation of evidence from non-English-speaking countries and could contribute to the geographical concentration observed in the literature.

Third, the bibliographic dataset of 219 entries was self-compiled and pre-curated. Although it was used as a methodological instrument and cross-referenced against database-screened material, it should not be interpreted as an independent source of empirical evidence. The descriptive statistics derived from the dataset therefore depend on the accuracy and completeness of its underlying classification.

A further limitation concerns the nature of the evidence base itself. The existing literature is dominated by cross-sectional and single-country studies, which limits the ability to establish temporal relationships or broad causal generalisations. In addition, the empirical testing of the eight propositions proposed in this study has not yet been undertaken. The configurational relationships specified in P8 therefore remain theoretical propositions requiring future empirical validation.

8.4 Future Research Agenda

The findings establish a focused research agenda for advancing EMA research in SMEs.

8.4.1 Longitudinal examination of EMA adoption

Future research should employ longitudinal designs to examine how EMA develops over time. Such studies could investigate whether initial institutional pressure leads to basic adoption and whether subsequent improvements in organisational capability and performance encourage deeper integration.

8.4.2 Cross-country comparative research

Comparative research across developed and developing economies is required to determine whether coercive, normative, and mimetic pressures operate differently across institutional environments. Such research could also examine how regulatory enforcement, professional support, financial constraints, and technological infrastructure influence adoption.

8.4.3 Cross-industry empirical testing

The proposed industry moderator should be tested through comparative research involving manufacturing, food and beverage, hospitality, recycling, chemical processing, and service-sector SMEs. Such studies would help establish whether the determinants and outcomes of EMA adoption differ systematically across industry verticals.

8.4.4 Empirical testing of the configurational proposition

P8 provides an important direction for future empirical research by proposing that institutional pressure, organisational capability, and digital-technology enablement jointly influence EMA adoption depth.

Future researchers could employ fuzzy-set Qualitative Comparative Analysis (fsQCA) or related configurational methods to determine whether particular combinations of conditions are necessary or sufficient for high levels of EMA adoption.

This approach would complement conventional regression-based research by recognising that SMEs may reach similar adoption outcomes through different combinations of institutional and organisational conditions.

8.4.5 Digital absorptive capacity

Future research should develop firm-level measures of digital absorptive capacity rather than relying primarily on employee-level technology-readiness indicators. This would allow researchers to examine whether SMEs can effectively acquire, integrate, and apply digital technologies to environmental accounting processes.

8.4.6 Integration with emerging sustainability domains

As EMA research develops, future studies should investigate its relationship with emerging areas such as circular economy practices, climate-related accounting, carbon management, supply-chain environmental accountability, and digital sustainability reporting.

The theoretical framework proposed in this study should therefore be regarded as an adaptable foundation rather than a closed theoretical model.

8.5 Concluding Statement

EMA adoption among SMEs is not adequately explained by any single antecedent. The evidence reviewed in this study indicates that meaningful adoption emerges through the interaction of institutional pressure, organisational capability, and digital-technology enablement, with stakeholder relationships providing an important connecting mechanism and industry context influencing the depth and consequences of implementation.

The central proposition of the framework is therefore:

Institutional pressure creates the motivation to adopt; organisational capability provides the capacity to respond; digital technology facilitates implementation; stakeholder relationships translate external expectations into organisational action; and industry context conditions the resulting outcomes.

This perspective provides a coherent explanation of why SMEs exposed to similar environmental expectations may nevertheless demonstrate different levels of EMA adoption and different performance outcomes.

The study contributes a structured framework and eight propositions that can be empirically tested across countries, industries, and organisational contexts. Its substantive contribution will ultimately depend on such empirical testing. Future research should therefore move beyond further conceptual refinement and focus on longitudinal, comparative, cross-industry, and configurational testing of the proposed relationships.

In this respect, the framework provides not a final explanation of EMA adoption, but a structured platform for developing a more empirically grounded understanding of how SMEs can integrate environmental information into management, operational decision-making, and sustainability strategy.

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